UTAH STEM ACTION CENTER PROGRAM EVALUATION

Academic Year 2017-18

THE UNIVERSITY OF UTAH
UTAH EDUCATION POLICY CENTER

in partnership with

UVU School of EDUCATION
UTAH VALLEY UNIVERSITY

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Addendum to the 2017-18 STEM Action Center Program Evaluation

To be added once 2017-18 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 is supported by the Governor's Office of Economic Development (GOED).

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 three of the STEM Action Center's programs:

- K-12 Mathematics Personalized Learning Software Grant,
- Elementary STEM Endorsement Program, and
- STEM Professional Learning Program.

This report presents findings and recommendations on the 2017-18 implementation year of these three programs. This is the second year of a five-year evaluation cycle for the UEPC and UVU team.

Similar to 2016, this evaluation was informed by two frameworks. These frameworks included the Pedagogical Content Knowledge (PCK) and the Technological, Content, and Pedagogical Knowledge (TPACK) frameworks.

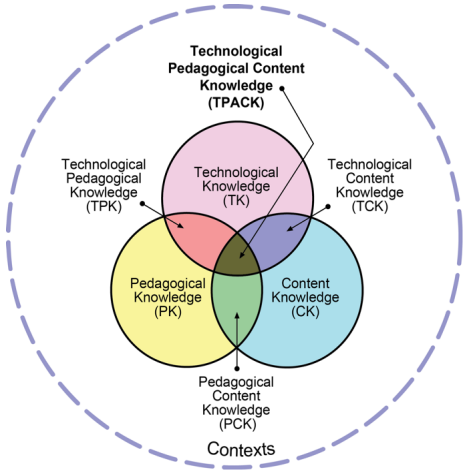
Evaluation Background

Continuing the plan started in 2016-17, the 2017-18 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 below.

PCK and TPACK

The Pedagogical Content Knowledge (PCK) framework proposed by Shulman (1986) 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

Figure 1. TPACK Framework



SOURCE: HTTP://TPACK.ORG

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.

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 not only about the degree to which the outcomes are obtained, but also why or why not.

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. The three primary data sources for the evaluations include software vendor data, survey data, 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 (all three programs), administrators (math software and professional learning programs), and students (math software program only). In all cases, the data collection instruments from prior evaluations were reviewed and considered in order to provide continuity in the evaluation. In addition, existing surveys from the research literature on TPACK and STEM education were reviewed. Surveys for the three STEM AC programs to be evaluated were then developed using the 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 methodology and analysis specific to each grant program is provided in the relevant subsections of this report.

SAGE data for the 2017-18 school year are not yet available at the time this report was finalized; analyses from those data will be provided in an addendum to the 2017-18 report.

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 Four of the K-12 Mathematics Personalized Learning Software Grant (2017-18). In the first year of the grant (2014-15), there were 11 software products available to schools and LEAs. In year four (2017-18), there were five supported software products (see Table 1 on page 11). Schools and LEAs applied to utilize the programs through a grant application released in January of 2017 and awarded in spring 2017.

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 students with problems that are suited to each individual's ability. 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. Because programs are designed to adapt to students' skill levels, frustration with too difficult problems and boredom with too easy problems reportedly should be minimized. 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 participation records, vendor data (including usage), and year-end surveys of administrators, teachers, and students who used the program during the 2017-18 school year. 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). In addition, 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. Implemented Personalized Math Learning Products

Year	Vendor	*McGraw-Hill*	*Ascend Education*	*Hot Math*	*The NROC Project*	*Imagine Learning*	*Curriculum Associates*	*Pearson*	*Carnegie Learning*	*Compass Learning*	*Explore Learning*	*MIND Research Institute*	*Pearson*
	Product	***ALEKS***	***Ascend Math***	***Catchup Math***	***Ed Ready***	***Imagine Math***	***iReady***	***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	

Table 2. Statewide Distribution by Schools and Districts

	2014-15	**2015-16**	**2016-17**	**2017-18**
Total licenses requested	n/a	183,109	223,623	195,449
Total licenses funded by STEM AC	193,213	166,993	134,269	134,616
Total districts and charters with STEM AC funded licenses	139	93	72	62
Total schools with STEM AC funded licenses	653	556	586	440
Total number of student licenses used	150,706	131,602	147,238[1]	134,807

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

SOURCES: STEM AC DATA, VENDOR DATA, AND NATIONAL CENTER FOR EDUCATION STATISTICS DATA (FOR SCHOOL CLASSIFICATIONS)

[1] The number of licenses used in 2016-17 is larger than the number of licenses funded by STEM AC because vendors provided data for all students in Utah who used the program regardless of funding source.

Table 3. 2017-18 License Statewide Distribution by Product

	ALEKS	*Ascend Math*[2]	*Imagine Math*	*iReady*	*ST Math*	Combined Programs
Licenses requested	98,508	3,145	28,324	28,698	36,774	195,449
Percent of total licenses requested	50%	2%	14%	15%	19%	100%
Initial licenses awarded	66,412	2,206	20,006	18,322	27,670	134,616
Percent of total licenses awarded	49%	2%	15%	14%	21%	100%
Percent of awarded licenses compared to requested licenses	67%	70%	71%	64%	75%	69%
Number of districts with awarded licenses	28	3	8	14	11	32
Number of schools with awarded licenses	251	19	83	89	113	440
Adjusted licenses awarded (STEM AC funded student licenses) by school level						
Elementary (274 schools)	15,100	2,124	15,492	16,399	26,763	75,878
Secondary (98 schools)	23,816	55	1,744	1,826	445	27,886
Mixed (66 schools)	27,585	27	2,770	97	533	31,012
Overall (438 schools)	66,501	2,206	20,006	18,322	27,741	134,776
Total students who used the product (licenses from STEM AC and other sources) by school level*						
Elementary	6,783	662	18,630	16,216	37,032	79,323
Secondary	38,366	28	3,608	2,074	374	44,450
Mixed	3,980	0	1,060	243	0	5,283
Overall	49,129	690	23,298	18,533	37,406	129,056
Average minutes of use per year per student by school level*						
Elementary	1,435	317	2,212	1,109	1,136	1,402
Secondary	1,755	1,050	1,277	1,062	641	1,674
Mixed	1,539	--	1,293	1,027	--	1,466
Overall	1,693	347	2025	1,102	1,131	1,498

SOURCE: STEM AC DATA, VENDOR DATA, AND NATIONAL CENTER FOR EDUCATION STATISTICS DATA (FOR SCHOOL CLASSIFICATIONS)

- ✓ In 2017-18, half of the requested licenses were for *ALEKS.*
- ✓ STEM AC met 69% of product requests.
- ✓ Based on a 36 week academic year, elementary students spent an average of 39 minutes and secondary students spent an average of 47 minutes per week on the programs.

* Cases were excluded from analysis if a student's monthly use was less than one minute or larger than the 99.99th percentile for the software vendor for that month.

[2] Due to low student usage, Ascend Math was not included in the evaluation on the recommendation of STEM AC.

Table 4. Fidelity Recommendations by Product

Product	Publisher	Supported	Fidelity Requirements
ALEKS	*McGraw-Hill*	Grades 3-12	60 minutes OR 5 topics per week
Ascend Math	*Ascend Education*	K-12 Secondary Math I, II, and III	K-1: 5 learning objectives in Quarter 1, thereafter, 2 objectives per month 2-3: 5 learning objectives in Quarter 1, thereafter, 4 objectives per month 4-6: 30 minutes or 1 learning objective per week 7-12: 45 minutes or 1 learning objective per week
Imagine Math	*Imagine Learning*	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
iReady	*Curriculum Associates*	Grades K-8	45 minutes per week
ST Math	*MIND Research Institute*	Grades K-12	K-1: 60 minutes per week 2-8: 90 minutes per week

SOURCE: STEM AC RECORDS

Table 5. Survey Response Rates and Grade Level Distributions for the Math Personalized Learning Software Grant

		ALEKS	*Imagine Math*	*iReady*	*ST Math*	**Combined Programs**
Teachers	**Ns**	405	237	287	434	**1363**
	% Using Each Program	30%	17%	21%	32%	100%
	Teacher Grade Level Distributions within Each Program[3]					
	K - 2nd	0%	0%	29%	40%	0%
	3rd - 6th	43%	95%	66%	65%	43%
	7th - 8th	36%	5%	8%	0%	36%
	9th - 12th	33%	1%	1%	0%	33%
	Other	4%	2%	2%	0%	4%
Students	**Ns**	20,063	7,677	7965	5,548	**41,253**
	% Using Each Program	49%	19%	19%	13%	100%
	Student Grade Level Distributions within Each Program					
	3rd - 6th	21%	82%	79%	99%	54%
	7th - 8th	48%	13%	20%	1%	30%
	9th - 12th	31%	5%	1%	1%	16%
Administrators	**Ns**	44	26	35	36	**141**
	% Using Each Program	31%	18%	25%	26%	100%

✓ The majority of teacher respondents taught elementary classes (83%). Student respondents for Math, iReady, and ST Math were primarily in grades 3 through 6 while respondents for ALEKS were primarily in grades 7 through 12.

SOURCE: ADMINISTRATOR, TEACHER, AND STUDENT SURVEYS SPRING 2018

[3] 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 2017-18 Student Program Use Reported by Teachers

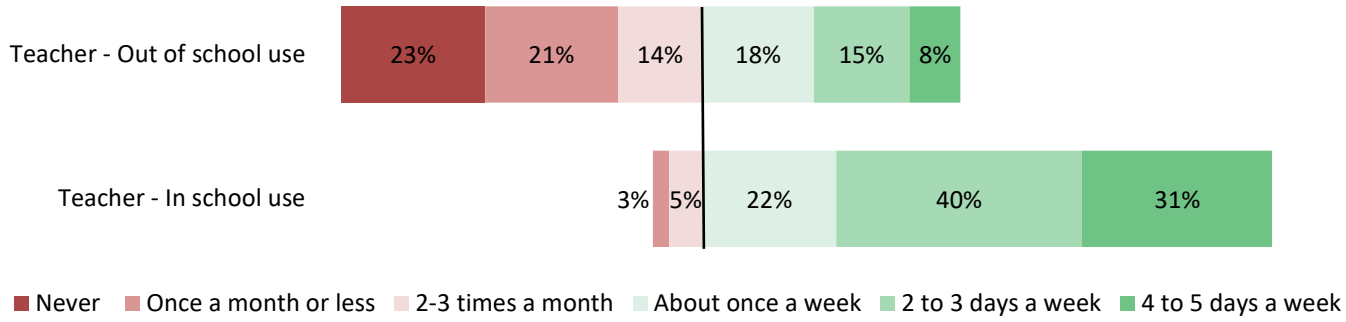
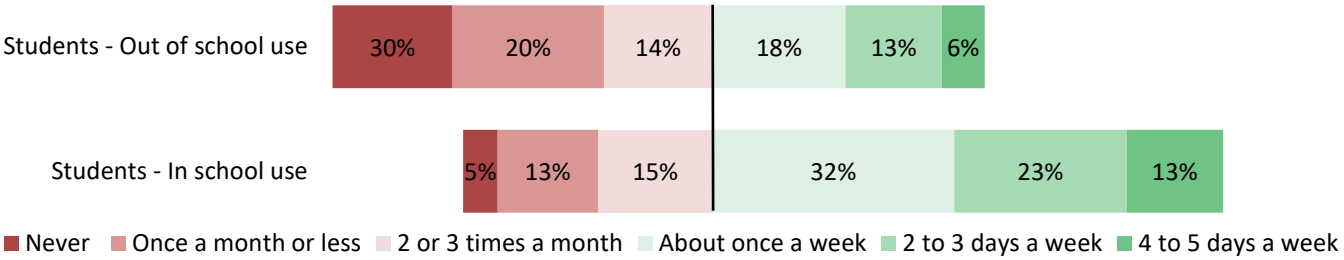


Figure 4. Frequency of 2017-18 Student Program Use Reported by Secondary Students



- ✓ On the student survey, this question was asked only of secondary students. Teachers of all grade levels were asked this question.
- ✓ Teachers reported greater use than secondary students.
- ✓ 93% of teachers and 68% of secondary students reported using the program at school at least weekly.

SOURCES: TEACHER AND STUDENT SURVEYS SPRING 2018

Table 6. Frequency of 2017-18 Program Use by Program Type

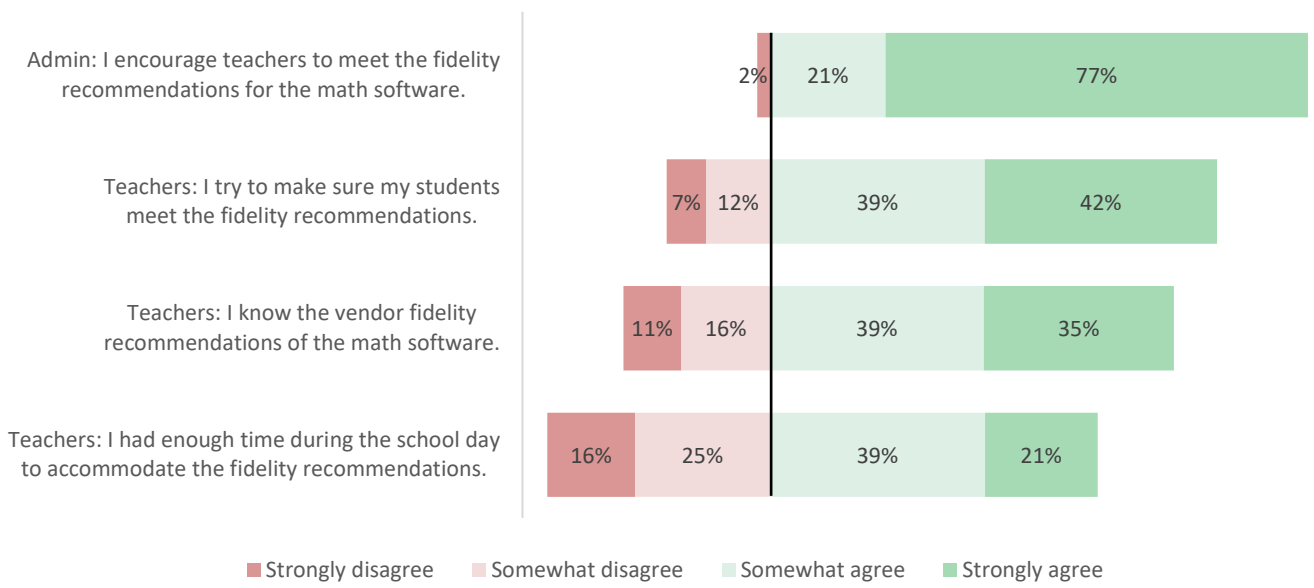
Percentage of teachers and students reporting student use *about once a week* or more.

	ALEKS	*Imagine Math*	*iReady*	*ST Math*	**Combined Programs**
Teachers					
In School	87%	91%	97%	94%	91%
Outside of School	60%	39%	29%	34%	42%
Secondary Students					
In School	69%	29%	79%	61%	67%
Outside of School	38%	25%	19%	29%	36%
Teacher estimates of their average number of minutes used per week					
Minutes per week	76	76	66	70	**72**

SOURCES: TEACHER AND STUDENT SURVEYS SPRING 2018

- ✓ All programs were used primarily *in* school, although over half of ALEKS and almost a third of other programs reported out-of-school use as well.
- ✓ Teachers reported having students use the software an average of 72 minutes per week.
- ✓ *Not shown:* Number of reported years of teaching and years of using the software did not predict number of minutes used each week.

Figure 5. Administrator and Faculty Intentions to Meet Fidelity Requirements



- ✓ Over three quarters of administrators strongly agreed that they encourage teachers to meet the fidelity recommendations.
- ✓ Over 80% of teachers somewhat or strongly agreed they try to have their students meet the fidelity recommendations.

Table 7. Faculty Intentions to Meet Fidelity Requirements

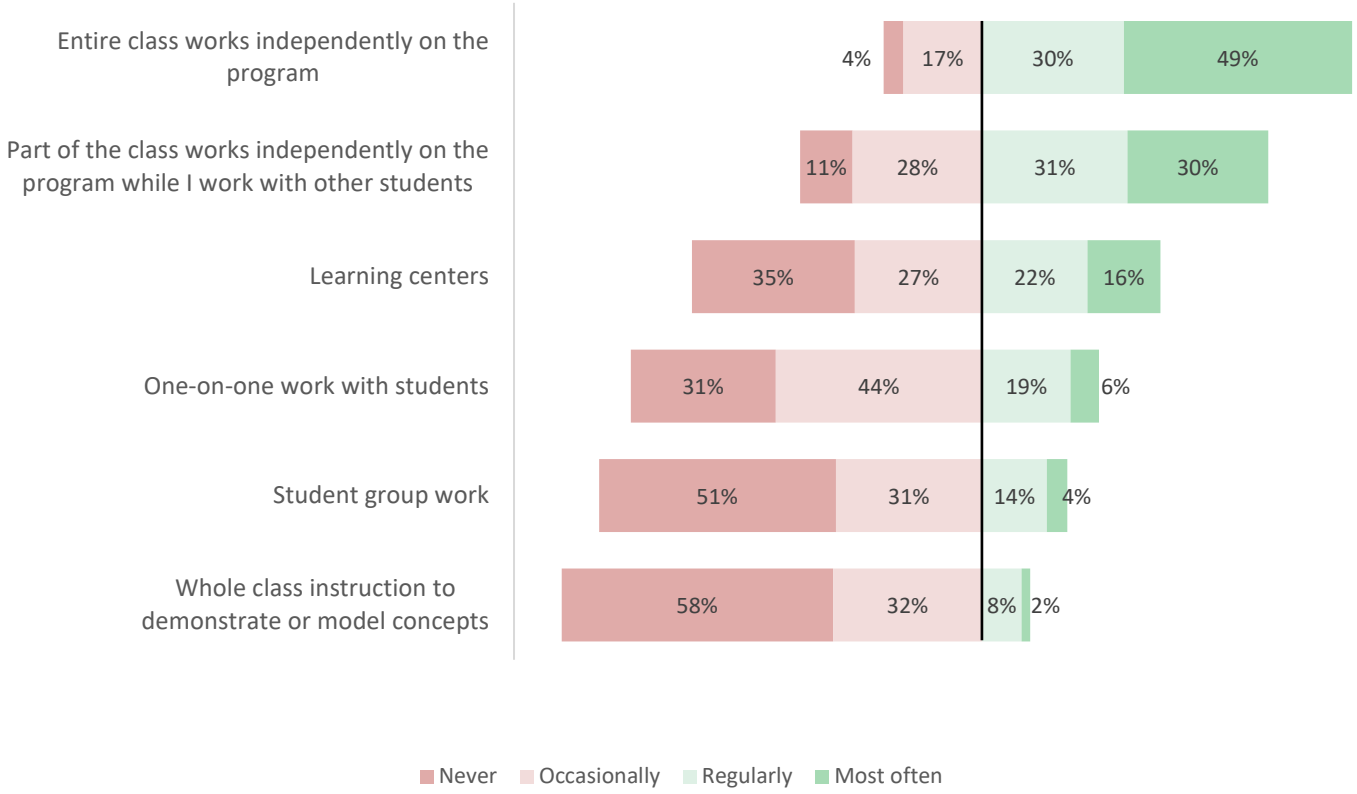
Percentage who *somewhat agree* or *strongly agree* with each statement

	ALEKS	*Imagine Math*	*iReady*	*ST Math*	Combined Programs
Administrators					
I encourage teachers to meet fidelity recommendations for the math software.	98%	100%	97%	97%	98%
Teachers					
I try to make sure my students meet the fidelity recommendations.	76%	85%	85%	82%	82%
I know the vendor fidelity recommendations of the math software.	67%	79%	78%	73%	73%
I had enough time during the school day to accommodate fidelity recommendations.	57%	66%	68%	53%	53%

SOURCES: ADMINISTRATOR AND TEACHER SURVEYS SPRING 2018

- ✓ Almost all administrators indicated they encourage teachers to meet the fidelity recommendations.
- ✓ The majority of teachers across programs (82%) reported they try to have students meet the fidelity recommendations.
- ✓ 27% of teachers across programs were not sure they knew the fidelity recommendations for their program. *Not shown:* Only 35% of teachers strongly agreed they knew the fidelity recommendations.
- ✓ A slightly higher percentage of teachers reported they try to meet the recommendations than knew the recommendations.
- ✓ 53% of teachers across programs indicated they had enough time during the school day to meet fidelity recommendations.

Figure 6. Type of In-Class Use Reported by Teachers – All Programs Combined



- ✓ 79% of teachers report they regularly or most often have the entire class work independently on the program.
- ✓ 61% have the class work independently while they work with other students.
- ✓ *Other ways* teachers listed were:
  - Assessment
  - Intervention
  - Review and mastery practice
  - Use with language learners
  - Cooperative learning
  - Discussion generation

SOURCE: TEACHER SURVEY SPRING 2018

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

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

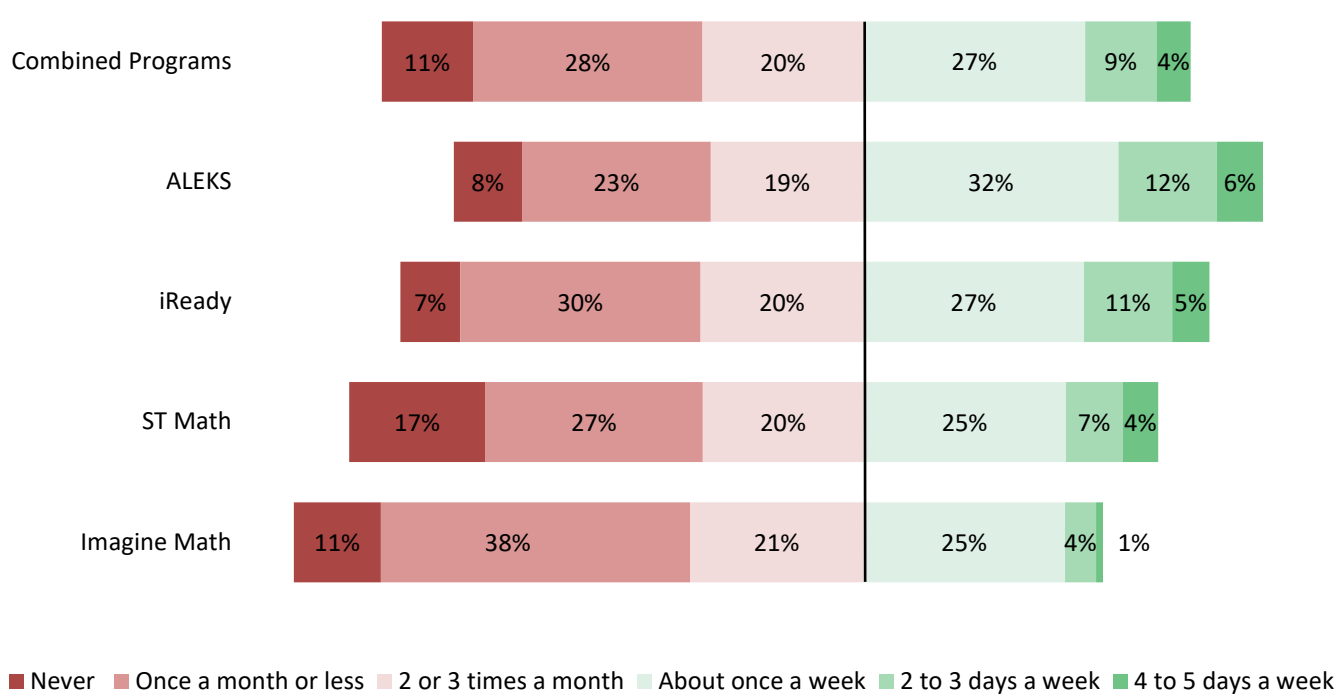
	ALEKS	*Imagine Math*	*iReady*	*ST Math*	**Combined Programs**
Entire class works independently on the program	84%	77%	75%	78%	79%
Part of the class works independently on the program while I work with other students	55%	64%	63%	64%	61%
Learning centers	24%	39%	36%	52%	38%
One-on-one work with students	35%	18%	20%	23%	25%
Student group work	15%	13%	22%	22%	18%
Whole class instruction to demonstrate or model concepts	10%	3%	17%	10%	10%

✓ Patterns of use are similar across programs with teachers reporting that most commonly they have the entire class work independently, or work independently while the teacher works with other students.

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

Source: Teacher Survey Spring 2018

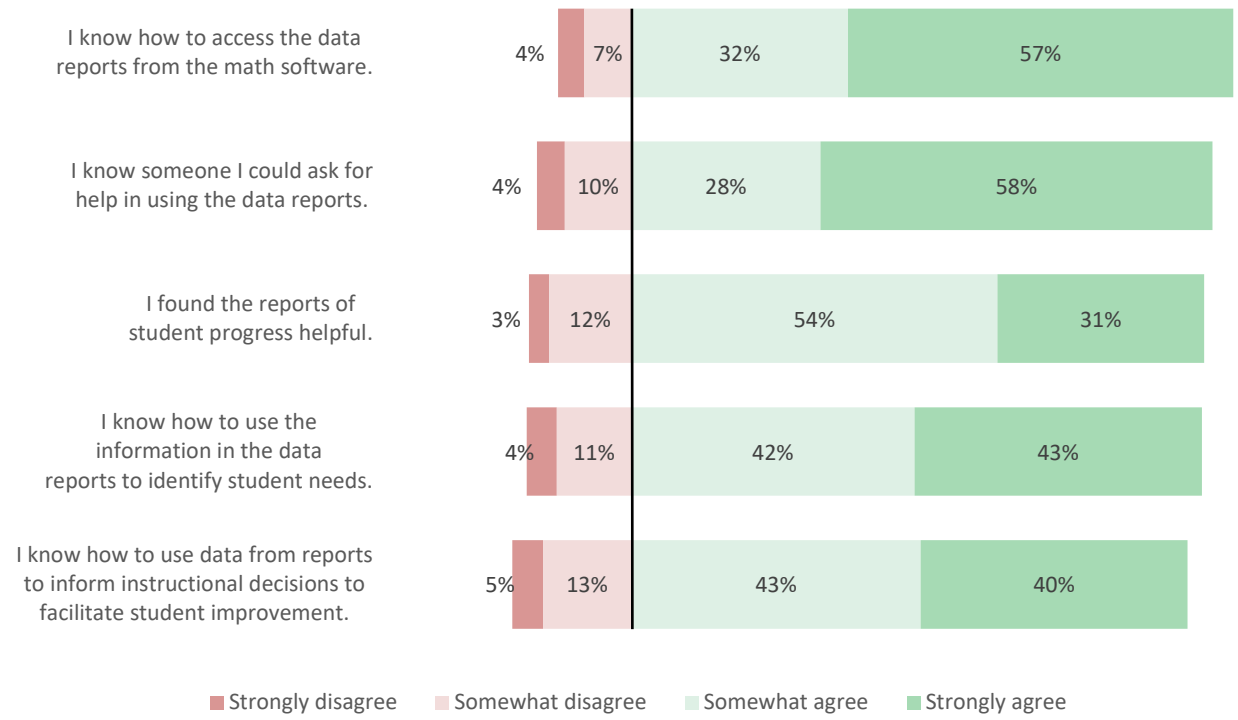
Figure 7. Teacher Reported Frequency of Use of Data Reports by Program



- ✓ For all programs combined, 40% of teachers were using the program data reports at least weekly to assess student learning.
- ✓ For all programs combined, 39% of teachers were using data reports once a month or less.

SOURCE: TEACHER SURVEY SPRING 2018

Figure 8. Teacher Perceptions of Data Reports



- ✓ In general, teachers know how to access and use the data reports.
- ✓ 85% of teachers overall agreed the reports of student progress were helpful.

SOURCE: TEACHER SURVEY SPRING 2018

Table 9. Teacher Perceptions of Data Reports by Program

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

	ALEKS	***Imagine Math***	***iReady***	***ST Math***	**Combined Programs**
I know how to access the data reports from the math software.	91%	85%	93%	87%	89%
I know someone I could ask for help in using the data reports.	86%	82%	90%	86%	86%
I found the reports of student progress helpful.	90%	78%	87%	83%	85%
I know how to use the information in the data reports to identify student needs.	85%	80%	87%	84%	84%
I know how to use data from reports to inform instructional decisions to facilitate student improvement.	82%	78%	88%	82%	82%

SOURCE: TEACHER SURVEY SPRING 2018

- ✓ Across programs, the majority of teachers know how to access and use the data reports. However, there are still a number of teachers who could benefit from additional support:
  - 11% do not know how to access the data reports.
  - 16% do not know how to use the data reports to identify student needs.
  - 18% do not know how to use the data reports to inform instructional decisions.

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

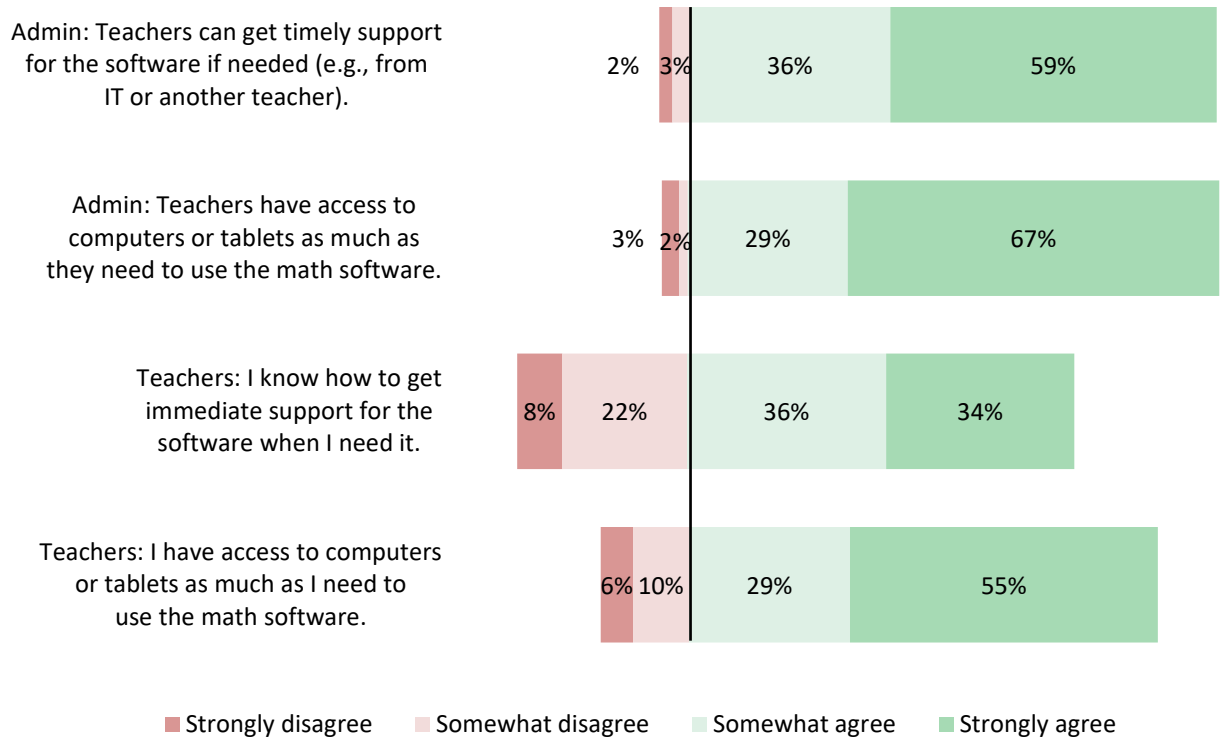
Approximately 2% of responding teachers indicated they do not use the software. These teachers were asked to explain why they do not use the software.

Theme	Example Quotes
Some teachers did not use the software because they lacked resources and time to do so.	"I do not have sufficient access to Chromebooks/the Computer Lab to use these programs consistently. I also feel that the Go-Math program with additional resources I have accumulated are sufficient for meeting the Core needs. I also feel that there is not enough time to cover all that has to be taught in such a tight schedule with additional programs." "I teach special education. The students have their own computers but I feel that bringing them back and forth to my room takes up too much of my instructional time." "Lack of time and training."
Some teachers did not use the software because they were not given the option to do so.	"didn't get licenses" "I didn't know it was available."
Some teachers did not use the software because they did not find it helpful.	"The only one that was offered was imagine math and my students did not like that one the previous year so I chose not to use it." "Because they teach memorization and procedure, students don't actually learn the concepts behind them."
Some teachers did not use the software because they used other resources instead.	"I use math worksheets and one touch math." "Currently I am using work sheets and physical math."

SOURCE: TEACHER SURVEY SPRING 2018

Access and Support

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



- ✓ 84% of teachers reported they had sufficient access to computers or tablets.
- ✓ Administrators reported greater access and support for teachers than teachers reported.

Note: Because the samples for teachers and administrators may represent different schools and districts, a direct comparison is not recommended.

SOURCES: ADMINISTRATOR AND TEACHER SURVEYS SPRING 2018

Figure 10. Secondary Student Access to Devices at Home

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

- ✓ Most, *but not all*, secondary students 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.

SOURCE: STUDENT SURVEY SPRING 2018

Table 11. Teacher Professional Development and Training on the Programs

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

	ALEKS	*Imagine Math*	*iReady*	*ST Math*	**Combined Programs**
Admin					
Teachers were provided with professional development on effective use of the math software.	90%	83%	93%	83%	88%
I was satisfied with the professional development provided to teachers.	88%	83%	90%	91%	88%
Teachers: I would like to receive more training on…					
customizing programs to better meet student needs.	89%	75%	78%	77%	81%
using the program to differentiate instruction better.	80%	71%	73%	73%	75%
aligning the program with the concepts I am teaching.	81%	73%	76%	64%	73%
using various program tools.	80%	67%	69%	70%	72%
using the student data reports.	75%	73%	63%	72%	71%
integrating program use with regular instruction.	77%	69%	71%	64%	70%
ways to use the math software.	69%	55%	53%	55%	59%

- ✓ Most administrators indicated they were satisfied with the training teachers received on using the software.
- ✓ 12% of administrators indicated their teachers were not provided with training or were not satisfied with the training provided.
- ✓ The majority of teachers indicated a desire to receive more training on all aspects of using the programs.
- ✓ *Other topics* teachers listed were:
  - Assessment methods
  - Use with language learners, early readers, and special education students
  - Sharing customized assignments with other teachers
  - Student engagement
  - Trouble-shooting

SOURCES: ADMINISTRATOR AND TEACHER SURVEYS SPRING 2018

Perceived Outcomes

Table 12. Teacher Opinions on Programs Helping to Develop Soft Skills

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

	ALEKS	*Imagine Math*	*iReady*	*ST Math*	Combined Programs
The personalized math software has helped me teach my students how to…					
be self-directed learners.	95%	90%	90%	93%	92%
think critically.	85%	90%	84%	94%	89%
think creatively.	69%	80%	73%	94%	80%
collaborate.	49%	40%	35%	56%	47%
communicate effectively.	49%	41%	44%	48%	46%

- ✓ The majority of teachers agreed the software helped them teach their students to be self-directed learners, think critically, and think creatively.
- ✓ Less than half of teachers thought the software helped teach their students to collaborate and communicate.

SOURCES: TEACHER SURVEYS SPRING 2018

Table 13. Teacher Opinions on Programs Helping Them Provide Effective Mathematics Instruction

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

	ALEKS	*Imagine Math*	*iReady*	*ST Math*	**Combined Programs**
Use of the software…					
Provided students with increased opportunities to learn from mistakes.	96%	89%	86%	94%	92%
Helped me engage with students more equitably.	84%	71%	76%	80%	78%
Increased my ability to explain concepts in more than one way.	78%	71%	76%	85%	78%
Helped me use data and other evidence to make changes in my instruction.	75%	60%	77%	70%	71%
Helped me analyze student errors and misconceptions and adjust my instruction.	71%	58%	68%	70%	68%

- ✓ Most teachers agreed 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, and use data to make changes to instruction.
- ✓ Two-thirds of teachers agreed the software helped them analyze errors and misconceptions.

SOURCES: TEACHER SURVEYS SPRING 2018

Table 14. Stakeholder Opinions on Programs Providing New Ways to Solve Math Problems

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

	ALEKS	*Imagine Math*	*iReady*	*ST Math*	Combined Programs
Teachers					
The math software helped students understand different ways to solve math problems.	89%	91%	90%	95%	92%
Elementary Students					
The program showed me new ways to solve problems.	79%	71%	75%	76%	75%
Secondary Students					
The program showed me ways to solve problems that my teacher didn't show me.	60%	45%	49%	49%	58%
The program helped me understand different ways to solve math problems.	61%	46%	55%	56%	59%

SOURCES: TEACHER AND STUDENT SURVEYS SPRING 2018

- ✓ Most teachers across programs (92%) indicated the software provided new ways to solve math problems.
- ✓ The majority of elementary students (75%) and over half of secondary students (59%) agreed the software provided new or different ways to solve math problems.

Table 15. Stakeholder Opinions on Programs Building Student Confidence in Math

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

	ALEKS	*Imagine Math*	*iReady*	*ST Math*	Combined Programs
Teachers					
The math software seemed to make students feel they could learn a lot in math.	81%	79%	80%	91%	83%
Elementary Students					
The program helped me feel confident about math.	67%	62%	60%	65%	63%
The program made me feel I could be good at math.	70%	67%	64%	71%	68%
Secondary Students					
The program helped me feel more confident about math.	51%	36%	39%	57%	49%
The program made me feel I could be good at math.	53%	40%	44%	45%	52%
The program helped me feel I could learn a lot in math.	52%	38%	42%	53%	50%

SOURCES: TEACHER AND STUDENT SURVEYS SPRING 2018

- ✓ Across programs, a majority of teachers (83%) reported the software seemed to make students feel like they could learn a lot in math.
- ✓ Elementary students were more likely to agree that the software increased their confidence than secondary students.
- ✓ Approximately half of secondary students reported the software increased their confidence in math.

Table 16. Teachers' and Elementary Students' Opinions on Programs Creating Student Enjoyment of Math

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

	ALEKS	*Imagine Math*	*iReady*	*ST Math*	Combined Programs
Teachers					
My students enjoy using the software.	71%	80%	70%	93%	79%
The math software helped make math fun this year.	59%	67%	63%	88%	70%
Elementary Students					
I liked using the program at school.	63%	58%	56%	73%	62%
The program helped make math fun.	44%	47%	45%	61%	49%
I spent more time on the program than my teacher required.	36%	35%	36%	43%	38%
I liked using the program at home.	32%	34%	27%	39%	33%
I looked for other math computer programs I could use.	25%	28%	28%	32%	28%

- ✓ Teachers were more likely than elementary or secondary students (see next page) to agree that students enjoyed using the software and that the software made math fun.
- ✓ Elementary students were more likely than secondary students to report increased math enjoyment.
- ✓ 28% of elementary students and 18% of secondary students liked the program enough to look for additional math programs they could use.

SOURCES: TEACHER AND STUDENT SURVEYS SPRING 2018

Table 17. Secondary Students' Opinions on Programs Creating Student Enjoyment of Math

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

	ALEKS	*Imagine Math*	*iReady*	*ST Math*	Combined Programs
Secondary Students					
I liked the way my teacher had us use the program.	59%	41%	52%	41%	57%
I liked using the program to work on math at school.	45%	28%	35%	50%	43%
The program helped me want to learn more about math.	39%	28%	35%	45%	38%
The program helped make math fun this year.	24%	17%	23%	45%	24%
I spent more time on the program than my teacher required.	25%	18%	30%	34%	25%
I liked using the program to work on math at home.	28%	22%	18%	31%	27%
The program got me excited about taking more math classes.	21%	15%	19%	32%	21%
I looked for other math computer programs I could use.	18%	16%	24%	35%	18%

- ✓ About a quarter of secondary students reported that the programs helped make math fun this year.
- ✓ About a quarter of secondary students reported that they spent more time on the program than required.

SOURCES: STUDENT SURVEY SPRING 2018

Table 18. Student Opinions on Programs Increasing Student Perceptions of Math Utility and Importance

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

	ALEKS	*Imagine Math*	*iReady*	*ST Math*	**Combined Programs**
Elementary Students					
The program showed me ways math can be useful.	74%	72%	74%	74%	74%
Secondary Students					
The program showed me ways math can be useful in everyday life.	45%	44%	52%	50%	45%
The program made me realize how important math is.	42%	36%	39%	44%	42%

- ✓ Nearly three-quarters of elementary students agreed the program showed them ways math can be useful.
- ✓ 45% of secondary students agreed the program showed them how math can be useful.
- ✓ 42% of secondary students agreed the program made them realize the importance of math.

SOURCES: STUDENT SURVEY SPRING 2018

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
Students liked when teacher provided class time to work on the software.	“He didn't give us a lot of homework on [software] and when he did it was fairly simple and easy to do. I liked that he had us use [software] for in class assignments and gave us enough time to work on it so we didn't have to do it at home.” "And It was nice to have time to work on it in class to. I really liked that part because I wasn't always able to go home and work on it every day."
Students liked receiving extra credit for using the software.	“I like how my teacher required ten topics a week, but after that it was extra credit. The extra credit was really nice, because I sometimes struggled with math but the extra credit topics gave me the chance to keep up my grade with math problems I already understood.” “I also like that you can get extra credit when you get two right in a row it really pushes you to do the best you can.” "I like what he did because he allowed for every topic we did over the 10 that were required and the rest were extra credit and that helped me keep my grade up by constantly doing extra credit [software] topics.
Students liked when teachers helped them understand the content so it was easy to do.	“My teacher helps me try and understand what is in [software], and when it is not enough, he will research the information. If [software] is wrong he will send an e-mail to someone to get it fixed. He does all that he can.” “She helped us if we were unsure about a question and helped students know how to fix their mistakes." "I liked the way my teacher helped demonstrate as it is helpful to learn math outside of school and to always keep learning."
Students liked when teachers let them work at their own pace.	"Our teacher would have us use [software] two or some times more a week and let us take notes on it if we needed it and would have us be at our own pace. Teacher having a goal in mind too like finish at least 3 or 4 lessons everytime we do it in class and do as much as we can at home for 30 or 10 minutes every few days. I like this because I feel accomplished when i make it through, I don't feel stupid or dumb or pressured to be at the same pace as everyone else. The teacher makes me feel at ease with [software]." "I really liked the [software] this year; I could go at my own pace, it taught me multiple ways to solve problems, and it had a great design and reward system. It was efficient and easy to use for my math teacher and myself. I especially love that if you need extra help you can go home and work on it, instead of having to stay after class. I believe that the [software] program is a great, new way to learn."
Students liked how teachers used the software for them to practice skills and content.	“We could just use it when we needed help on a certain area or subject of math, but we weren't forced to do a certain amount of problems a week.” "I kind of liked the way our teacher had us use [software] because I feel like I got a little bit more learning time to go over things we've learned or go through things that we haven't gone over." "I didn't enjoy how much time I spent on it but it helped me get the practice i needed to Ace my math class...[software] is a key stone in my learning process for math."

Continued from the previous page.

Theme	Example Quotes
Students liked when teachers used the software as assessment.	"I liked the quiz at the end because it showed how much I understood the subject." "I also liked how we had 4 tries to get 100% on tests on [software]. It helped me not feel so stressed." "My teacher gave us tests sometimes in [software], and I liked that because doing it digital is easy for me (especially when I could show my work on paper.)"
Students liked that using the software made them feel smart and confident.	"I did like the weekly goals, so when I finished one, I felt like I had accomplished something that week and was making progress." "[Software] made me feel like I could do math and made me feel like I was smart and could accomplish things. Even if we didn't spend a whole class period it was nice to spend a small amount of time on the site." "[Software] made me good about Math, It taught me how to do the problems, and the explain option and the unlimited amount of tries on tests made feel confident and not nervous about doing the problems. I strongly recommend [software] to anyone learning math and is struggling with it. I've come from math double dose into math regular education, because of one thing, [software]."

SOURCE: STUDENT SURVEY SPRING 2018

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
Students disliked the pacing of how their teachers used the software.	"It was really hard to get all the way to the required percent on the [program], and I'm pretty good at math. I also didn't like that the teacher only let us work on [program] for one day in the week. Trying to get a new 20 question assignment finished in one day is really hard, not to mention the 10 topics we have to do every week." "It seems to be designed for those who have trouble in math and not the average or above average student." "She made it an assignment so that you had to do a certain number of topic each week but I didn't have time at home and I work a lot slower than other students so while some students only had to work for 45 minutes I had to work for about 2 hours to get it all done, which I often didn't."
Students disliked that using the software was required and/or that it counted toward their grade.	"I find it to be really frustrating and annoying to use for those of us who actually understand math and are being forced to do a certain number of topics a week." "My teacher put [program] on as an actual grade that affected us rather than an extra credit opportunity, & most of the topics were things that we didn't even cover during class, yet would be on our tests at the end of the unit." "I didn't like the way my teacher used it because we have to get done a certain amount of lessons which then goes on our grade… [The software] did not help me get better at doing math as well." "I dont think that things that are not in the curriculum should go on our grades. And this dont help me on tests because Im not doing what we are learning."
Students disliked having to use the software at home rather than in class.	"We had to do 10 [program] a week, and it gets frustrating when your trying to do it at home but you don't know it and neither does your family," "I have math homework my teacher gives me and on top of that I have [program]. It is not fair that a kid has to do [program] if he already has other math homework." I very much am against homework in general I got a four in my sage math test and I have 17 missing assignments homework and [program] dose nothing for me. I think [program] and homework should only be given to those who need it not to people that don't.
Students disliked when their teachers did not provide help in understanding the content taught by the software.	"[Program] is very frustrating because I never really get the way they teach us to do math….I understand the way my teacher at school teaches, and I get good grades/ scores on my Tests and Homework, but once my teacher puts my grade on [program] in, my grade drops.." "The way we learn from our teacher Mrs. [removed] has been one of the funnest ways to learn math, she makes it simple and easy to do things, [program] is preventing that from happening by taking time out of our math class and making it more directly into boring, making me want to fall asleep." "She didn't teach, she used [program] as an excuse for not teaching. Our entire math class struggled this entire year because we had to teach ourselves every part of everything."

SOURCE: STUDENT SURVEY SPRING 2018

Table 21. Perceived Effects on Student Math Performance

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

	ALEKS	*Imagine Math*	*iReady*	*ST Math*	Combined Programs
Teachers					
The math software helped my students strengthen important skills.	97%	93%	94%	97%	96%
The software increased my instructional effectiveness.	84%	70%	79%	84%	81%
Administrators					
The math software had a positive impact on students' math performance.	95%	100%	97%	91%	95%

SOURCES: ADMINISTRATOR AND TEACHER SURVEYS SPRING 2018

- ✓ Nearly all teachers felt the software helped students strengthen important skills.
- ✓ 81% of teachers agreed the software increased their instructional effectiveness.
- ✓ Nearly all administrators (95%) agreed the software had a positive impact on students' math performance.

Table 22. Teacher Perceived Ancillary Effects of the Software

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

Teachers	*ALEKS*	*Imagine Math*	*iReady*	*ST Math*	Combined Programs
The math software increased my satisfaction with my job.	77%	62%	65%	75%	71%
The math software increased parent engagement.	34%	26%	27%	27%	29%

- ✓ Although not a specific goal of the software, 71% of teachers reported that the software increased their job satisfaction.
- ✓ Approximately a quarter of teachers thought use of the software increased parent engagement (29%).

SOURCE: TEACHER SURVEY SPRING 2018

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
Parents communicated more with teachers because they had questions about the program.	“Parent's [sic] were asking questions about it and asking if they could do it at home.” “Parents contacted regarding questions/concerns with [the software] in some cases where I wouldn't have heard from them otherwise.” “I had a situation where a parent wanted to know how the program worked. I sat down and showed them. Very effective.” “Parents seemed to check in with me more this year and encourage their child to meet math goals set specifically with [this software].”
Parents took ownership over tracking student progress and encouraging home use.	"Parents were checking on student progress and could better see the progress that their child had made. They also took charge of making sure they did it at home.” “During conferences, parents were interested to see this game that their child has explained to them. They were excited that this math program helped their child enjoy math. Since then, I have had many parents contact me to ask me how they can log on at home so their child can practice there.” “Some parents encouraged their students to be using [the software] as practice at home. As a teacher it was awesome.” “some parents develop a routine at home to do [the program]”
Parents knew what content was being taught.	“By allowing the students access to the program at home, it allowed the parents to see what they are learning and to be able to help them if needed. It also allowed the parents to see how their child was doing.” “Parents are aware of the concepts we cover in class and their student's performance at a better level because they are seeing the work done on [the software]. They can view a tutorial as well if they don't know how to help their student.” “When I have students struggling, I would tell the parent to work on [the software] with them at home. It helped the parent see how it was being taught.”
Parents had resources to help their children and spent time helping their children with math assignments.	“When using assignments, parents are able to use the"worked examples" button to help there students. They are able to monitor progress and encourage students to reach class goals.” “A few parents mentioned working with their child at home on some of the problems.” “Parents were involved in [the software] and lessons at home, and showed interest.”

SOURCE: TEACHER SURVEY SPRING 2018

Facilitators of Program Use

Table 24. Teacher Responses for What Helped Facilitate Use of the Math Software

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

Theme	Example Quotes
Access to equipment	"Having access to the lab as well as a cart full of computers made it easier." "Easy access in my classroom." "Having 1:1 computers in my classroom was a tremendous help!"
Technical support to understand how to use the software.	"I liked that I could get a hold of main contact to get questions answered and the help desk. Everyone worked hard to help me when I needed it." "Having a representative teach us how to use it was helpful." "Collaborating with colleges helped. Also training on the software." "Another team member helped show me what it was."
Time allocated to use the training.	"I just found a small chunk of time each day after recess to have the students work on it. They looked forward to it and for the most part worked hard during that short time." "Having students have a "Math Lab" class where [the software] was the mode of learning. Each student got 45 min per day in [the software]."

SOURCE: TEACHER SURVEY SPRING 2018

Table 25. Administrator Reported Facilitators of Software Use

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

Theme	Example Quote
Availability of devices	"We were able to get 1:1 technology for all of our students 1-5 grade this year." "Our school has a computer lab and Chromebooks shared among grade-level teams. Students also use [the software] during center time in classrooms.
On-going training and professional development	"Continual PD for new and more experienced teachers. Very accommodating." "The reps were great with training and meeting with teachers during PLCs." "The [software] team came to us and gave us PD two times this year to help us better use the software."
Scheduled time for program use	"We scheduled time into our master schedule for all classes to be in the lab to do [software] 3-4 days per week." "We scheduled time at the beginning of the year and planned to use the math program at the same times every week. That made it easy to get the required minutes." "We have a rotation schedule so our computer lab is used at full capacity."
Teacher comfort with the program, including having an expert teacher who could help other teachers	"Teacher's being familiar with the interface aided the overall use." "Having a teacher who had piloted the program the previous year was very helpful. He was able to help the other teachers with any problems they might have had." "We assigned a teacher expert over the software and she helped the others with any questions or needs." "Teachers training other teachers. It was nice to have teachers try out the software first and then have them train our staff on how the program works for our unique population"
Teacher buy-in	"It was most impacted by the buy in from our teachers." "[teachers] were anxious to have something for the students that would help them understand Math better." "A need to improve student competency in math facilitated widespread use of [the software]."
Support from the vendor, IT, or designated staff	"We had digital coach assigned to our school on a part time basis and she helped support and facilitated effective use." "We had an excellent training and we have an excellent school technology specialist that is able to support our teachers when necessary." "Our implementation specialist is great to work with! She made sure we had access to the software and the company is great to work with!"
Lab access provided at school	"We provided before, during and after school access to the computer lab for struggling students." "Students being able to access the software at school and home." "We had an established schedule for when students were to use the programs. We had an open lab after school and encouraged home use with parents."
Rewards for student goals	"We also rewarded students immediately when they passed a lesson with 80% or better in the lab. Then we put those names into a weekly drawing for little prizes. Teachers celebrated regularly with students on their progress." "We did do some incentivizing in particular classrooms to ensure effective use of the program. We also use it to support small group instruction which has made a world of difference for our teachers and students."

SOURCE: ADMINISTRATOR SURVEY SPRING 2018

Problems and Difficulties with the Software

Table 26. Difficulties Using the Programs

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

	ALEKS	*Imagine Math*	*iReady*	*ST Math*	Combined Programs
Teachers					
Sometimes the math software was frustrating for students to use.	69%	72%	69%	75%	71%
The math software works well on our devices (without crashing or slowing, etc.).	96%	90%	87%	88%	90%
I would have used the math software more, but I had trouble getting it to work correctly.	8%	12%	15%	14%	12%
Administrators					
The math software works well on our devices (without crashing or slowing, etc.).	95%	96%	97%	97%	96%
Our school has enough wifi coverage to support widespread use of the software.	95%	96%	97%	97%	96%
Elementary Students					
I had trouble using the program.	19%	20%	16%	22%	19%
Secondary Students					
Sometimes the program was frustrating to use.	72%	80%	68%	52%	73%
I would have used the program more, but I had trouble getting it to work correctly.	24%	28%	22%	19%	24%

- ✓ Most administrators (96%) and teachers (90%) agreed the software worked well on their devices.
- ✓ 73% of secondary students and 71% of teachers agreed the program could be frustrating for students.
- ✓ On average, 24% of secondary students and 12% of teachers agreed they would have used the program more if they had not had trouble with it.

Sources: Administrator, Teacher, and Student Surveys Spring 2018

Table 27. Teacher Reported Problems with Software

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

Theme	Example Quotes
Software could be slow, have glitches, or not work on certain hardware or browsers.	"The only thing I really have trouble with is the writing feature does not work well on the Chromebooks. Also, the data is very overwhelming so I don't really use it." "You can 't do it on the ipads." "The diagnostic is ONLY usable on a desktop computer. My classroom only has iPads. A week or more would go by before we would have access to desktops or laptops to continue the testing. This can be frustrating. Plus the diagnostic is only available for a controlled window of time. It should be free to issue when the teacher wants. The lessons became frustrating when the student could not pass a lesson, it would repeat twice then lock them out for the prep instructor or myself to set them on another path. For the cost this should be more intuitive." "Sometimes there were glitches in the software and the students had to reboot or the software froze." "…Students entering the correct answer but getting is wrong." "Sometimes there were glitches, answer boxes not showing up was the main one. My students finally just knew that at that point they had to log all the way out and start over. It was very frustrating for them when this happened during knowledge checks."
Logging in and remembering passwords could be troublesome.	"Signing in was an issue sometimes…" "There were times that it wouldn't let part of my students login when they were entering in their correct user name and password." "The lengthy passwords caused us issues at first."
Some teachers did not have good internet connections to support use of the software.	"Most was a result of some computer access. Some was a result of internet connections…" "We had some connectivity issues when we were accessing the program on the school Chromebooks in our classroom. Because of the security settings, in my understanding, the students have been logging in as if from home, and what work they were doing has been under "homework." So it's been impossible to track since then if they have been working only at school or also at home (other than the number of log ins), and all the work has had to be assigned as homework."
Some teachers need additional training to use the software.	"A great deal was also a result of my lack of knowledge on how to make the program work for me." "Being my first year using this software, it is very complex and has a lot to it. The more I used it, the more I realized what I could do with it, and the easier it became to have it do what I needed it to do."
Some teachers felt the software was not aligned with the curriculum or core standards.	"It was not testing Utah standards. The way the program worded the questions and answers was confusing." "The lessons were not tailored to the way we learned the math concepts."
Setting up the software could be slow.	"I only had difficulty when we were first trying to put students onto the program." "It is a slower process at the beginning of the school year, or when a new student joins the class."

Continued from the previous page.

Theme	Example Quotes
Some teachers felt the content was confusing.	“Many students did not understand the math questions it asked, so this caused me to give more one-on-one instruction that I had not planned on giving. It was very time consuming for me and not necessary. The online assistant was also not helpful for these students. A few of the math questions need to be reworded.” “Occasionally it worded the questions in very confusing ways. I didn't even understand what it was asking on some problems.” “Students did not understand how to answer the questions. It was too hard for struggling students.”
Some teachers felt the tools were difficult for students.	“Students had a hard time understanding how to manipulate and use some of the tools.” "I never had trouble getting it to work, but students sometimes found different tools or ways of entering solutions frustrating." "Students struggled creating lines and angles using the tools."
One problem is that the software was not accessible to students of all levels, which made it hard for them to use independently.	“It was designed for touchscreen and in Australia so some wording and formats were a little weird for the kids, but we adjusted” “Spanish Speaking students could not understand the characters” “The kids had trouble getting the help they needed with just the "explain" portion of the software. They needed more one on one guidance and we can't really use the teachers that are available in the software chat.” “When students have reached the "Challenge" component of [the software], there is less and less direction or instruction and students are easily frustrated.”

SOURCE: TEACHER SURVEY SPRING 2018

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
Some students reported that the software was boring.	"Well it worked fine, but it was so boring to do…" "The problems where that the system was just really boring…" "I was not able to choose the topics i wanted to do. it made me do the long boring ones and not the ones i was comfortable with doing"
Some students reported that they had trouble understanding the content and needed better explanations.	"Some of the questions are confusing and the hints don't help." "The questions weren't specific and was very confusing to use" "I didn't get what the problems were asking. Sometimes the explanations were confusing."
Some students reported that the content was difficult.	"IT was somewhat difficult because i had a hard time solving some problems!!!!" "On some problems it would ask for an explanation and is was very difficult cause it took 3-4 tries every time to get it right."
Some students reported that the software did not help them learn the material.	"Sometimes I would get the problem wrong and I just did not know how to do it right so [the software] was not helpful to me. It would have clues that did not help." "The entire program is a mess, its not helpful and it did more hurt then help."
Some students reported that using the software was stressful.	"Horrible, doesn't explain STRESSFULL" "… It was stressful to always have on your mind." "It was stressful having to get the assignments done and the questions are just worded weird."
Some students reported problems with technological aspects of the software.	"… sometimes it would mark a problem wrong when it was right" "A lot of the times, [the software] would not accept answers if you did not solve it their way. Some tools were also very difficult to use."

SOURCE: STUDENT SURVEY SPRING 2018

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
Some students reported having trouble with all aspects of using the software.	"Every time I go on [program] it says that there is a problem and it never really works. "almost every time I clicked a button it would say there was an unexpected problem." "um everything? Nothing made cents and it doesn't say how you were incorrect!!! :("
Some students reported that the math was generally difficult.	"I got to a point, where I learned every topic that I had learned in class already, so the problems got extremely hard, and the explanations were super long and made no sense." "It does not give me the right questions for my grade. i get super hard questions on the test and i have to repeat lessons." “Solving the problems that we had were really difficult and did not teach me enough for each lesson which made it very difficult for me and that is why i have triouble with it an that is why i do not like to use that math source”
Some students reported having trouble understanding particular topic areas.	"I had trouble solving problems like exponents and i also had trouble with fractions other than that the math was not that hard" "I had trouble with division and the drag the box in the box and it is just hard all together." "I had to use the [program] calculator to turn a multiplication problem into a decimal and I don't know how to do that" "figuring out how to find the product of adding, subtracting, and multiplying all together"
Some students reported being confused by what they were learning.	“[The software] didn't explain how to do things that I didn't understand. The math that they taught me was confusing from what my teacher was teaching me and it was very stressful to learn one thing that I understood and learn another at the same time. It was really confusing to me.” “It was very confusing and the examples made no sense. It gave you no way to help solve the problem like a fraction calculator. It should not be used as a math homework system at all!!!!!!!” "It didn't explain some of the things i was wondering about, and was sometimes confusing with its explanations"
Some students reported having technical difficulties	"Every now and then I would always glitch out and I would need to restart my computer. When I got back in all of my progress would be lost." "I would get an answer right and it would tell me wrong. My teacher would do it multiple times and get the same answer but [software] would tell my wrong. [Software] would glitch a lot." "It wouldn't let me finish the knowledge check. Every time i finished it would log me out and make me restart."

SOURCE: STUDENT SURVEY SPRING 2018

Table 30. Negative Reactions to the Program

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

	ALEKS	*Imagine Math*	*iReady*	*ST Math*	Combined Programs
Teachers					
The math software was a waste of time.	5%	10%	9%	3%	6%
The math software takes time away from instruction.	17%	21%	21%	12%	17%
The math software is an added burden.	11%	16%	18%	9%	13%
The math software is not worth it.	5%	11%	10%	4%	7%
Elementary Students					
The program was boring.	53%	53%	57%	40%	51%
Secondary Students					
The program was a waste of time.	48%	64%	57%	41%	50%
The program was boring.	75%	81%	77%	57%	75%

SOURCES: TEACHER AND STUDENT SURVEYS SPRING 2018

- ✓ Three-quarters of secondary students and half of elementary students indicated the software was boring.
- ✓ 17% of teachers indicated the software took time away from instruction, and 13% indicated it was an added burden.
- ✓ Despite some negative reactions to the software, few teachers indicated the software was not worth it (7%) or was a waste of time (6%).

Table 31. Teacher and Administrator Overall Assessment of the Program

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

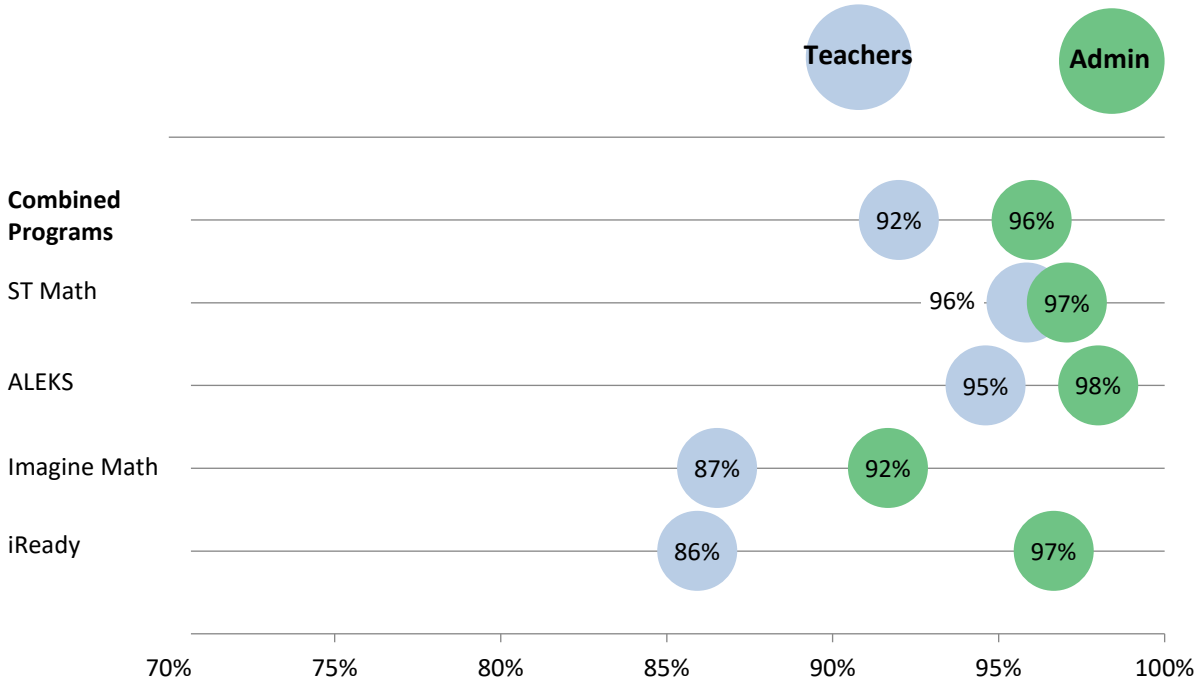
	ALEKS	*Imagine Math*	*iReady*	*ST Math*	Combined Programs
Teachers					
The software was a good complement to classroom instruction.	91%	85%	88%	94%	90%
The content of the software was well aligned with Utah Core Standards.	93%	94%	90%	94%	93%
The software was well aligned with my textbook or other curricular materials.	78%	77%	72%	81%	78%
Administrators					
Overall, I am satisfied with the math software.	98%	96%	93%	94%	95%

- ✓ Most teachers felt the software complemented classroom instruction (90%) and was well-aligned with the Utah Core Standards (93%).
- ✓ 22% of teachers indicated the software was not well-aligned with their textbook or other curricular materials.
- ✓ Most administrators (95%) were satisfied with the math software.

SOURCES: ADMINISTRATOR AND TEACHER SURVEYS SPRING 2018

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



- ✓ 92% of teachers would recommend the program to another teacher.
- ✓ 96% of administrators would recommend the program to another school.

Sources: Administrator and Teacher Surveys Spring 2018

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
The software aligns well with ongoing instruction and standards.	"I would recommend the software to others because it is aligned to the math program the district uses. It provides an opportunity for students to independently practice concepts taught in class. It allows for students to correct mistakes they make through guided scaffolds. [The software] provides notes for students to use and fluency exercises. It was highly recommended by my math coach! We even prepared lessons and activities together using the software." "I think it is a great supplement to instruction…" "The students are motivated to earn points for their avatar so they want to do well and master the concepts, and [the software] presents things in ways similar to SAGE testing so the student feels capable for year end testing."Also, the program gives practice in a standard or strand in multiple ways, which solidifies true mastery." "This program is the closest program I've seen in 22 years to use as a SAGE indicator. The scores seem to match quite closely. It provides individualized instruction that is so difficult to do with only one teacher in a classroom." "…it goes along with our 4th grade curriculum and the standards and either teaches them before I teach it or after to solidify their understanding."
The software provides supplemental instruction.	"It is a good support tool but should not replace direct classroom or group instruction. Aligning with classwork is sometimes challenging." "It is a great supplement, however our school has adopted a comprehensive math program (that we didn't have before) and it has similar technology components. Prior to this, we did not have access to those components and so [the software] was critical to providing rigor to our math instruction." "Its [sic] great in addition to classroom instruction I would not use it to replace math in a class."
The software promotes critical thinking.	"This is the best program I have seen for teaching students to keep trying things and not giving up when it is hard. I have seen an increases their critical thinking. Often when I teach a concept they will say"Oh I know this, I did it on [the software]. They love [software] time-they beg for it!" "It provides different ways to learn concepts, and helps foster critical learning." "I like that this software offers more critical thinking skills for my students. Next year I plan on using it more frequently and analyzing the data more."

Continued from the previous page.

Theme	Example Quotes
The software provided different and multiple ways to learn a concept.	"[The software] teaches math concepts in a very different way from our book. Students are able to interact with the problems, manipulate real-life scenarios, and understand abstract concepts in a concrete way..." "I think that this software gives students a way to see math differently. I like that they need to work it out and see another way to do it. I also think that the added ability to work on this at home created a link in the curriculum with parents. Some parents do not like the math." "It gives students additional math instruction in a different format." "It is a very different way for the students to look at doing math. I love the problem solving component, since that is a big part of my approach to most learning. Also, I have noticed that the children that either finish or come close to finishing the whole curriculum have a better understanding of math in general and do consistently better on their end-of-year tests."
The software fills gaps in understanding.	"[The software] is another way to help fill in the gaps that students have in their understanding. It promotes problem solving, critical thinking, and confidence in math. Gives creative ways to solving problems. Not just one way. Gives extra practice for skills to become mastered. Motivating and engaging activities for students." "[The software] is useful in many ways. I liked the ability to identify gaps in what a student knows or doesn't know, track student progress, and assign extra lessons based on need."
The software provides immediate feedback.	"Immediate feedback is very helpful. The way the program adapts to student abilities is also a major advantage. Your slow kids can go slow, you fast kids can go fast." "The best thing is that the software gives immediate feedback to students, and requires them to get 2 or 3 problems correct consecutively."
The software is highly personalized.	"It differentiates to student ability and knowledge. It also covers the concepts that I am teaching in class. [The software] explains to the students when they miss an answer." "i like the way it has students on their own level and at their own pace." "It adapts well to each student and they enjoy the program."
The software meets needs of accelerated students and struggling students.	"I like that it goes with the student. Students that excel can go as high as they want. I like it best for advanced students." "It is essential to meet the needs of all students, including the mathematically gifted. The standard curriculum does not do this and until I started using [the software] I had no idea how far my gifted kids could go. I even sent some of my 5th graders onto 7th grade for next year's general ed math. Truly this is a program that is worth every minute spent." "It is a great way for my students who struggle with reading to access math concepts." "It was a great tool for students that are struggling."

Continued from the previous page.

Theme	Example Quotes
The software shows results.	"I have noticed over the years that every student who has passed off the [software] curriculum for their grade has done exceptionally well on the state summative math test scoring on grade level and above grade level." "My students who have worked on [the software] during the school year did better on the end of year test." "Students who consistently completed at least 45 minutes per week made more growth academically in math than students who did not do minutes…"
The software provides data.	"This software provides me with lots of data that use almost every day to help me do small group instruction…." "The diagnostic gives me data that is difficult to obtain through other avenues." "identifies off grade level misconceptions and records them into a friendly report"
Students find the software engaging.	"[The software] is the absolute best math software that I have seen out there. It is amazing in its ability to engage students on an immediate level. They love the program and beg to use it! I love that they learn to solve math problems in creative and thoughtful ways, not just through rote memorization. There is real thinking and strategizing going on with [the software]. It is truly worth the investment of classroom and homework time." "It is engaging for the students and helps them to learn to solve problems."
The software is easy to use.	"[the software] is very user-friendly for the most part." "[The software] is easy to use. I can usually find any topic I would like. The students can easily use the software at home and at school." "It is easy to use and the students enjoy the program."

SOURCE: TEACHER SURVEY SPRING 2018

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
Lack of alignment with ongoing instruction and standards.	"The questions were not aligned to the Utah Math Core. For struggling students, problems that are not similar to the in-class problems create a much bigger burden." "It is nice for giving students a head start as they grow in math, but I would rather see a math program used that gave more practice for what we are learning. That way teachers can focus on interventions that are applicable to what the students should be proficient in at the time." "Not able to align with on-going classroom instruction, many of the activities were not intuitive to students…"
The software does a poor job of explaining concepts, correcting student errors, or meeting students' individual needs.	"I don't feel that [the software] has enough opportunities for students to get explanations when they have errors." "I feel that the explanations and worked examples are usually very confusing. When I have taught a concept and they have practiced in other ways, giving them an [the software] assignment tends to increase rather than decrease confusion. This isn't all bad, as the kids have practice for confusing language on the SAGE test, but it lowers confidence because they have been successful with the concept until they try to understand the [the software] questions and explanations." "It has too much reading for the low readers in the group." "Many of the program content activities were over-used and once a student had demonstrated proficiency, it should have moved them forward. Some of the skills were represented in a simplistic way that did not promote a broader range of thinking." "The wording of the questions was confusing and I did not feel like the creation of assignments was conducive to my students' needs."
Lack of training or difficulty using the software.	"Never trained on it. It was used as an activity covered by a teacher's aid. I never knew what it was all about..." "The program is a little confusing and I feel I did not have adequate training to make it helpful to use as a teaching tool."
Too many technology issues with the software.	"Complicated to get to, not wholly student-interactive, needs more props and individual devices to use for student work. Still had to print out worksheets for every lesson." "Many times it would kick my students out of the program. It would also say their answer was wrong and it wasn't when they tried the second time. Some of the wording was not student friendly" "I didn't feel like the math reports were super user friendly. I got on a few times during the year to try to use them, but found that they were more overwhelming than helpful so I didn't really use the results to inform my instruction. Also, the diagnostic tests were kind of annoying as if a student didn't get done within three weeks, it would just start over again. I had an ELL student who needed it translated so she couldn't work on it all the time and it reset her to 0 two different times. Not the most effective use of her time or mine."

Continued from the previous page.

Theme	Example Quotes
Lack of student engagement	"My students did not enjoy it as much as programs like [software]. It was frustrating and confusing for them." "It wasn't engaging for the students. They would race through the instructional part, and then be lost during the quizzes and come ask me to reteach it. Much of what they were being taught wasn't aligned to our core. They could "complete" a section without actually demonstrating proficiency. Things they learned didn't generalize to classroom instruction." "My students hated it and I felt like I was just using it as a time filler while I worked with other students."
The software took time away from other instructional activities	"I have tried to use [software] as a home assignment for children to receive the added benefit outside of school hours. Parents have not followed through. It is all but impossible for students to meet fidelity during the school day without added support from home, and this takes away from valuable instruction time. I've noticed that students who already spend lots of time on screens at home are those who gravitate towards using the software (and those who I don't worry about in terms of screen time do everything in their power to avoid it.)" "Software requirements of 90 minutes a week to enhance instruction time that is taken away from Go-Math, from the computer lab for projects like teaching argumentative writing, PowerPoint Presentations, etc."

SOURCE: TEACHER SURVEY SPRING 2018

Table 34. Administrator Reasons They Would or Would Not Recommend the Software to Another School

Theme	Example Quotes
The software facilitates differentiated instruction.	"It is a multi-tier system so that students may work at their independent level and be pushed to harder math problems." "Students are able to pace themselves and move as fast as they want. It is differentiation at its best!" "I would recommend it because of how individualized it is. It allows us to challenge the higher achieving students on their level. I also like that it helps fill the gaps of the lower achieving students." "The rigor of the instruction and the differentiation of instruction helps teachers meet the needs of all their students."
The software is well aligned with the Utah Core Standards and end-of-level testing.	"Many of the teachers that use the program consistently have noted growth for students. It also easily goes along with our math curriculum." "It is great support material for the curriculum." "The teachers have felt like it provides students with a good spiral review….When teachers have presented lessons, they have heard comments from students such as, *I already saw this on [software]*." "Aligns with the Core… Strong correlations with SAGE testing results." "I think it is very close to determining outcomes for how well the students will perform on the end of the year testing. It is helpful for setting goals for students with special needs."
The software promotes student depth of learning and problem solving.	"We love [the math software] at our school. I love how it encourages students to really think and problem solve." "The math software has helped to develop our students' conceptual knowledge." "It helps students look at math and problem solving in a different way that helps them remember." "It is easy to use for the students and it encourages them to problem solve to figure out solutions." "The students that work through this program find great success in all math areas. We find that our students who finish the program each year have more tenacity and a larger ability to struggle for longer before they shut down and quit."
The software increases student engagement with math.	"I feel like the software is beneficial when we can get students to be engaged." "The main reason I would recommend this software is because the students really enjoy using the software." "We find it to be a creative approach to mathematical concepts and not an on-line workbook." "The students at our school love [the math software]."
The software improves student scores on end-of-level testing.	"We have seen great academic gains in our students." "With only one year of use, we have seen tremendous growth and our end of level math assessments are showing overall improvement." "It has greatly impacted our math scores overall. Teachers are able to use the intervention piece in their math intervention block." "We believe that [the math software] has been a large part of the success of our SAGE scores." "End of year testing in math improved this year at our school. We believe it is a result of great teachers and [the math software]!"

Continued from the previous page.

Theme	Example Quotes
The software helps increase math learning in students who are language learners or not strong readers.	"Great program. Visual, adaptive, not language or reading dependent." "I love how it supplements students in the lower grades that don't necessarily have the reading skills required of other mathematics supplementary resources. Students can show their skills in math without being hindered by reading skills that aren't fully developed." "I love the program. It is accessible to our students regardless of their level in math or their knowledge of English."
Teachers value the software.	"We will be purchasing this software again next year based on teacher recommendation. We believe the software has supported increased learning and engagement." "Teachers indicate they feel it is valuable." "Teachers have seen positive student outcomes." "My teachers LOVE it." "All the feedback I have received from teachers has been positive. They feel [the software] has had a strong influence on student learning. It is used weekly and is part of student grades."
The software helps teachers, parents, and students monitor progress.	"Good diagnostics to inform instruction and interventions." "The formative and summative assessments have guided our math teachers toward better instruction and services." "It provides detailed information to teachers about progress or lack of it." "It is a very motivating program that allows the students to actually see their progress." "[The software] provides intervention as well as enrichment for all students. Students are able to track their own progress. Teachers are able to program the units and monitor student progress easily. Parents are able to help their students at home with their homework because the tutoring component is simple and easy to understand." "Our students know the program well and respond to their growth reports."

SOURCE: ADMINISTRATOR SURVEY SPRING 2018

Table 35. Teacher Opinions on How Software has Increased Innovation in Classroom

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

Theme	Example Quotes
Supports blended learning.	"It brings tech to my stations and leads to a better blended classroom" "We created custom pathways to use with our Blended Learning groups across our grade level." "Allowed an extra option of technological learning for the students…"
Provides a different way of doing homework.	"I assign it as homework which is more effective and the kids like much better than a worksheet." "I like having the students do some of their homework on the computer. It is where the world is going."
Provides new ways to present content and reinforce concepts.	"It has helped me use different instructional strategies with my students." "Again, it frees up time for more creative learning activities in class and it helps me plan instruction around topics students are actually ready to learn." "I am able to give my students different ways of looking at the information they are learning." "It provided an extra opportunity to review concepts that we have talked about."
Provides more personalized learning and differentiation for students.	"It allows me to see the students who need my help and prioritize where I spend my one-on-one time." "it has allowed me to structure my instruction for students needs while focusing on each students progress" "It's great at helping higher students go even further." "The software goes the student's pace. It is differentiated. Looking at the data, I can decide where my students are on different levels based on the data."
Allows for greater use of data to inform instruction.	"It has not helped my to be innovative but it has given me immediate data after my students have completed their daily practice. The reports were easy to read and gave the data I needed on their individual progress." "The data has helped to drive my instruction and create my small groups for the kids that need it. That includes kids that wish to go above and beyond." "It helps me collect quality data and use it as a launch pad to help me plan more applicable lessons."
Allows for more individual and small group instruction.	"I am able to direct more attention to students who are having a difficult time completing their assignments." "Allows me to teach new concepts in small groups, while the rest of the class gets meaningful practice." "It allows me to be more flexible with group and one on one learning/teaching"

SOURCE: TEACHER SURVEY SPRING 2018

Table 36. 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
Align with curriculum	"Taking the time to align the program with the sequence of lessons taught in the classroom is CRITICAL!" "After we completed a topic in our math books, I would assign an extra lesson on that topic as a review for the students before we tested on the topic." "Before you start the year align it with your curriculum and set up the map to align with the order you will teach the topics. That way you can hand-select the topics they are struggling with and apply to what you're teaching." "I create homework pathways each week that correlates with my in-class instruction. This is the only work my students have for homework for the week. This allows me to push out pathways to the majority of my class that are on grade level, but still gives me the flexibility to personalize lessons for my high-achieving or struggling students." "I like giving quizzes and tests on the topic we are learning because they get immediate feedback and I can allow them to retake the quiz until they get 100%." "Rearrange the order of the standards. The kids think it's like magic when it matches what they are learning in class."
Use data and reports to direct instruction and engage students in goal setting	"Make sure you look at the data to change instruction or enhance instruction." "Use this as a progress monitoring system, and give the students a knowledge check on a monthly basis." "It is important to look at the individual reports to check for understanding. That way it is easy to know what needs to be retaught as a class or with individual students." "It is an excellent source of data and to know what standards the students are missing. They are able to receive immediate feedback which really helps them as well." "The software has an "exit ticket" option that is a good glance at each student's level of understanding. It helps me to quickly see who is developing understanding and who is in need of more direct instruction."
Use as supplement to instruction	"When a student had an alert (meaning they failed a lesson twice), I would work with the individual student and connect what they were learning in class to the lesson in [program]. Then, I would re-assign the lesson and they would pass it off. This is the way the program is supposed to be used. Never are the children left to work on it while the teacher check their e-mail or works on correcting papers." "Design homework assignments that will reteach and score their work so that your class time is freed up for math activities." "If students don't have access to computers at home - we encourage them to come early and use the computers at school or go to the public library." "It is a very useful tool that provides many opportunities, but not a stand-alone instruction. Students get bored if they work too long on it with no other learning activities or interaction and its effectiveness decreases without accompanying activities, instruction, and authentic learning experiences."
Ensure teacher familiarity and understanding of program utility and content	"I would recommend teachers spend adequate time learning how the data can be displayed on the teacher-end of the program as well as how to best assign tasks and assessments to get the most out of the program."

Continued from the previous page.

Theme	Example Quotes
Engage families	"I would encourage teachers to orient parents to all of the components of ALEKS so they can better monitor & assist their child." "Use the benchmark assessment results in PT conferences." "Train the parents on how to check their students' progress, and explain that it is perfectly fine to struggle with a concept. They will not get everything on their first try, and that is O.K."
Use to reteach, review, redirect, and accelerate	"When I have students who are frustrated I have had another student who has finished that section of [program] help them so they know what to do. I realize that they are supposed to be doing [program] independently but I haven't had the time to explore well enough to show them myself and am working with small groups and individual students during the time when they are using [program]." "I use it for instruction and modeling by opening up an assignment and showing examples before having student start the assignment." "I have used it whole group on the smart board to introduce new concepts. Sometimes we'll go through an activity whole class if many students are struggling with it. I have those who have been successful show us what they did."
Use consistently	"I think it is important to set up a schedule and stick to it. Otherwise, you will find that you don't use it regularly and will not get the benefits." "Get the students on a routine. They need to get the chromebooks out at the beginning of class the same day of the week. It takes a few weeks but once they learn the routine it is no longer a hassle." "My tip is for teachers to use it consistently. It is in the consistency that my students build their fluency and accuracy." "Must meet weekly minutes. Turn off the games until the minutes are met." "Set aside time in class for devoted time on this program. Make it a necessary component of instruction."
Continue to improve access to technology and training	"I would highly recommend get training. Don't try to figure things out on your own." "Specific training for special education teachers so we understand better how to use the program to help us with IEP goals." "Get the in-person training very early so you start out the year correctly. We goofed up on the placement test because we didn't really understand the importance." "Learn about the reports, learn more capabilities of the software all the time." "Make sure you have enough computers or tablets scheduled for usage. Our main concern was the problem with having the designated time and resources in order to get the time in." "Sometimes the program would work and sometimes it would not. My teammates have chromebooks in their rooms, and they frequently had connectivity issues."
Consider motivators for student	"Do not hesitate to drop a student down a grade in the same strand if he/she is having a lot of frustration at grade level. Success at a lower level spurs the student on in the program so they are willing to try harder when they are put back on grade level." "The students love the avatars and they love to earn points towards donating. I would recommend that other teachers limit the students to only changing their avatars 1x/week so they don't waste time doing that when they should be working on their lesson. I would also recommend that they use the goals and contests as a way to motivate students and that they post the fliers around or send them home to increase student involvement."

SOURCE: TEACHER SURVEY SPRING 2018

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

Overall, administrators, teachers, and students had favorable opinions of the personalized learning software. Administrators and teachers perceived that the software had positive effects on student math performance (95% and 96%, respectively). They also agreed the software showed students new ways to solve problems; increased student math confidence, interest, and engagement; and increased student understanding of math utility and importance. Educators clearly value these programs, with 92% of teachers and 96% of administrators indicating they would recommend the program to other teachers or schools. Student perceptions were not as strongly positive, but still the majority of students indicated that the software showed them new ways to solve problems, increased their confidence in math, showed them ways that math could be useful, and helped make math more fun. Importantly, teachers report utilizing the software as a means of enrichment, differentiation, and reteaching.

Despite the positive opinions expressed by teachers, administrators, and students, respondents also indicated some 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
78% of teachers felt the software helped them engage more equitably with students, and 71% felt it helped them to use data and evidence to make changes to their instruction. Teacher comments also revealed multiple ways that teachers utilized the software to differentiate instruction and meet individual student's needs. Most teachers (81%) try to have their students meet fidelity recommendations. However, only 35% of teachers strongly agreed they knew the recommendations. This is consistent with findings from the 2016-17 school year. 41% of responding teachers indicated they do not have enough time during the school day to accommodate fidelity recommendations. 40% of teachers reported using data reports at least weekly to assess student learning. 39% reported using data reports once a month or less. For the most part, teachers felt the data reports were useful and knew how to use them; however, 18% of teachers indicate they do not know how to use the data reports to inform instructional decisions. Notably, 71% of respondents indicated they would like to receive more training on using the reports. While most teachers and administrators agreed they have access to devices and support for using the software, 30% of teachers indicated they do not know how to get immediate support and 16% indicated they did not have access to devices as much as they needed. 2% of responding teachers indicated they do not use the software. Reasons provided for not using the software included issues of access to software or devices, need for training, and preferences for other instructional methods.	**Increase effective utilization of math personalized learning software programs:** • Provide regular training opportunities for teachers on a range of desired topics such as ways that other teachers have used the software to free up instructional time rather than detract from instructional time. • Offer a wide range of training formats, including webinars, brief emails with usage tips, and online community forums for asking questions and sharing strategies. • Provide a protocol for accessing support resources for implementation and maximizing utility of the programs. • Provide a venue for teachers to share best practices in using

Findings	Considerations for Improvement
We asked teachers whether they would like training on seven aspects of the software, including customizing programs, differentiating instruction, aligning with concepts being taught, using program tools, using data reports, integrating program use with regular instruction, and ways to use the software. The majority of teachers wanted additional training on all of these.	software to expand community of practice. • Engage teachers who utilize the software programs in ways to enrich, differentiate, and reteach students to provide professional learning opportunities for other educators.
The majority of teachers (84%) have sufficient access to computers or tablets, and 90% indicated the software works well without crashing and slowing. However, in their comments, a number of teachers indicated they had problems ranging from poor internet connections, incompatibility of software with available devices, and glitches.	**Resolve issues regarding access to software and hardware:** • Work with LEAs with the lowest usage rates to resolve specific frustrations identified in the surveys.

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 spaces 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.

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 improve student math performance through the increase of teachers' instructional effectiveness. Specifically, courses in the endorsement program are designed 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 (see forthcoming appendix).

The 2016-17 report provided survey results from teachers who had just completed (or were about to complete) the two-year program. Because a new cohort started in 2017-18, the survey data reported in this report are baseline data, that is, data collected from the new cohort as they were beginning the program. Therefore, survey results reported here focus on teachers' expectations at the start of the program rather than their experiences in the program.

Data sources included participation records and a survey administered to all teachers participating in the second cohort. The survey was administered in the fall of 2017 to reflect participant expectations of the program as well as STEM instructional practices prior to participation in the Endorsement program.

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.

Student outcomes will be further assessed by analyzing student math performance of participating teachers at the classroom level, as these data become available.

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

Table 37. Elementary STEM Endorsement - Participants Starting the Second Cohort

Partner IHE	Total IHE Participants	Partner Districts (and Number of Participants)
Brigham Young University (BYU)	35	Alpine SD (18), Nebo SD (18)
Dixie State University (DSU)	32	Washington SD (22), Charter (10
Southern Utah University (SUU)	105	Beaver SD (3), Canyons SD (7), Charters (9), Garfield SD (1), Iron SD (24), Jordan SD (48), Kane SD (4), Millard SD (2), San Juan SD (4), Washington SD (3)
University of Utah (UU)	43	Granite SD (24), Murray SD (7), Salt Lake City SD (12)
Utah State University (USU)	49	Cache SD (10), Charter (3), Logan SD (3), Tooele SD (15), Weber SD (18)
Utah Science Teachers Association (UT STA)	39	Cache SD (3), Canyons SD (3), Charter (1), Granite SD (9), Iron SD (1), Jordan SD (9), Murray SD (3), Nebo SD (1), Ogden SD (3), Provo SD (2), Salt Lake City SD (2), 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)	100	Davis SD (70), Ogden SD (30)
Total	**435**	**24 School Districts plus 7 Charter Schools**

SOURCE: STEM AC DATA

Table 38. Elementary STEM Endorsement Survey Respondents by Partner IHE

	BYU	DSU	SUU	USU	UU	UVU	WSU	Other	Total
Teacher Ns	23	25	0	17	50	1	48	4	**168**

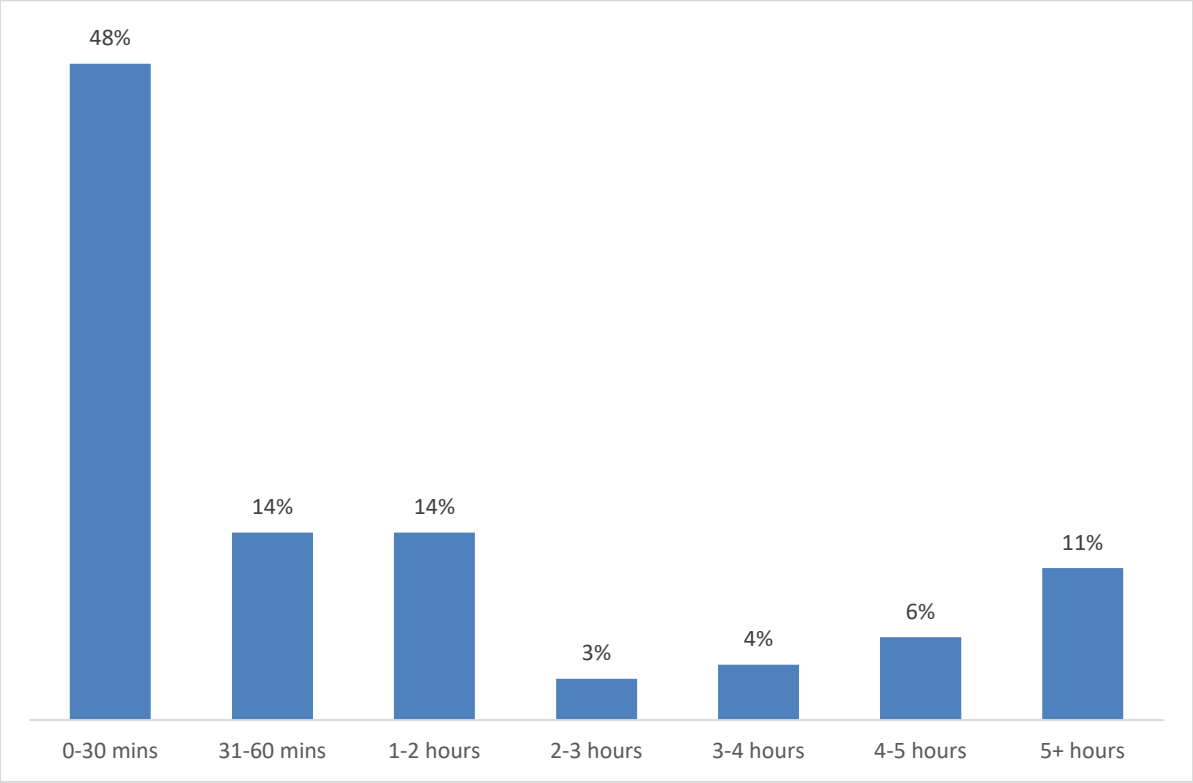
Table 39. Elementary STEM Endorsement Survey Respondent Characteristics

Grade Levels Taught[3]		**Subjects Taught**[4]		**STEM Subjects Taught**		**Years at Current school**	
K	7%	Science	87%	At least 1	95%	0 – 5 years	69%
1st	16%	Technology	56%	At least 2	81%	6 – 10 years	21%
2nd	13%	Engineering	28%	At least 3	52%	11+ years	10%
3rd	15%	Mathematics	84%	All 4	24%		
4th	22%	Health or PE	25%				
5th	27%	Social Studies	76%			**Years of Teaching**	
6th	22%	Language Arts	84%			0 – 2 years	16%
Admin/other	7%	Art	48%			3 – 5 years	18%
		Other	7%			6 – 10 years	25%
						11+ years	41%

SOURCE: STEM ENDORSEMENT TEACHER SURVEY FALL 2017

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

Figure 13. Last year, approximately how many minutes each week were your students engaged in instruction that integrates STEM?



- ✓ In the year prior to starting the STEM Endorsement program, on average, teachers engaged students in instruction integrating STEM about two hours per week; however, almost half reported 30 or fewer minutes per week.

SOURCE: STEM ENDORSEMENT TEACHER SURVEY FALL 2017

STEM Endorsement Course Format and Teacher Motivation

Figure 14. What is the format of the STEM endorsement course(s) you are currently attending?

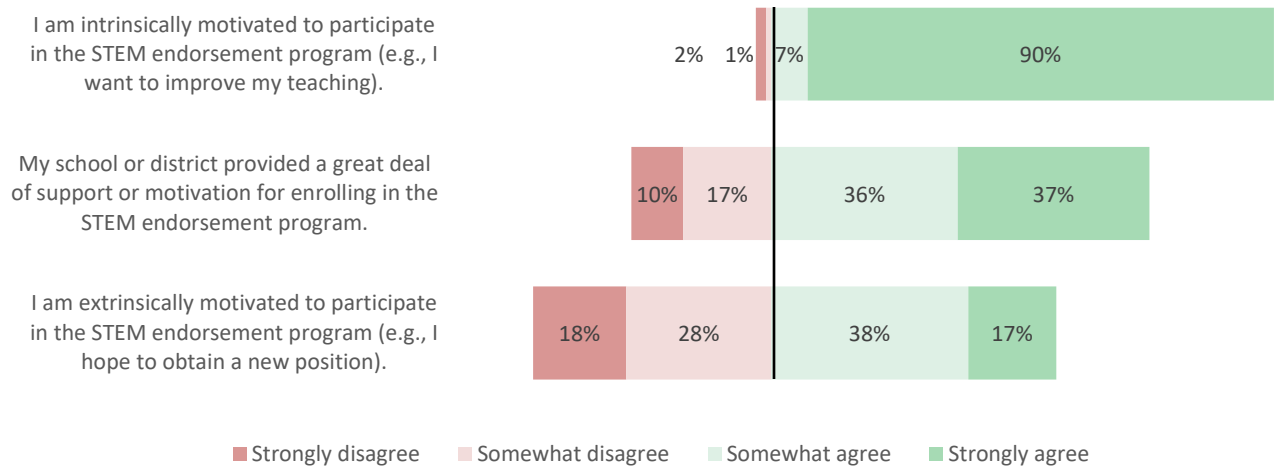
96% **of teachers attend face-to-face instruction** (instructor and students present in the classroom)

1% **of teachers attend distance education** (instructor broadcasts to multiple classrooms across the state)

4% **of teachers attend blended courses** (part of the course is face-to-face or distance and part is online

- ✓ Teachers could select as many as applied.
- ✓ Most teachers reported attending only face-to-face classes.

Figure 15. Teacher Motivation for Pursuing the STEM Endorsement



- ✓ Teachers indicated they were primarily intrinsically motivated to pursue the STEM endorsement (90%), although extrinsic motivations also played a part (55%).
- ✓ 73% of teachers agreed that their LEA provided strong support or motivation for the STEM endorsement.

SOURCE: STEM ENDORSEMENT TEACHER SURVEY FALL 2017

Table 40. Teacher Motivation for Pursuing the STEM Endorsement by Institution

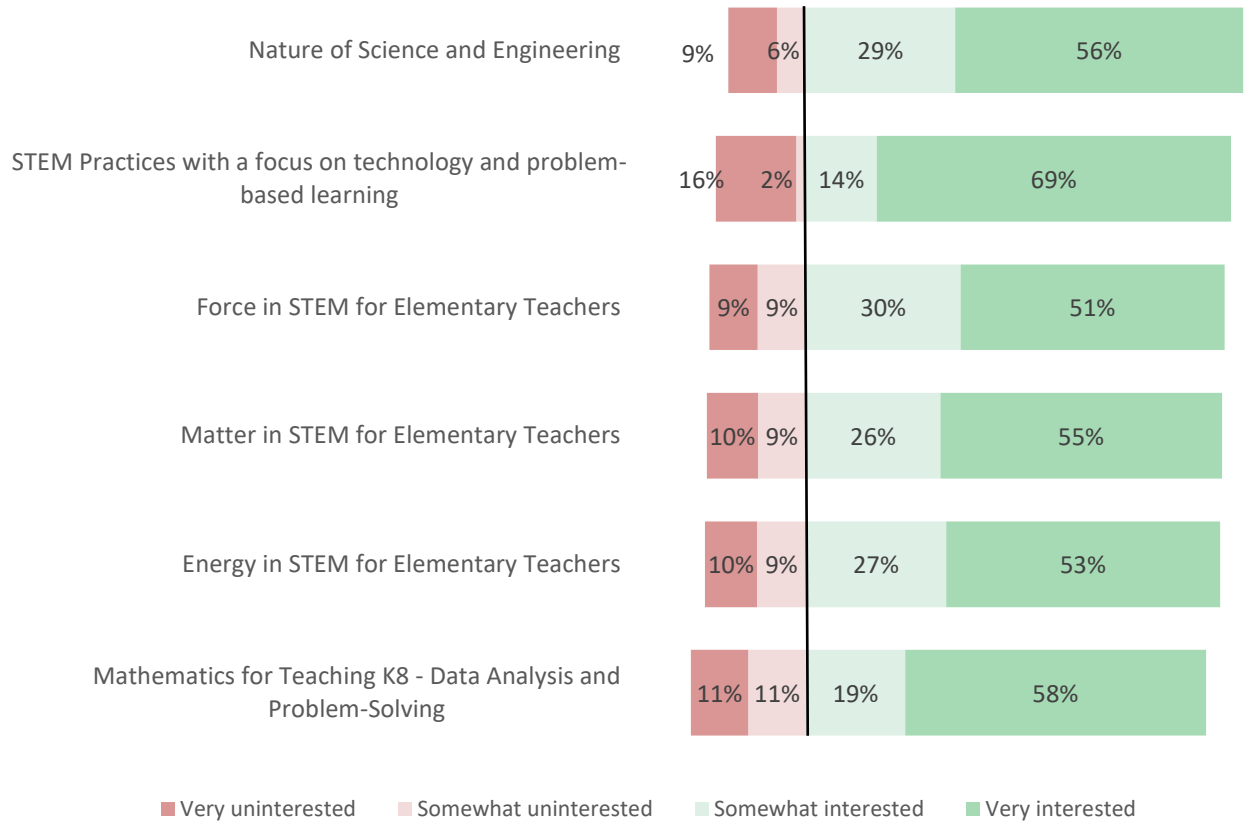
Percentage who *somewhat agree* or *strongly agree* with each statement.

	BYU	DSU	USU	UU	WSU	Total
I was intrinsically motivated to participate in the STEM endorsement program (e.g., I want to improve my teaching)	100%	96%	94%	98%	98%	98%
I was extrinsically motivated to participate in the STEM endorsement program (e.g., I hope to obtain a new position).	26%	43%	63%	53%	71%	54%
My school or district provided a great deal of support or motivation for enrolling in the STEM endorsement program.	65%	65%	94%	66%	83%	73%

SOURCE: STEM ENDORSEMENT TEACHER SURVEY FALL 2017

- ✓ Teachers across institutions showed high levels of intrinsic motivation to complete the STEM endorsement.
- ✓ There were variations between institutions for extrinsic motivation and school or district support.

Figure 16. Teacher Interest in Endorsement Courses

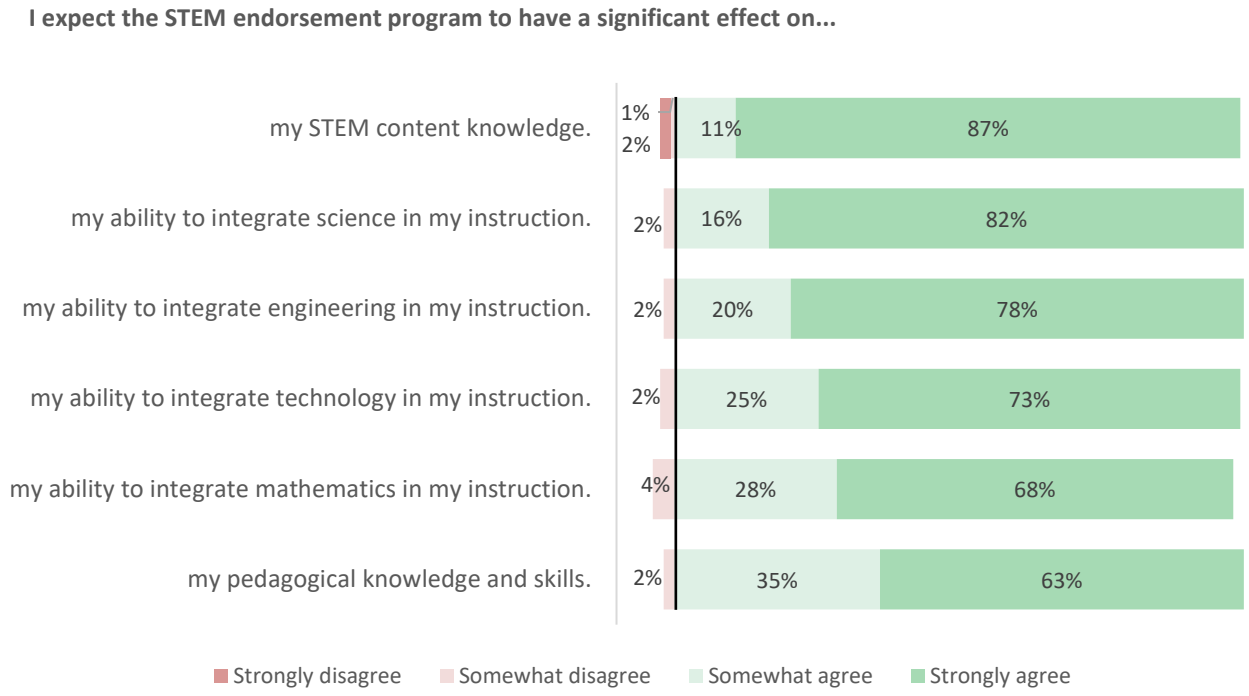


✓ More than three quarters of the teachers were interested in all of the endorsement courses offered.

SOURCE: STEM ENDORSEMENT TEACHER SURVEY FALL 2017

Anticipated Outcomes of the STEM Endorsement

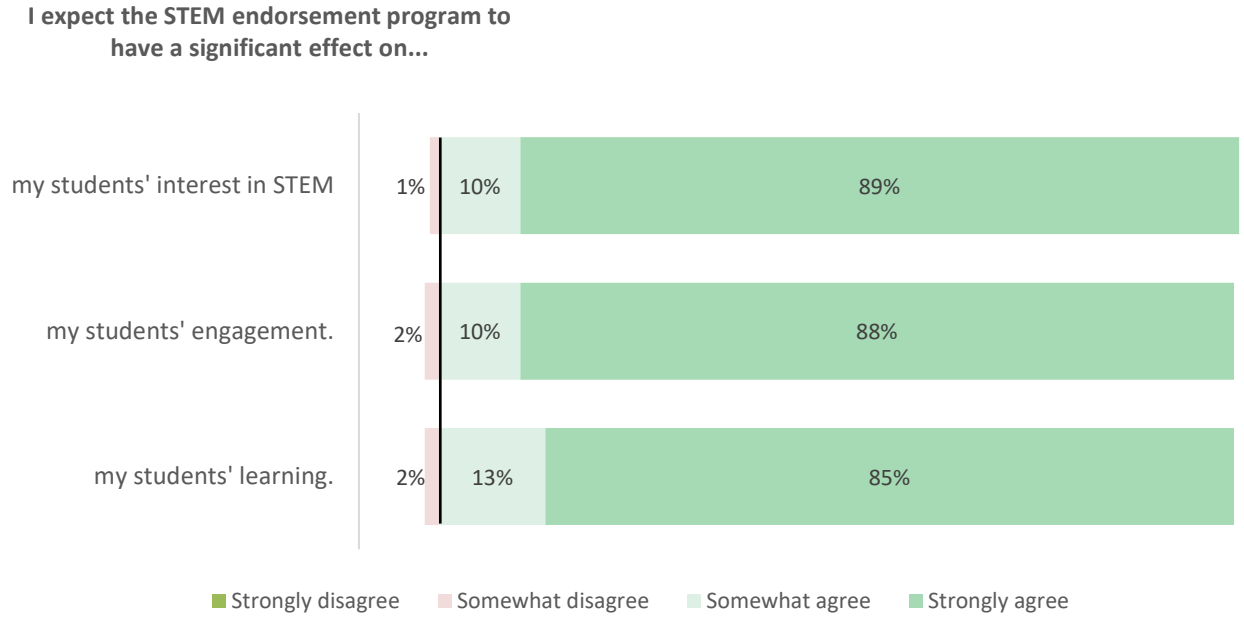
Figure 17. Expected Impact of the STEM Endorsement Program on Teaching



- ✓ More than half of teachers strongly agreed that they expect the STEM endorsement program to significantly affect their instruction.
- ✓ More than three-quarters (75%) of teachers strongly agreed that they expect the STEM endorsement program to significantly affect their own content knowledge and ability to integrate STEM areas into their instruction.

SOURCE: STEM ENDORSEMENT TEACHER SURVEY FALL 2017

Figure 18. Expected Impact of the STEM Endorsement Program on Students



- ✓ The majority of teachers strongly agreed that they expect the STEM endorsement program to increase students' interest, engagement, and learning in STEM.

Table 41. Teachers' Overall Expectations for the STEM Endorsement Program by Institution

Percentage who *somewhat agree* or *strongly agree*.

	BYU	DSU	USU	UU	WSU	Total
I expect that my participation in the STEM endorsement program will be a professionally rewarding experience	100%	96%	100%	100%	98%	99%

SOURCE: STEM ENDORSEMENT TEACHER SURVEY FALL 2017

- ✓ Nearly all teachers across institutions expect that participating in the STEM endorsement program will be professionally rewarding.

Table 42. Teachers' Expectations from Participating in the STEM Endorsement Program

Theme	Example Quotes
Participating will enhance my own content knowledge.	"I hope to gain a better understanding of STEM…" "more confidence in the STEM areas…" "I anticipate that it will broaden and deepen my understanding & opportunities available in the current field of STEM education." "I hope to be able to add more engineering experiences to my classroom and feel more comfortable with teaching the math concepts."
Participating will enhance my instructional skills.	"I feel that the STEM endorsement will help me to be a more effective teacher in all aspects of my teaching. As I have taken this course, I find that I ask more questions from my students to make them think about things more deeply." "More ideas, more resources" "Application and relevance [to students]."
Participating will enhance my ability to teach subjects in integration.	"…how to integrate across curriculum to give my students the best possible chance to learn these concepts and ideas." "…help me to be confident in my abilities to teach subjects integrated STEM base strategies." "…being better prepared to integrate these subjects into daily teaching routines."
Participating will enhance my ability to engage students in inquiry-based learning	"I just hope it will help me be a better, more hands-on instructor." "I think it will help me get the students making sense of the science instead of me trying to teach them the sense of the science." "I'm hoping that my teaching will become more project/theme based. I want to teach all the subject areas around a central topic so that my students are very invested in the learning."
Participating will enhance my ability to provide student-centered instruction	"Change my teaching by moving to a student-centered approach rather than teacher-centered." "I have already experienced a shift in my approach to teaching. I am realizing through these courses that most effective teaching occurs when students are motivated, interested, involved, and allowed to own their learning. The integration piece of this program is helping me to apply new skills to begin teaching in this way." "I will teach with more student interaction among themselves."

SOURCE: STEM ENDORSEMENT TEACHER SURVEY FALL 2017

Table 43. Teachers' Concerns About the STEM Endorsement Program

Theme	Example Quotes
Concern about the time and work required to complete courses	"Time is a concern." "I'm only concerned about how much additional work I'll be doing on top of my personal class work load." "Our district has adopted a new math program this year. I have concerns about my ability to complete my weekly work assignments, give enough time to study and teach the new math program, and have enough time to meet all my obligations for my endorsement class." "I'm concerned about the workload compared to other endorsement classes I've taken." "I am worried about the work load outside of class and its effect on my job as a teacher."
Concern regarding instruction received	"There was a lack of communication at the beginning of the program." "Too much theory not enough hands on STEM activities." "Giving purpose to learning for the students, not just sitting and learning from the teacher in whole group and small group instruction. More hands on and application."
Concern about how to implement lessons learned in classroom	"Would like more processing time during the class time. It has been overwhelming at times since the classes so far have been geared more for adult thinking than student thinking." "Time to implement- Preparation for the classroom instruction." "I have noticed an interest and excitement with many of the teachers as they have taken the classes through the summer, but there seems to be a little hesitation to implement what they have learned. I have offered to help as well, but I wonder if some of the hesitation comes from a lack of resources. The materials are all there when the teachers take the STEM classes, but when they go back to the schools there is a lack of resources and materials."
Concern about logistics of taking courses	"My concern is more about the availability of the classes." "I wish that the location was closer like within [my city's] boundaries." "It would be nice to be registered before classes start so we can access what we need. Textbook availability has been a bit disappointing."

SOURCE: STEM ENDORSEMENT TEACHER SURVEY FALL 2017

Table 44. Teachers' Positive Feedback About the STEM Endorsement Program

Theme	Example Quotes
General excitement for this program	"Thanks for doing this, I am excited for the classes." "I'm really excited to get started!" "I am really looking forward to completing this. I am so glad I decided to take it." "Jessica has been extremely helpful in answering questions and explaining the expectations of the program. I have a colleague that encouraged me to apply for the program. because she loved it!" "Great program, AMAZING instructors!" "LOVE IT!"
Excitement about what they'll learn/have been learning	"I am excited to take this course, and looking forward to the benefits of science, technology, engineering, as well as math processes to improve upon my teaching." "I wish this is the way I learned about science. It is very fun and engaging and the self-discovery makes it the most rewarding." "So far the program has been very intensive, thought provoking, and engaging. My view of the world has broadened so that I may now encourage my students in their learning." "The instructors and labs that are provided are great as examples of how to teach using the new methods. Love the hands on, and the opportunity to write a vignette to share and have feedback on it."
Excitement about trying new things in the classroom and improving instruction	"I can't wait to apply things I learn from this course in my classroom-especially the ideas that have to do with technology!" "The courses I have taken so far have been challenging and eye opening. I am excited to baby step my way into this program as I reevaluate how I teach and how I will have students learn." "I have completed two classes, and have absolutely loved them, the instruction was incredible. I'm more excited to begin teaching our students this year than I've been before, after participating in the classes I've been in." "I have found the classes that I have taken so far very engaging and enlightening. I look forward to using much of what I have learned this year with my students in science and Math." "WSU and DSD are doing a great job creating an engaging, worthwhile program. This will change teaching and learning in my school." "I already have both mathematics and technology endorsements. I hope that the STEM endorsement will help unify those areas in my teaching practice."

SOURCE: STEM ENDORSEMENT TEACHER SURVEY FALL 2017

Considerations for Improvement for the Elementary STEM Endorsement Program

New teachers beginning the STEM Endorsement Program were very enthusiastic about the program and optimistic that their participation would improve their instructional practices and their students learning and engagement.

These data are from teachers beginning the program. We will follow these participants longitudinally to report on persistence, attrition, and outcomes of participation. The following considerations are provided for the purpose of informing the STEM Endorsement program improvement efforts.

Findings	Considerations for Improvement
370 teachers from 7 charter schools and 24 school districts started the second cohort for the STEM Endorsement. Nearly all respondents (97%) indicated they were participating in the program for intrinsic reasons, but over half (55%) were also participating for extrinsic reasons. All respondents indicated they believed the program would improve their STEM teaching and their students learning and engagement.	**Maintain a focus on persistence of participants to maximize return of participation.** • Provide an exit, completer, and two year completer survey to determine impact of the endorsement program. • Determine a scalability plan for subsequent years of the endorsement program. • Utilize endorsement participants to provide professional learning and support recruitment efforts. • Strategically market the endorsement program to recruit teachers from schools with low scores in math and science.
95% of teacher indicated they teach at least one STEM subject, while only 24% teach all four. On average, teachers reported engaging in instruction that integrated STEM topics an average of 2 hours per week; however, 48% of teachers indicated they spent 30 minutes or less per week on STEM integration. Teacher comments indicated concerns about finding time for the course requirements and while maintaining their teaching loads. Teachers also indicated they preferred hands-on, usable instruction over theoretical material.	**Increase the impact of the STEM endorsement program:** • Provide samples of the changes in lesson plans resulting from the endorsement program. • Provide an integrated approach to the endorsement program that attends to the applied side of the learning and “class ready” instructional techniques. • Build a repository of integrated lessons attempted and feedback/reflections from participants to contribute to the lesson bank and professional community.

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. 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 19. 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 45. Numbers of Participants in STEM Professional Learning (PL) 2017-18

School District or LEA	Number of LEA-Reported Professional Learning Participants	Number of Edivate Users
Alpine School District	1,366	--
Cache School District	10	--
Canyons School District	119	--
Carbon School District	21	--
Charter Schools	759	719
Davis School District	862	364
Granite School District	54	63
Jordan School District	160	--
Millard School District	41	11
Morgan School District	154	127
Nebo School District	104	72
Ogden School District	55	--
Park City School District	11	--
Piute School District	28	24
Provo School District	483	563
San Juan School District	36	11
Salt Lake City School District	64	--
South Sanpete School District	75	161
South Summit School District	95	91
CUES (Central Utah Educational Services includes Tintic, Juab, North Sanpete, South Sanpete, Sevier, Piute, and Wayne School Districts)	22	--
DLI STEM Schools (11 schools from Alpine, Cache, Davis, Jordan, Logan, Provo, and Tooele School Districts and 1 charter school)	11	--
Uintah School District	47	22
Washington School District	123	--
Wayne School District	33	25
Weber School District	859	--
Total	**5,592**	**2,253**

Source: STEM AC data and annual reports

- ✓ Edivate mean use by teacher = 625 minutes per year (52 minutes per month).
- ✓ 58% of Edivate users used the program an average of 20 minutes per month or more.

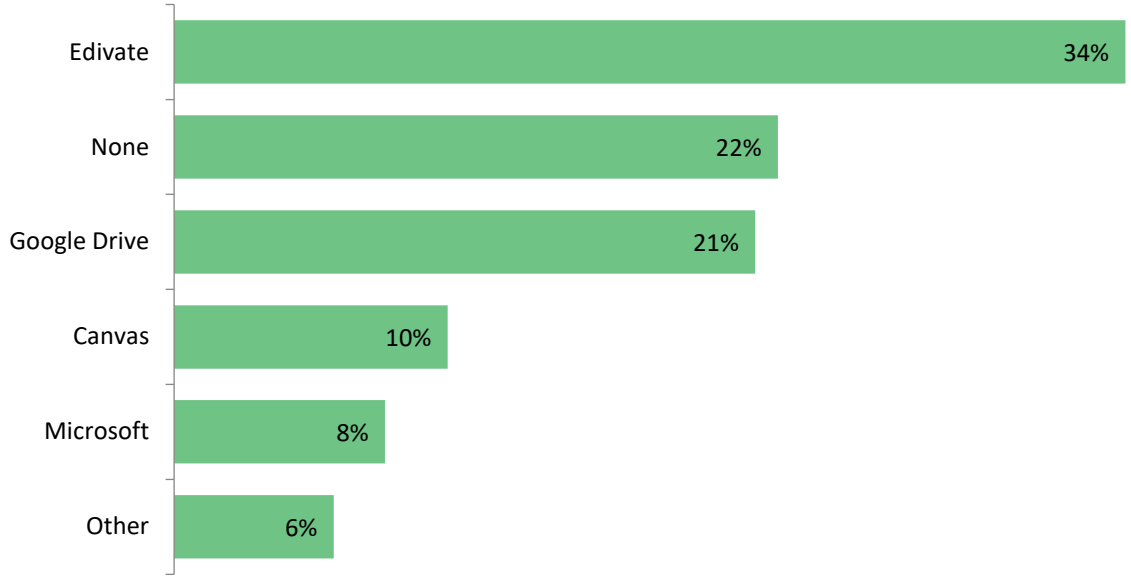
Table 46. Teacher and Administrator Survey Response Numbers for the Professional Learning Project

	N	%
Teachers Total	**489**	**100%**
Administrators Total	**26**	**100%**
Teachers by Grade Level Distributions		
K - 2nd	79	18%
3rd - 6th	280	64%
7th - 8th	95	22%
9th - 12th	65	15%
Teachers by STEM Areas		
Science	353	73%
Technology	275	57%
Engineering	214	44%
Mathematics	351	73%
Does not teach STEM	42	9%

- ✓ Teachers could choose more than one grade level and STEM area; therefore, the percentages add to more than 100%.
- ✓ Most teachers (91%) responding to the professional learning survey taught at least one STEM area.

SOURCE: ADMINISTRATOR AND TEACHER SURVEYS SPRING 2018

Figure 20. Teacher Reported Primary Platform for Video-Based STEM Professional Learning

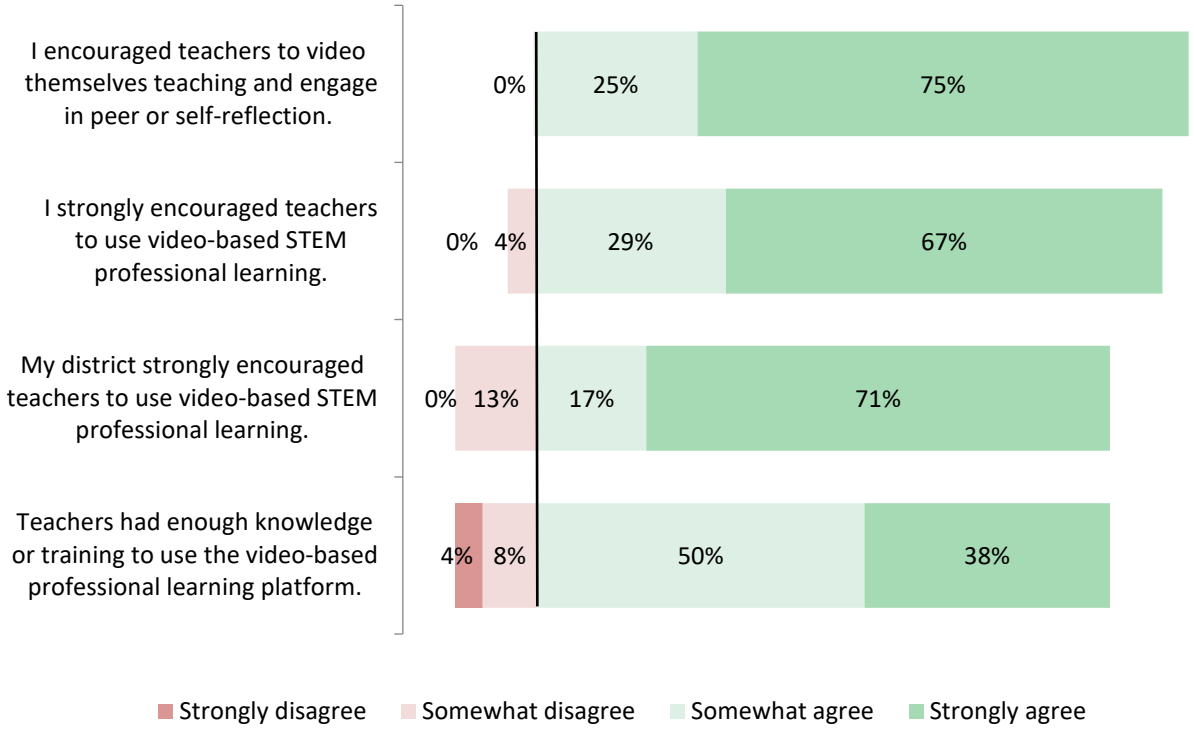


- ✓ The most commonly used platform was Edivate, followed by Google Drive.
- ✓ 22% of responding teachers did not have a platform for video-based STEM professional learning.

SOURCE: TEACHER SURVEY SPRING 2018

Preparation and Support

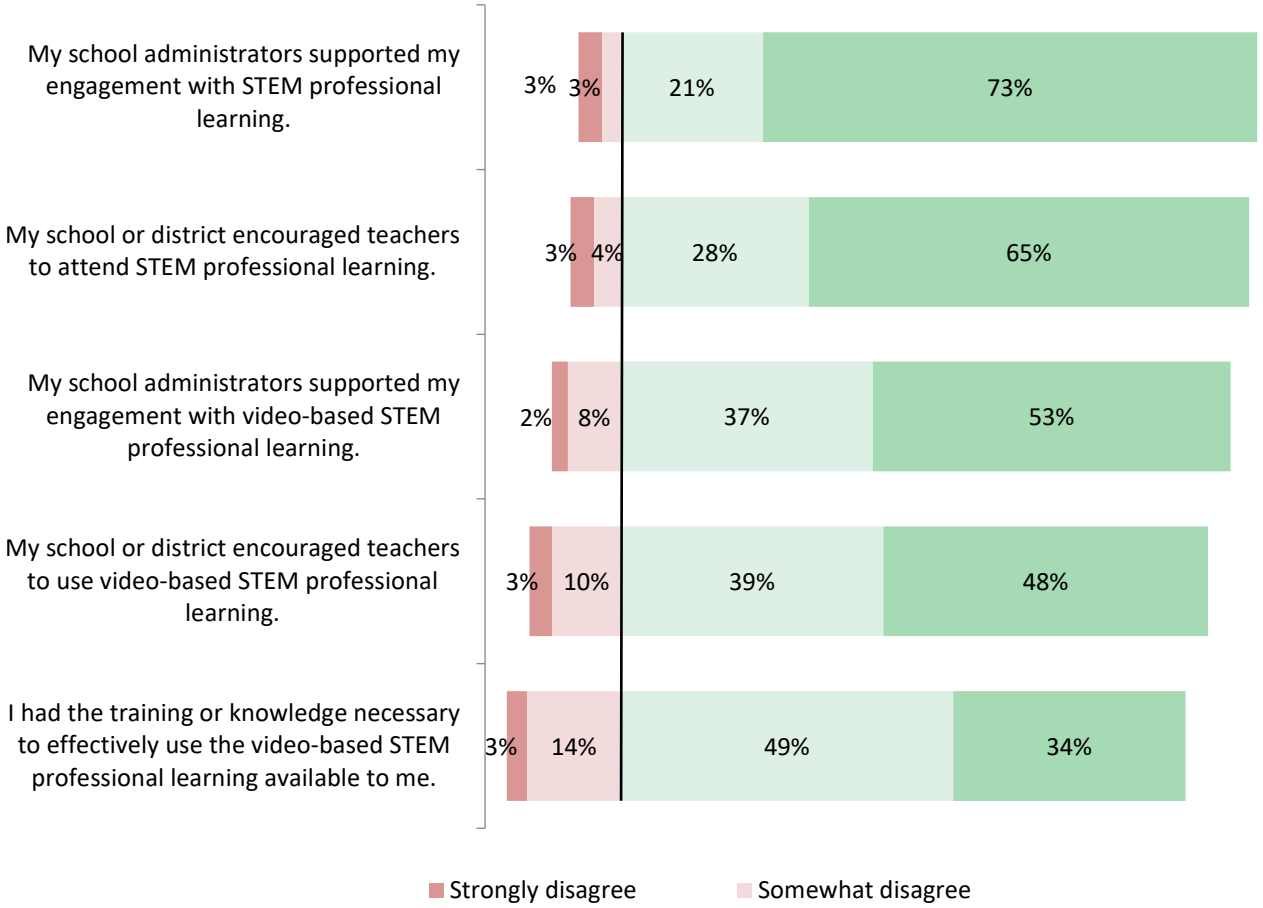
Figure 21. Administrator Perceptions of Support for Teachers to Use Video-Based STEM Professional Learning



SOURCE: ADMINISTRATOR SURVEY SPRING 2018

- ✓ This group of questions was asked only of administrators who indicated they used video-based STEM professional learning (n = 24).
- ✓ 100% of responding administrators encouraged teachers to video themselves for peer- or self-reflection.
- ✓ Responding administrators generally reported that teachers had district support and enough training to use the video-based professional learning.

Figure 22. Teacher Perceptions of Support for Use of Video-Based STEM Professional Learning

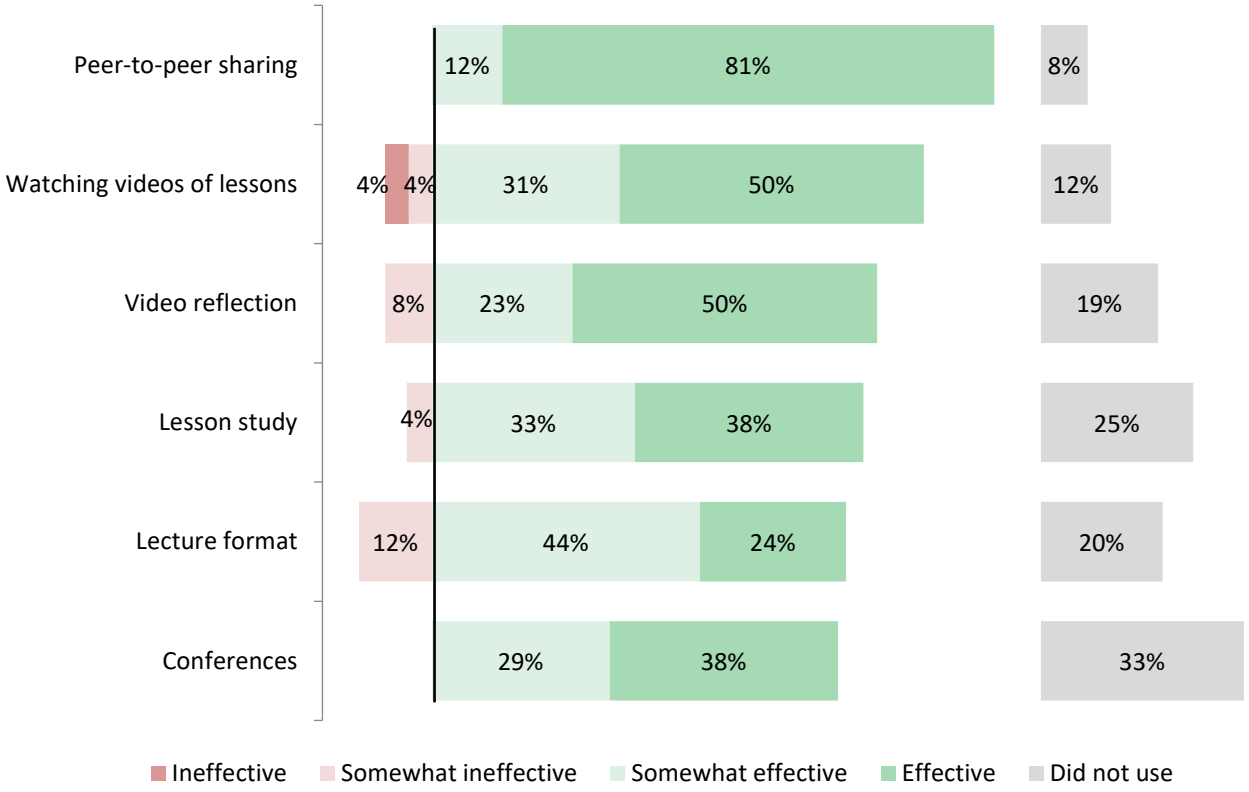


- ✓ This group of questions was asked only of teachers who indicated they used video-based STEM professional learning (n = 298).
- ✓ Teachers generally agreed that they had district and administrator support to participate in STEM professional learning.
- ✓ Most teachers agreed they had the training or knowledge necessary to use the video-based professional learning, but 17% could use additional assistance.

SOURCE: TEACHER SURVEY SPRING 2018

Use and Effectiveness of Professional Learning Formats

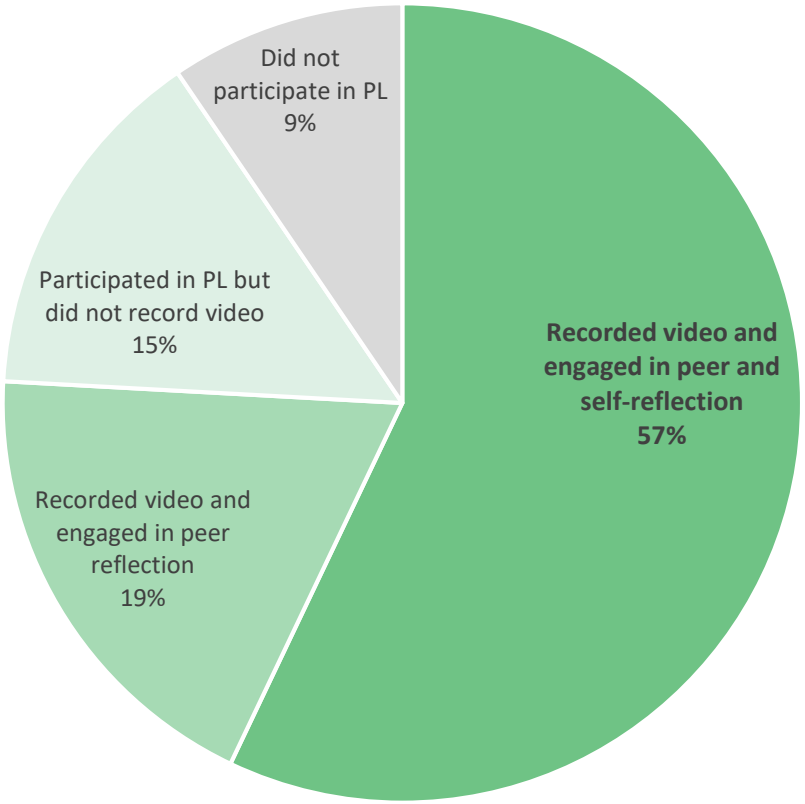
Figure 23. Administrator Use and Perceptions of Effectiveness of STEM Professional Learning Formats



- ✓ Peer-to-peer sharing for STEM professional learning used by the most administrators and was seen as effective by the most administrators.
- ✓ Watching videos of lessons and video reflection was also used by the majority of administrators and seen as effective by most.
- ✓ 19% of responding administrators indicated they did not use video reflection for professional learning.

SOURCE: ADMINISTRATOR SURVEY SPRING 2018

Figure 24. Teacher Participation with STEM Professional Learning in 2017-18

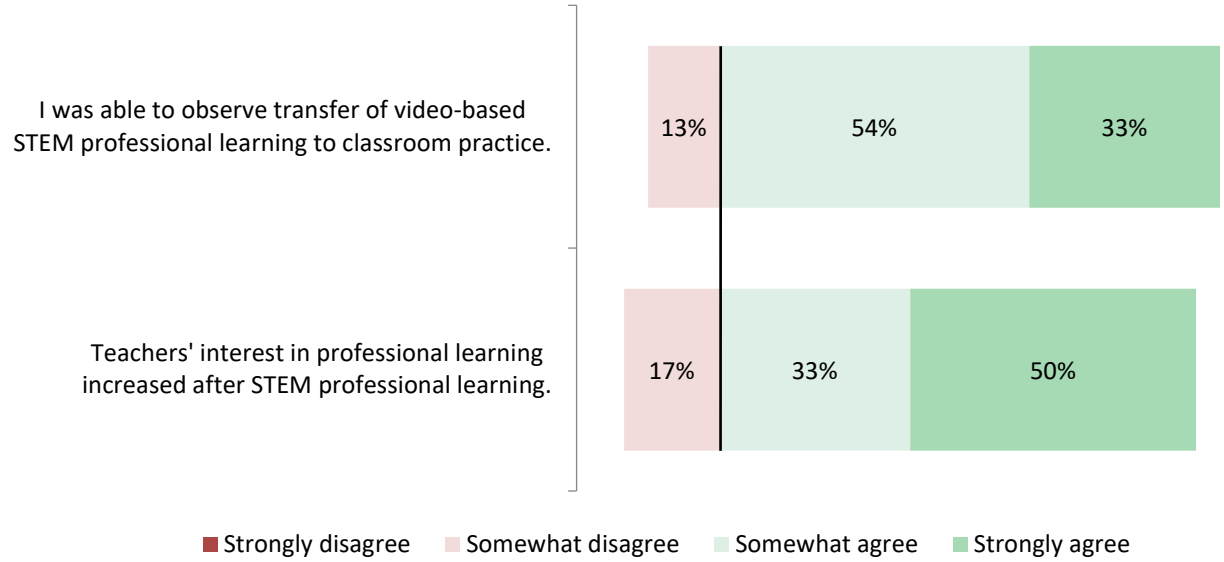


SOURCE: TEACHER SURVEY SPRING 2018

- ✓ 57% of all responding teachers indicated they recorded video of themselves teaching and engaged in peer and self-reflection (246 out of 431).
- ✓ Teachers were asked to indicate how many minutes they engaged in PL and video reflection each month during the school year. However, responses indicated that a large number of teachers likely provided the number of minutes per year, making the data uninterpretable.

Perceived Outcomes

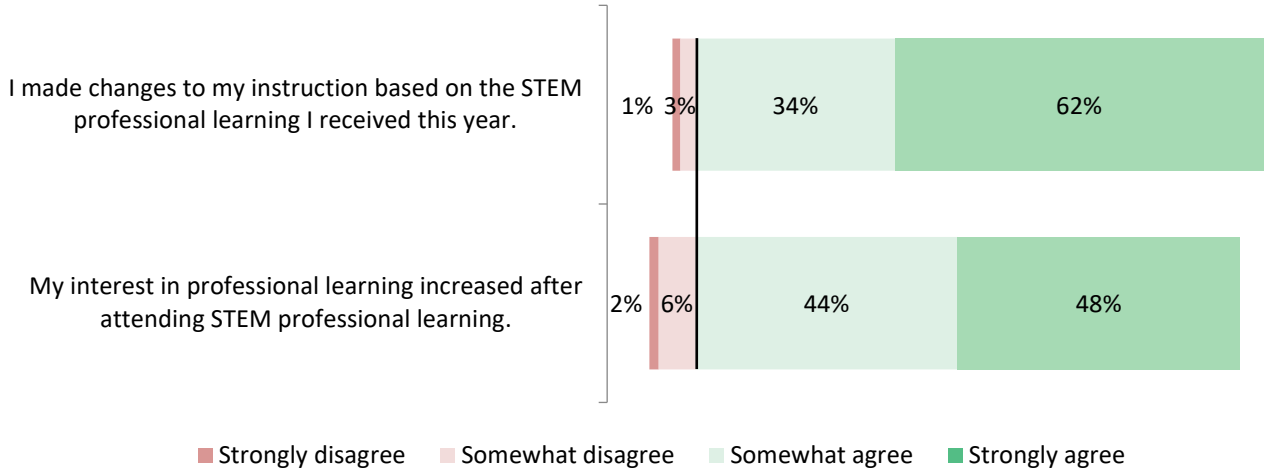
Figure 25. Administrator Perceptions of Overall Effects of STEM Professional Learning on Teachers



- ✓ 89% of administers were able to observe changes to classroom practice based on the STEM professional learning.
- ✓ 83% believed teachers' interest in professional learning overall increased due to the STEM professional learning.

SOURCE: ADMINISTRATOR SURVEY SPRING 2018

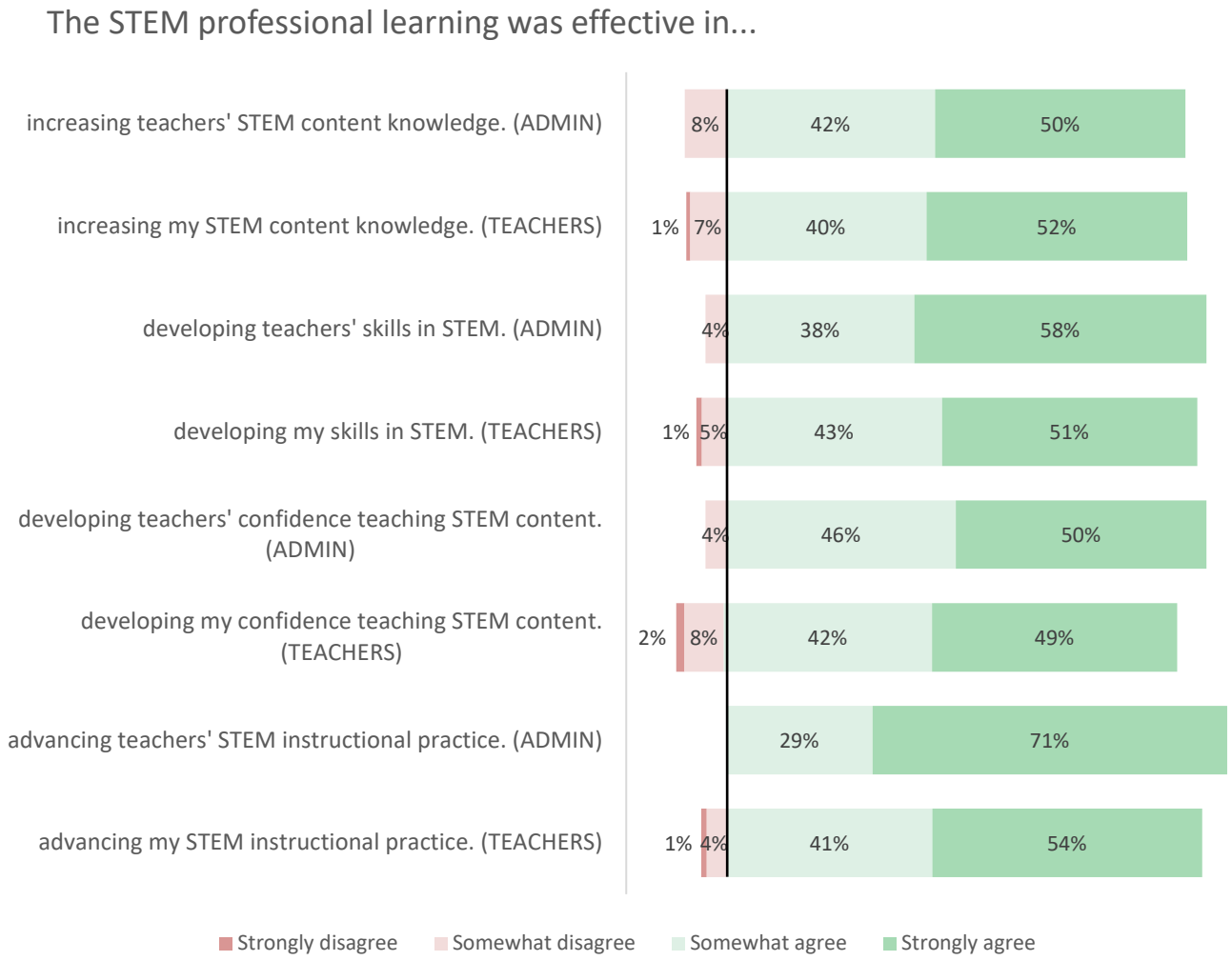
Figure 26. Teacher Perceptions of Overall Effects of STEM Professional Learning on Instruction



- ✓ 96% of teachers made changes to their instruction based on the STEM professional learning.
- ✓ 92% agreed their interest in professional learning overall increased as a result of the STEM professional learning.

SOURCE: TEACHER SURVEY SPRING 2018

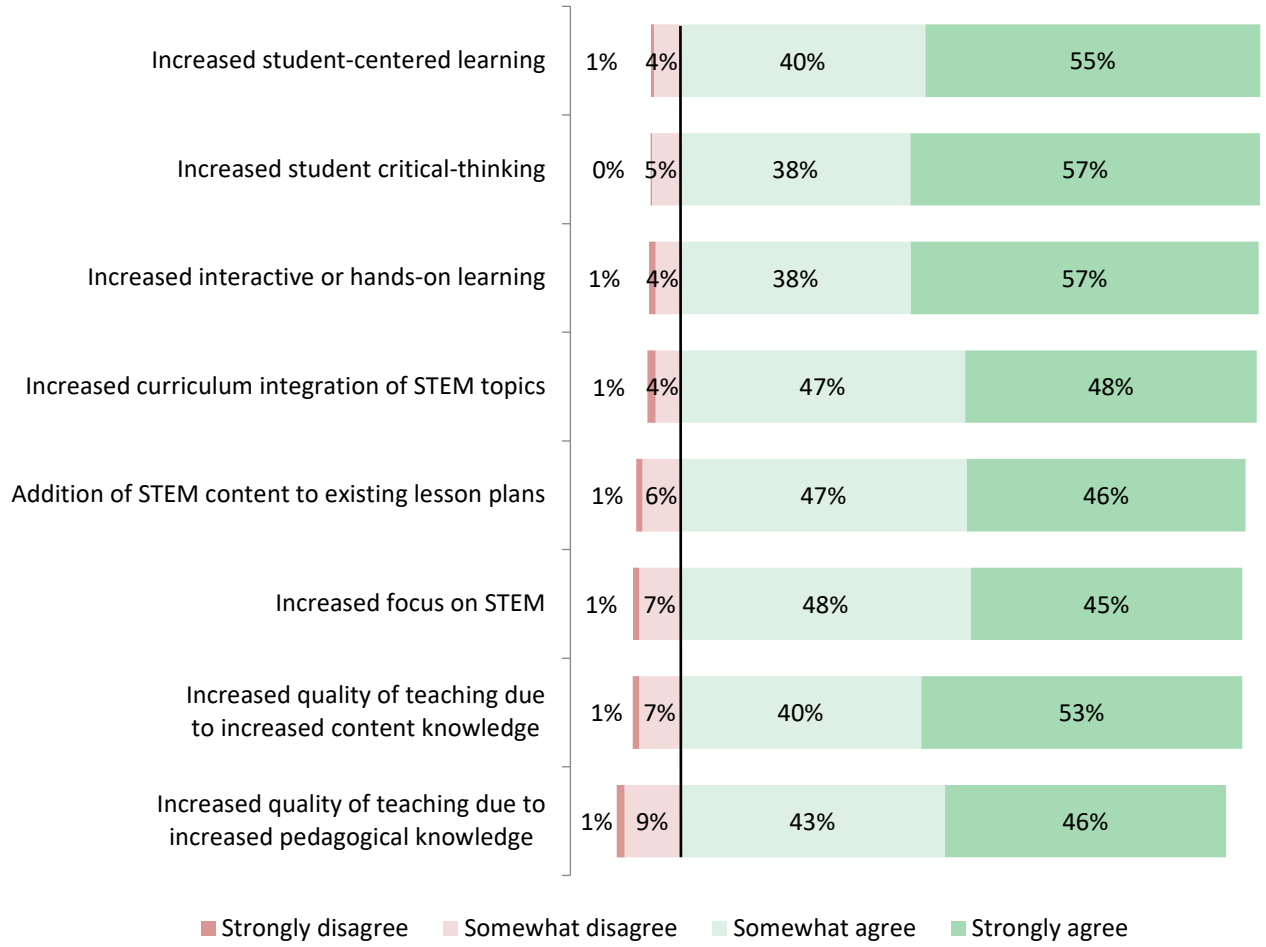
Figure 27. Teacher and Administrator Perceptions of Effectiveness of STEM Professional Learning



✓ Teachers and administrators both agreed the STEM professional learning was effective in advancing teachers' STEM instruction, including their STEM skills, confidence, content knowledge, and instructional practice.

SOURCES: ADMINISTRATOR AND TEACHER SURVEYS SPRING 2018

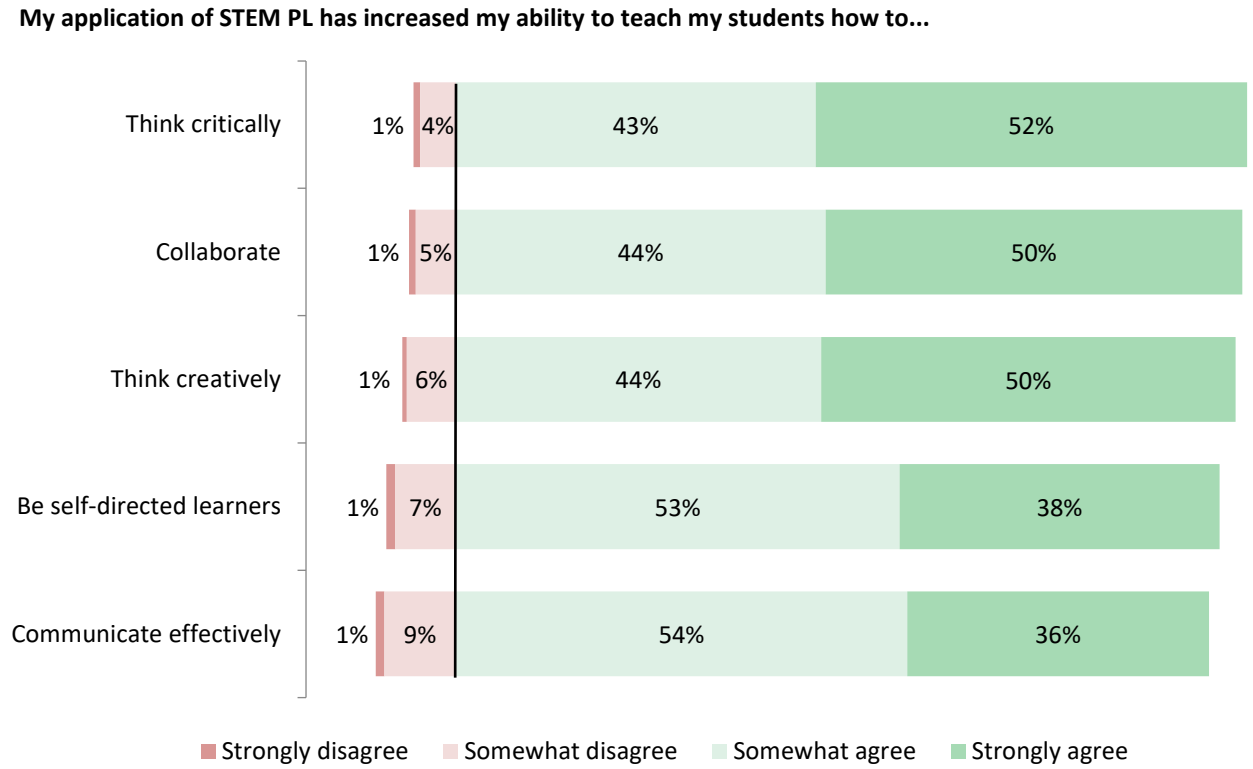
Figure 28. Teacher Reported Changes in Instruction based on the STEM Professional Learning



- ✓ The majority of teachers agreed they changed their instruction in all of the ways listed.
- ✓ Agreement ranged from 89% to 95%.

SOURCE: TEACHER SURVEY SPRING 2018

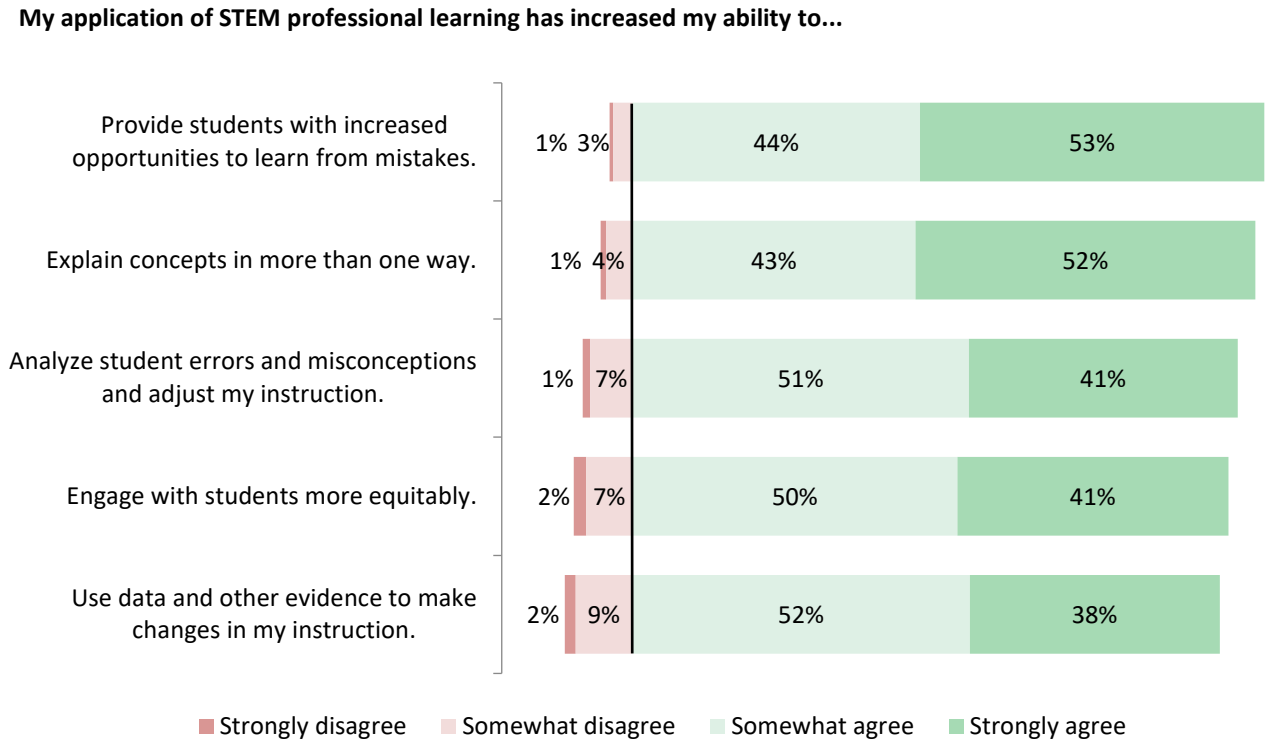
Figure 29. Teacher Reported Increase in Ability to Teach 21st Century Skills



- ✓ The majority of teachers agreed the STEM professional learning increased their ability to teach 21st Century skills.
- ✓ Agreement ranged from 90% to 95%.

SOURCE: TEACHER SURVEY SPRING 2018

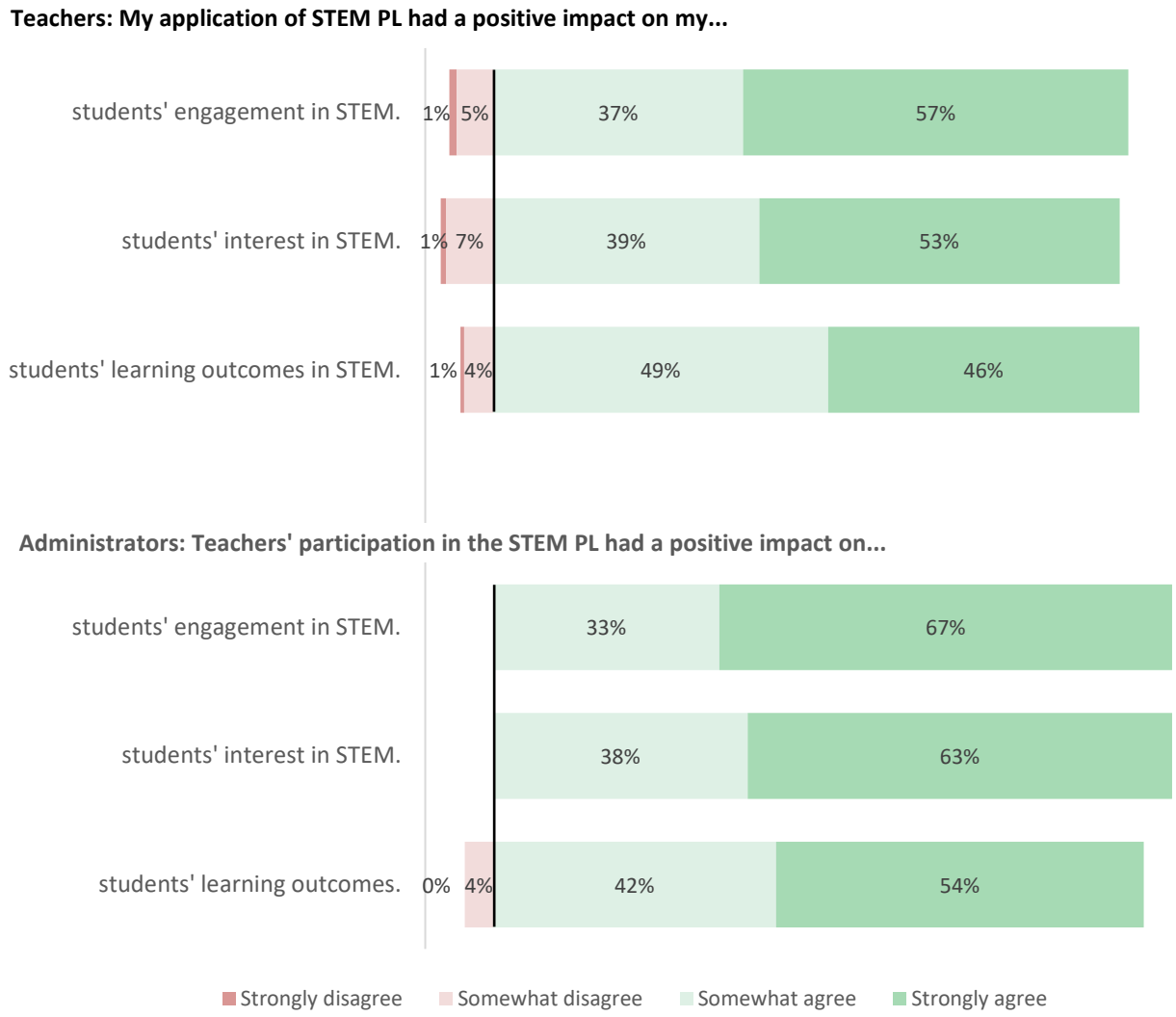
Figure 30. Teacher Reported Changes in STEM Instructional Abilities



- ✓ 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 97%.

SOURCE: TEACHER SURVEY SPRING 2018

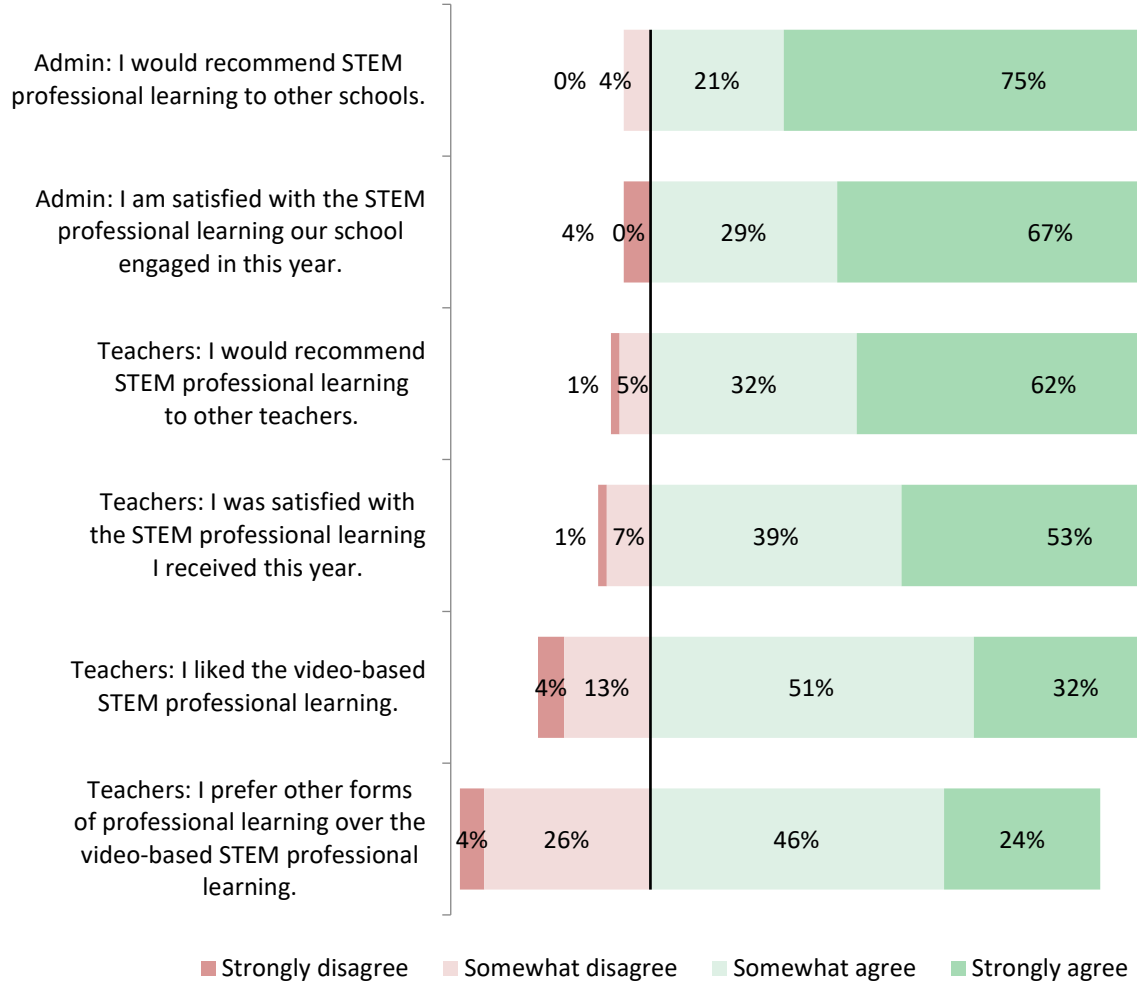
Figure 31. Teacher and Administrator Perceptions of Positive Impacts of STEM Professional Learning on Students



- ✓ Both administrators and teachers agreed that the STEM professional learning increased student engagement, interest, and learning outcomes in STEM.

Sources: Administrator and Teacher Survey Spring 2018

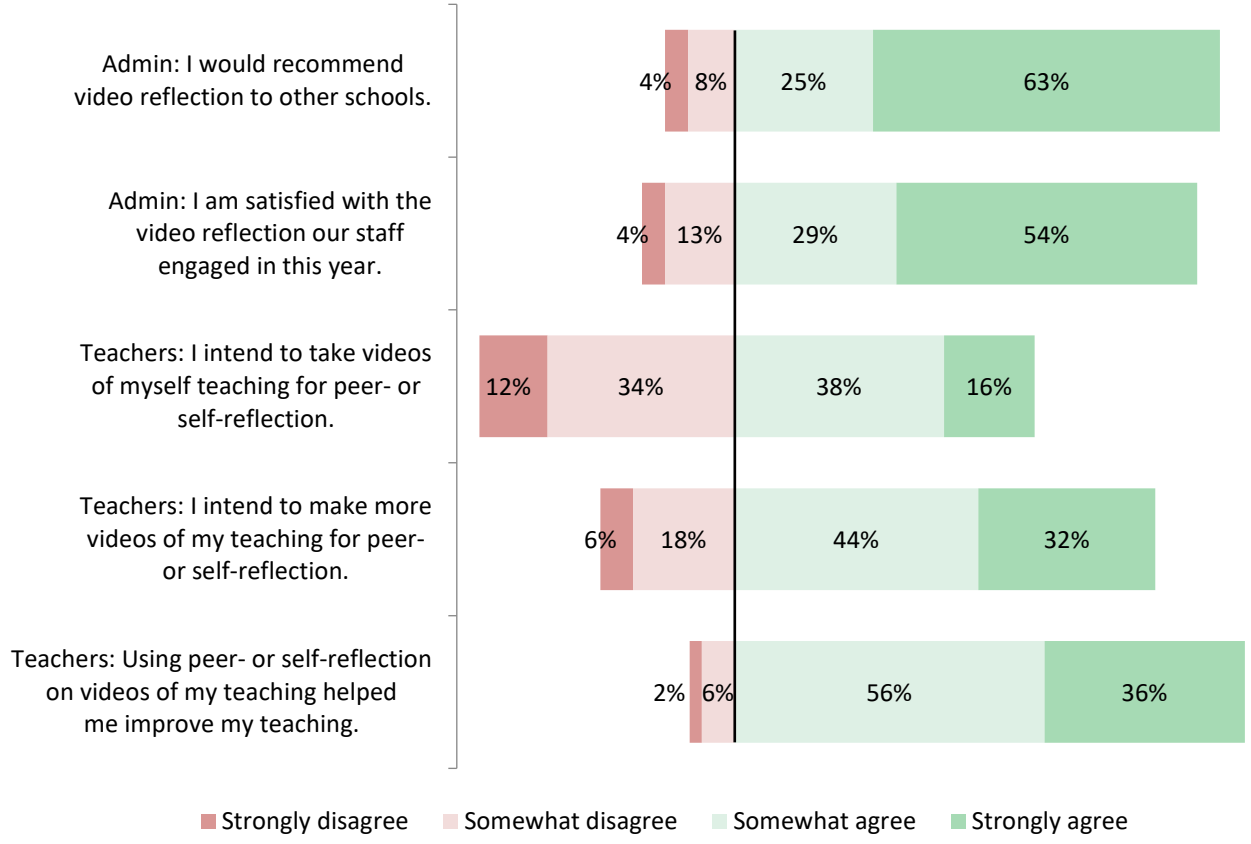
Figure 32. Administrator and Teacher Overall Perceptions about the STEM Professional Learning



- ✓ Both administrators and teachers report high levels of satisfaction with the STEM professional learning.
- ✓ 83% of teachers agreed that they liked the video-based STEM professional learning; however, 70% of teachers also agreed that they prefer other forms of professional learning.

SOURCES: ADMINISTRATOR AND TEACHER SURVEY SPRING 2018

Figure 33. Administrator and Teacher Overall Perceptions the STEM Video Reflection



- ✓ The majority of administrators were satisfied with the video reflection of their staff (83%) and recommend it to other schools (88%).
- ✓ Of the teachers who have not recorded videos of themselves, 54% intend to do so next year.
- ✓ Of the teachers who have recorded videos of themselves, 76% intend to record more.
- ✓ Of the teachers who recorded videos of themselves, 92% agreed it helped improve their teaching.

Sources: Administrator and Teacher Survey Spring 2018

Teacher and Administrator Open-Ended Feedback about STEM Professional Learning

Table 47. Teacher Reasons They Intend to Make Videos of Themselves Teaching for Peer or Self-Reflection

Theme	Example Quotes
Some teachers felt it was useful because reflection itself was useful.	"Allows me to reflect on things I am NOT noticing as I teach." "I will continue to video because it helps me reflect on how to communicate and guide discussion better." "I think making videos for reflection is key to becoming a better educator. I am able to see what things I do and don't do. I will only make my teaching better." "It helps you reflect on your own teaching so you can get better at it."
Some teachers felt it was helpful and informative.	"I think it helps to see what you are doing and what others are doing as they teach. I don't like to watch myself, but it is helpful." "It is difficult to take videos as I get so involved in teaching it's a challenge to slow down enough to think about it but when I do it is helpful." "I enjoyed critiquing myself…it was helpful to see what my teaching looks like not what it feels like." "I find that I always have room for improvement and by recording myself I can spot the things that I need to improve much quicker."
Some teachers felt it was useful to have another perspective on their teaching, particularly when they received peer feedback.	"It is always helpful to view how you teach from an outside perspective. I notice student engagement more, and improvements I can make while teaching." "It is helpful to hear feedback from other professionals for things that I do not realize that I am doing." "I enjoy the feedback from peers." "It is very helpful to watch myself and have trusted peers watch me."
Some teachers made the videos because they were required.	"I am required to video tape myself as part of a grant. I do like to reflect on what I can do differently." "Our school would like us to start using the swivel recorders. "School requirement as well as self improvement." "It is required for our professional development. Plus you can't change things you don't have the opportunity to notice."

SOURCE: TEACHER SURVEY SPRING 2018

Table 48. Teacher Reasons They Do Not Intend to Make Videos of Themselves Teaching for Peer or Self-Reflection

Theme	Example Quotes
Some teachers did not intend to make videos because they don't like to record themselves.	"I dislike videoing myself. I would much rather reflect on how the lesson went and have peer review in person." "I don't like watching myself teach." "I have not ever done this and feel somewhat uncomfortable with it." "It's uncomfortable for me to video myself."
Some teachers lacked resources (including time) to record themselves.	"The process making the video was frustrating, and had to be redone a couple of times to be done correctly so it could be loaded to Edivate. I only saw minimal benefit for the video that was posted. It ended up being more work than it was worth." "Time constraints" "Had a bad experience with the video recording equipment. Spent many hours trying to get it work and was never successful." "I worry about the time to watch it back and reflect."
Some teachers do not think recording themselves is helpful.	"The videos are not helpful for me to reflect in my practice." I feel like for me I reflect always as I am teaching and get the reaction from the kids. I don't feel like watching myself helps at all. I improve or change my lessons if the kids don't enjoy it or if their scores on tests aren't great." "I don't think filming myself was helpful. I would rather use the tools to film students so they can present and reflect."

SOURCE: TEACHER SURVEY SPRING 2018

Table 49. Teacher Descriptions of How STEM Professional Learning Has Helped Them Be More Innovative

Theme	Example Quotes
Some teachers felt that STEM professional learning helped change the way they think about teaching.	"Having more options on how to present material has helped me get out of teaching ruts and think outside the box a little more on how to present material." "I am getting better at thinking about my own teaching, about my students' learning, and try to change my instruction to match what they still need to master." "I enjoy teaching more and am more engaged with the students [sic] learning." "Helped remind me of the importance of experiments and hands on teaching." "It's reminded me to prioritize time to discover, build, create, fail, and try again. These are critical components to learning that I've really enjoyed focusing more on again."
Some teachers felt it added to their teaching practice by clarifying their current classroom practices.	"I already teach STEM in my classroom but the professional development helped clarify some of the things I did." "The STEM professional learning this year has validated skills and pedagogy practices I already use and learned in other non-STEM related classes during my master's level courses." "I realized how much STEM I already teach." "This year was very freeing, because I felt like I was encouraged to be more innovative vs. feeling like I was somehow going against the grain to do so. It is always a little scary to be outside of the box a bit (which is where innovation occurs), yet it is exhilarating at the same time… The professional learning gave me enough to light my innovation and creativity flame…"
Some teachers felt it helped them add new things to their current classroom practices.	"STEM learning has helped me be more open to the idea of these kinds of activities. I have been a little afraid of them in the past because I don't know how to implement them. I have also been a little unsure of how to manage these kinds of learning activities. I feel like I have a better grip on that now and I know the kids love these things." "…It has changed the way I teach. Reasoning skills come first now. Mathematical modeling essentially guides how we view learning our classroom." "I have given students more chances to explore and discover." "…I am now finding innovative ways to allow my students to direct themselves and take accountability for their own learning." "…I have found ways to include science and engineering in my classes along with the art."
Some teachers felt it helped them be more collaborative with other teachers, both during the professional learning and afterwards.	"I can see what other teachers are doing and implement it on my own." "Being able to read and discuss ideas, to watch the implementation and then share ideas and successes/failures…I feel this process speeds my learning curve…" "It helped me collaborate and be able to look at science with the mathematics I teach."

SOURCE: TEACHER SURVEY SPRING 2018

Table 50. Administrator Reasons They Would or Would Not Recommend STEM Professional Learning

Theme	Example Quotes
Some administrators found video reflection to be very effective.	"Video and peer reflection were easy to do and incredibly meaningful tools for furthering our work in improving instruction for all teachers." "I know that as teachers, when you are in the act of teaching you cannot see all of the things that are going on. When you video yourself and reflect on that video you can watch for the pedagogy and not just the content of what you are teaching." "I WOULD recommend it because viewing effective lessons helps solidify concepts of best practices. Then viewing reflection videos allows for us to observe what we actually do and how it comes across to our students."
Some administrators feel that collaborative professional learning is more effective than video-based professional learning alone.	"The video reflection and collaboration was great. Teachers were able to collaborate and share best practices and learn from each other in a very creative way." "The video reflection felt like one more thing to do rather than something that helped me strengthen my own professional learning. I enjoyed the times I was with my faculty and other teachers and found the greatest learning took place in those settings, not online." "I love STEM I just think it needs to be in group trainings and not done alone on a computer." "I have discovered that It is very difficult to engage teachers in the video reflection unless there is a specific time and place established for this. Leaving it up to teachers to do independently in an online format results in superficial depth of analysis and reflection. The grant covers the training and the stipends/substitutes for teachers to participate in the training, but there is insufficient funds to schedule face to face video sharing and reflection workshops."
Some administrators indicated that their teachers were uncomfortable recording video of themselves.	"Teachers do not like to film themselves teaching." "I believe in using video reflection for all learning. However, my teachers engaged in this project were not comfortable with this format and did not choose to reflect on the lessons they taught. They reflected on lessons in other ways, but the video reflection was not effective."

SOURCE: ADMINISTRATOR SURVEY SPRING 2018

Table 51. Teacher Reasons They Would Recommend STEM Professional Learning to Other Teachers

Theme	Example Quotes
Some teachers felt it was useful because students generally need to be better prepared in STEM subjects.	"I would recommend STEM to other teachers because we teachers need to prepare students for the work force of the future and that includes STEM fields." "Powerful to use with students and better prepare them for today's world." "I recommend STEM professional learning because it prepares students for future careers and it employs 21st century learning."
Some teachers felt the STEM professional learning helped them grow personally.	"I would recommend STEM professional learning to other teachers because it enhances your ability to feel comfortable with the technology and gives structure and support for teaching." "It got me more enthusiastic about the STEM I was teaching." "It was very helpful for my growth as an educator."
Some teachers learned new content.	"Whenever we increase our knowledge about subject matter, we are better prepared to help students learn." "New curriculum requires content knowledge."
Some teachers learned about the new standards.	"The STEM PD was essential for me to understand the new science core. Without the professional learning, I would not have understood how to implement the changes needed for my students to tackle the new core." "I would recommend STEM professional learning to other teachers because the new standards are a mind shift from the old ones, and the PL helps teachers make this shift."
Some teachers liked walking away with concrete resources.	"The classes were very informative and supplied materials that could be immediately integrated into classroom lessons." "I did learn a lot, and I liked the lessons (with the plans)"
Some teachers felt it improved their teaching overall.	"STEM professional learning has made a tremendous difference in how I teach and how my students learn!" "it makes me more aware of what methods I am using and how effective they are."
Some teachers reported gaining strategies for teaching critical thinking.	"I would encourage it because it gets students thinking…" "I know I can always continue to improve my math instruction and improve my ability to help my students think about math and communicate their thinking in more effective ways."
Some teachers reported gaining strategies to improve student engagement.	"I would recommend STEM professional learning to other teacher because of the results I saw within my classroom. It became less of the traditional teacher-lecture-student method and increased self-driven learning and increased engagement. Students felt more responsibility for their learning." "STEM is an awesome way to implement a lot of different valuable lessons. It engages students in a great way."

Continued from previous page

Theme	Example Quotes
Some teachers reported learning how to teach subjects in an integrated way.	"It's nice to integrate subjects together so students can see the value in learning and realize how related all learning is." "It helps you learn how to integrate skills into other areas. It helps students learn how to be better problem solvers and look outside of the box."
Some teachers recommended STEM professional learning because they enjoyed the format.	"It was great to collaborate and share ideas with my colleagues." "I would recommend STEM professional learning because it was hands on and relevant to my teaching. I was able to see teaching in a different way that I believe would benefit students. I also really appreciated getting the materials so that I could teach the same thing the next day."

SOURCE: TEACHER SURVEY SPRING 2018

Table 52. Teacher Reasons They Would Not Recommend STEM Professional Learning to Other Teachers

Theme	Example Quotes
Some teachers reported that the STEM professional learning was not helpful or well-organized.	"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."

SOURCES: TEACHER SURVEY SPRING 2018

Considerations for Improvement for the STEM Professional Learning Project

Teachers and administrators rated the STEM professional learning project very positively, with **96% of administrators and 94% of teachers indicating they would recommend STEM professional learning to other schools and teachers**. Additionally, **96% of teachers reported changes to their instruction** based on the STEM professional learning, and 92% agreed 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
57% of teachers reported recording video and engaging in peer and self-reflection 54% of teachers who have not recorded video of themselves teaching intend to do so next year. 76% of teachers who have previously recorded video of themselves teaching intend to do it again. Some administrators and teachers indicated that teachers find it uncomfortable to record and watch videos of themselves. However, the majority of who have done so report that it is an effective way to improve their teaching. 70% of teachers prefer professional learning formats other than video-based platforms.	**Increase opportunities to expand professional learning community** • Consider multiple platforms for delivering professional learning to teachers. • Provide collaborative spaces for sharing practice videos and having structured and open protocols for reflection. • Offer examples of teachers practice of videoing and reflecting on teaching. • Provide opportunities for teacher-led professional learning communities to share practice and increase peer-mentoring.

Addendum to the 2017-18 STEM Action Center Program Evaluation

Analysis A: 2017-18 Student Outcomes for the K-12 Mathematics Personalized Learning Software Grant

Why this Addendum?

The UEPC provided an annual evaluation report to the STEM Action Center in Fall 2018 for the 2017-18 school year. At that time, student achievement data were not yet available from the Utah State Board of Education. These data became available to the UEPC in March 2019. Therefore, this addendum provides analyses of student achievement associated with student use of the mathematics personalized learning software that was not available at the time the annual report was submitted. These analyses (Analysis A) are inclusive of identified software users during the 2017-18 academic year.

This addendum is separated into two parts. The first part of the report focuses on findings and contains basic technical information. The second part of this report, the Appendix, is provided for reference and provides detailed methods, analyses, data summary tables, and statistical outcomes.

Evaluation Questions

The following evaluation questions guided the analyses of student data.

1. What are mean SAGE scores, mean growth percentiles (MGP), and percentage proficient in math for users of each vendor program compared to each other and compared to non-users?
2. Is the use of software learning systems associated with student achievement for each of the vendors compared to non-users?
3. How are different levels of use on the software associated with student achievement?

Data Sources

Software vendors provided 2017-18 student usage data to the UEPC on a monthly basis through a secure platform. The Utah State Board of Education provided student education data to the UEPC following a data request and data sharing agreement.[1] Student outcome variables included 2018 SAGE mathematics raw scores, attainment of proficiency, and standardized growth percentiles (SGPs). Demographic variables that were used to control for pre-existing differences between students included 2017 SAGE mathematics raw scores and proficiency, grade level, gender, race and ethnicity, low-income (based on qualification for free or reduced lunch), math Title I status, and school type (elementary vs. secondary.)

Sample

There were 94,408 students identified as STEM AC math software users in grades 3 and above (see Table 1). (Users are defined as students identified in the vendor data as having logged at least one minute on the program. Some students used more than one software program, leading to a combined percentage larger than 100. Of those students, 89,488 (83%) could be matched with their student 2018 SAGE data and 73,858 (78%) could be matched with 2017 SAGE data (grade 3 does not have 2017 SAGE scores).

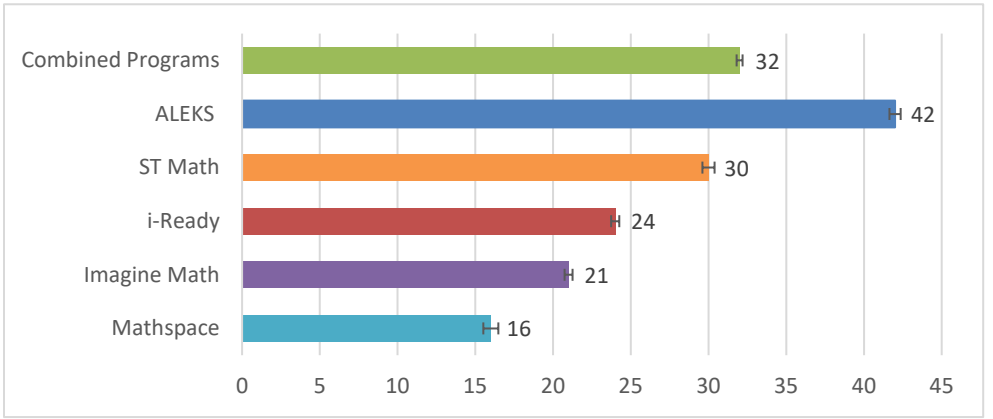
Non-users were defined as students who did not use any of the math software programs funded by the STEM Action Center or the unfunded pilot test of Mathspace during the 2016-17 school year. We do not have a way to identify students who may have used other mathematics software programs, or who may have had experience using mathematics software programs in previous years. Therefore, the term *non-users* should not be interpreted to mean students who have not had any experience using software programs of this type.

Table 1. Numbers and Percentages of Students who used Each Software

Software Vendor	N of Users (Grades 3-12)	% of Users by Vendor	N of Users with SAGE Scores	% of Users with SAGE Scores	Match Rate of Users with SAGE
ALEKS	40,585	43%	37,948	42%	82%
Imagine Math	18,982	20%	18,194	20%	81%
iReady	14,351	15%	13,651	15%	90%
Mathspace	6,588	7%	6,235	7%	81%
ST Math	14,517	15%	14,036	16%	80%
Total Users (All Programs)	**94,408**	**100%**	**89,488**	**100%**	**83%**

Source: Vendor Usage Data and Student Education Data
See also appendix Tables 2 and 3 (pp. 115-116).

Figure 1. Average Minutes per Week Students Used Each Program



Source: Vendor Usage Data
See also appendix Table 2 (p. 115).
Error bars represent the 95% confidence intervals.
Minutes per week were calculated based on a 36-week school year.

[1] The views expressed in this report are those of the authors and are not necessarily the USBE's or endorsed by the USBE.

There were 285,187 students in the education data with 2018 SAGE math scores who were classified as non-users during 2017-18. Approximately three-quarters of those non-users (240,217 or 78%) could be matched with 2017 SAGE data. Students classified as non-users provided a comparison group in the analyses.

Almost half of the sample used in the outcomes analyses used ALEKS software (43%), while relatively few used Mathspace (7%).

Use Levels

For all software programs combined, students used the software an average of 32 minutes per week (see Figure 1).

Descriptive Analyses

Detailed tables that provide frequencies, means, and standard deviations for minutes of use and outcome variables by all demographic categories are provided in the appendix to this addendum. Here we present some notable findings from those data.

Raw SAGE Scores.

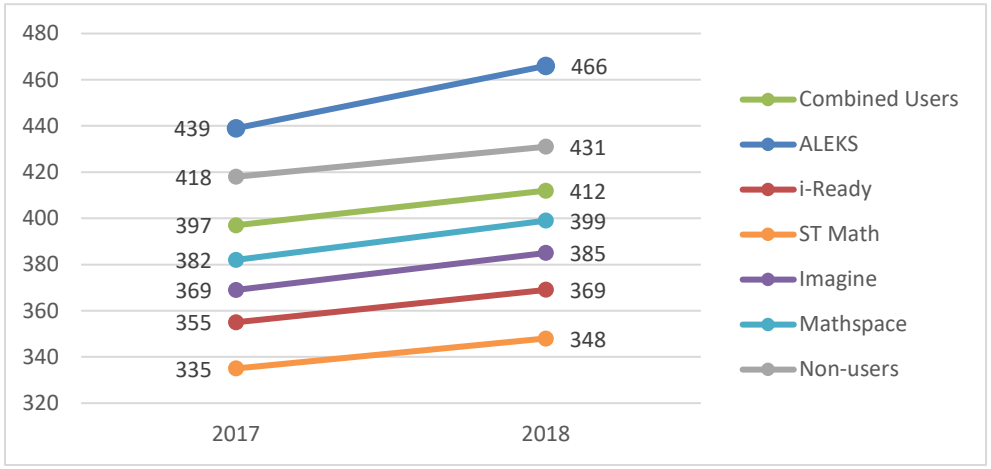
SAGE raw scores were different between software users and non-users in both 2017 and 2018 as well as between the vendors. These differences may reflect vendor use with different grade levels, as math scores increase generally with grade level progression. All categories showed increases from 2017 to 2018, as expected (see Figure 2).

Because students start at different levels of math performance, a simple comparison of raw SAGE scores is not the best assessment of the relationship between program use and student math outcomes, and are presented here for reference only.

SAGE Mathematics Proficiency by Previous Year Proficiency.

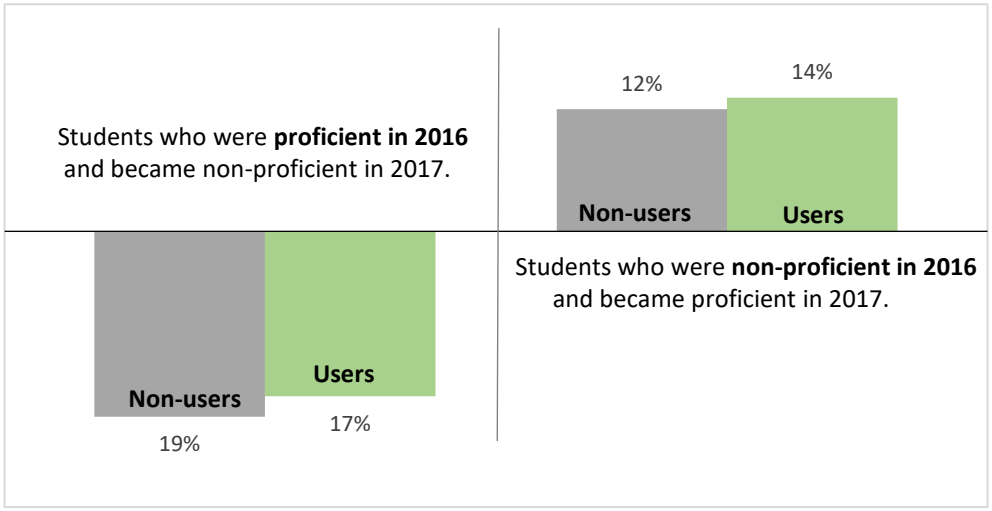
The percentage of students who were proficient in 2016 and 2017 are provided in Table 4 in the appendix. Because students proficient in 2016 can only stay proficient or drop to non-proficient, and students who are non-proficient can only become proficient or stay non-proficient, 2018

Figure 2. Raw SAGE Math Scores in 2017 and 2018 for Students who used the Software in 2017-18



Source: Vendor Usage Data and Student Education Data
See also appendix Table 3 (pp. 116), and Figures 8 and 9 (pp. 121-122).

Figure 3. Percentage of Students who Changed Math Proficiency From 2017 to 2018

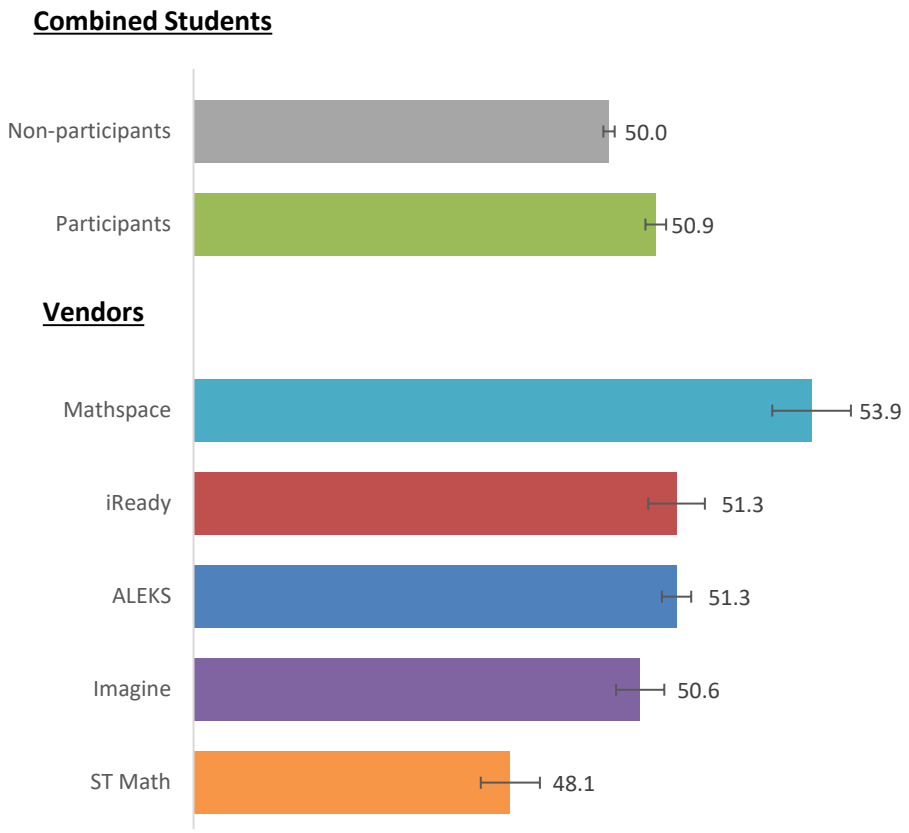


Source: Vendor Usage Data and Student Education Data
See also appendix Table 4 (p. 117).
The differences between users and non-users is significant at p<.0001 for both groups.

proficiency rates are presented in two groups based on proficiency in 2017. Fewer students who were proficient in math in 2017 became non-proficient in 2018 in the software user group than in the non-user group. Similarly, more students who were non-proficient in math in 2017 became proficient in 2018 in the software user group than in the non-user group (Figure 3). These differences are statistically significant, indicating they are unlikely to be the result of chance alone.

SAGE Student Growth Percentiles. Student Growth Percentiles (SGPs) are a measure of student growth calculated by the Utah State Board of Education. This measure assesses student growth by assigning each student to a percentile within an academic peer group.[2] Academic peer groups are created with quantile regression using each students' available SAGE scores in the subject area from previous years. For example, if a student was in the 45th percentile in math in the third grade, that student's fourth grade math score would be compared to all other students in the state who were also in the 45th percentile in math in the third grade that year. Growth percentiles are only available for students who have a SAGE score in the topic area in the previous year. The student's percentile rank within his or her quantile represents growth relative to similar peers. SGP scores range from 1 (lowest growth) to 99 (highest growth). By definition, the mean and median growth percentiles across the state will be 50. Within a school or classroom, a mean or median growth percentile that is above 50 represents greater than average student growth while taking into account each student's level at the end of the previous year. Mean growth percentiles for large subpopulations are very difficult to move above 50 because the larger the population (and the greater proportion of the total state), the more the mean will approximate the total population mean of 50. Therefore, small percentage increases among large groups may indicate important change.

Figure 4. Mean Student Growth Percentiles for Users by Category



Source: Vendor Usage Data and Student Education Data
Error bars represent the 95% confidence intervals.
See also appendix Tables 5 through 7 (pp. 118-120, 123), and Figures 8 and 9 (pp. 121-122).

[2] For more information on SGPs, please see https://schools.graniteschools.org/granger/files/2016/02/Measuring-Student-Growth-in-Utah-Schools-v.4-2015-11-04.pdf.

Students who used any software program in the 2017-18 school year were 0.9 percentile points higher than students who did not use any software programs. This difference is statistically significant based on a t-test of independent samples at p<.0001, indicating that is unlikely to have occurred by chance alone.

SAGE Student Growth Percentiles by Use Quartile and Vendor.

In order to compare levels of use for student outcomes, we divided students into quartiles (four equal groups) based on average use per week. Quartile 1 included all students who used the programs less than 8 minutes per week. Quartile 2 included students who used the programs 8 to 17.3 minutes per week, Quartile 3 included students used the programs 17.4 to 30.6 minutes per week, and Quartile 4 included students who used the programs more than 30.6 minutes per week.

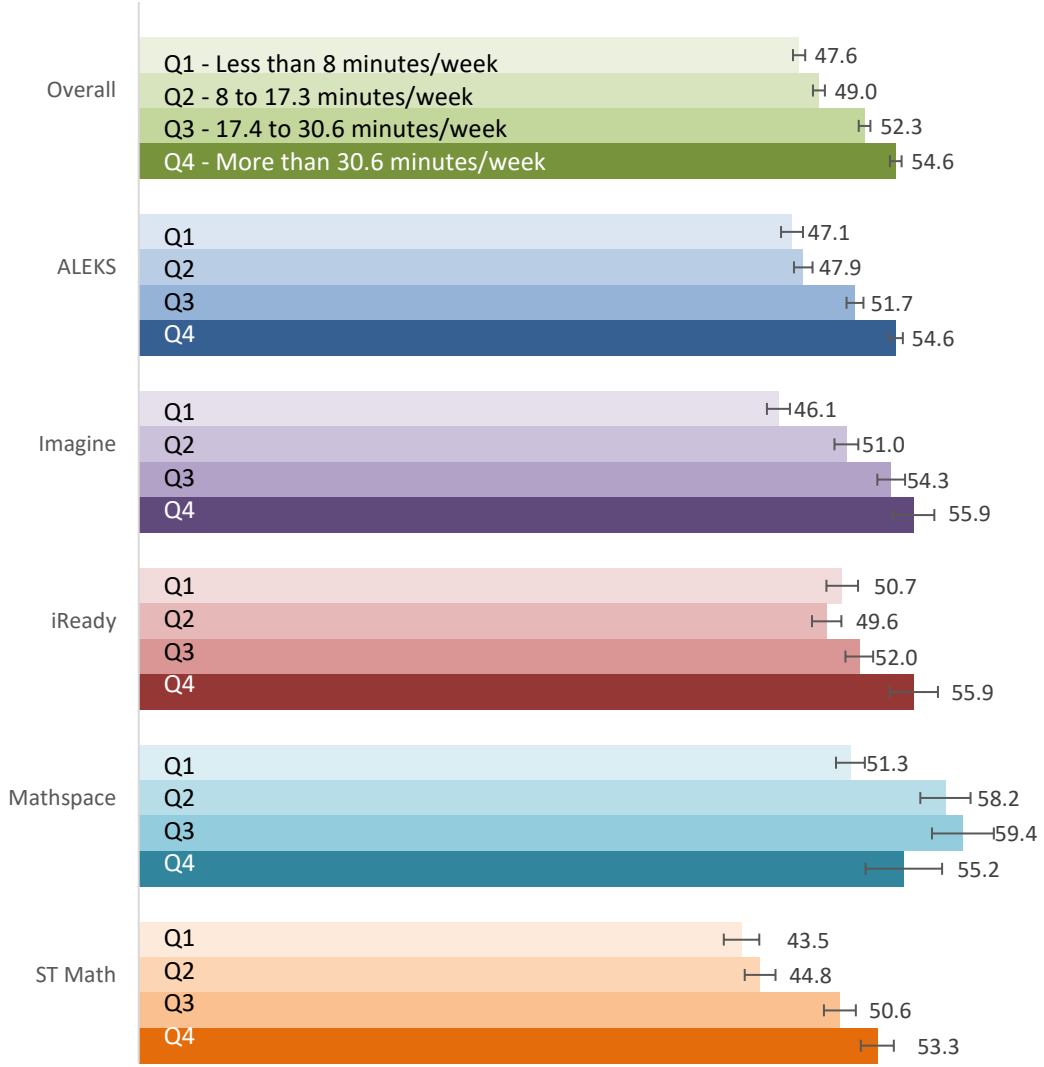
Quartiles are defined the same for all programs based on use patterns of the combined programs even though the patterns of use vary by program.

Overall, students in the fourth use quartile, who used the program more than 30.6 minutes per week, were 4.6 percentile points higher than non-users on SAGE growth percentiles.

Figure 5 shows the simple comparison of users to non-users and does not control for any demographic variables. See the appendix, Tables 8 through 13 for the results of the model that controls for school type, Title I math, low income, race, gender, and 2017 proficiency level.

Importantly, because students were not randomly assigned to usage quartile or program, the relationship between program use and SAGE outcomes should not be interpreted as causal. We can conclude that there is a relationship between time spent using the software and higher MGPs, but not that one caused the other.

Figure 5. Mean Student Growth Percentiles for Users by Vendor and Use Quartile



Source: Vendor Usage Data and Student Education Data
See also appendix Tables 8 through 15 (pp. 124-128).
Error bars represent the 95% confidence intervals.

Predictive Analyses

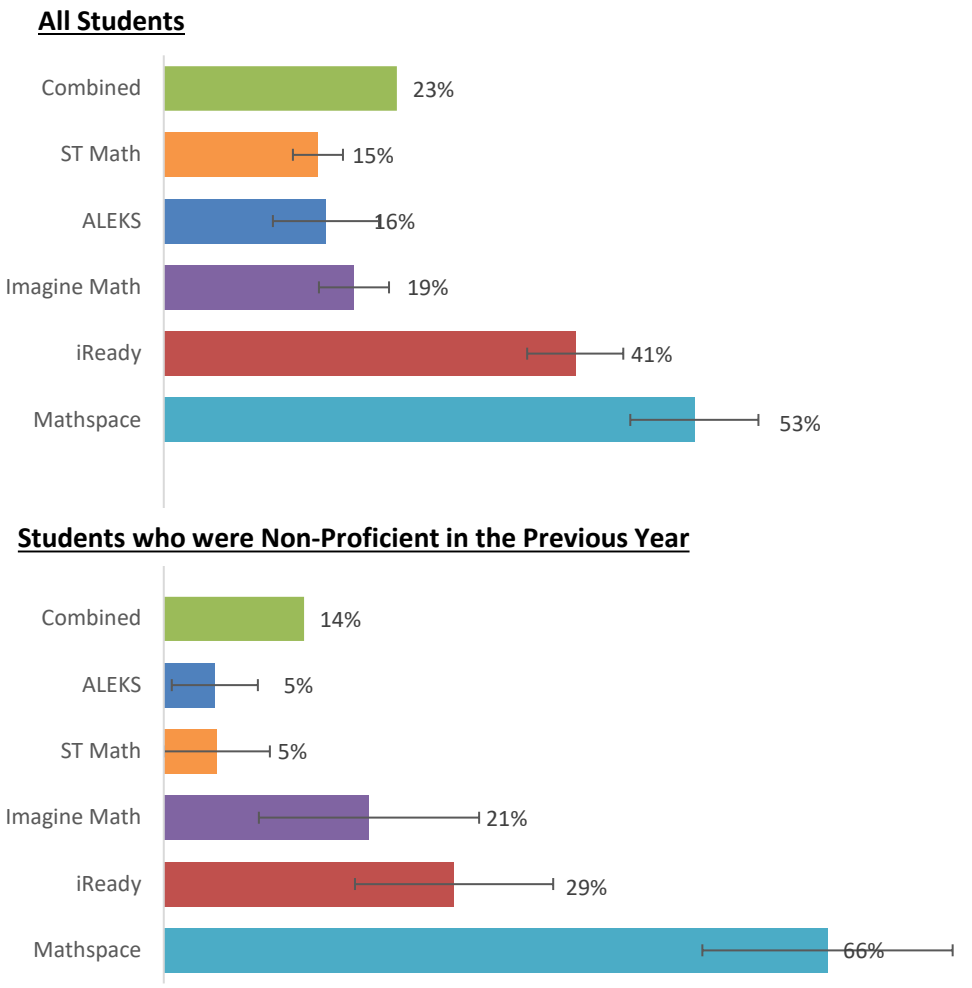
Increase in Likelihood of Proficiency. We used 2017 SAGE mathematics scores and demographic information to compare students to similar peers to determine whether there was a relationship between program use and SAGE outcomes. By comparing students to similar peers rather than looking at the simple comparisons of users to non-users, we were able to minimize the impact of pre-existing differences between students that can make it difficult to interpret outcomes.

Figure 6 provides the increase in likelihood of a student testing as proficient in mathematics on the 2017-18 SAGE if they used one of the math software programs. The percentages are provided for all students as well as for students who were non-proficient in the previous year.

On average, students who used any of the software programs were 23% more likely to be proficient than their peers with similar previous year SAGE math scores and demographics. Students who were non-proficient in the previous year were 14% more likely to be proficient if they used one of the programs.

All five software programs were associated with increased likelihood of proficiency for students overall at a p<.001 level. All but ST Math were associated with increased likelihood of proficiency among students who were non-proficient in the previous year at a p<.05 level. These p-values indicate that the increased likelihood of proficiency associated with program use was unlikely to have occurred by chance.

Figure 6. Increase in Likelihood of Math Proficiency by Category



Source: Vendor Usage Data and Student Education Data
Error bars represent the 95% confidence intervals.
Variables held constant include school type (elementary or secondary), Math Title I status, free or reduced lunch eligibility, race/ethnicity, gender, and 2017 SAGE proficiency level.
See also appendix Tables 16 and 17 (pp. 129-130).

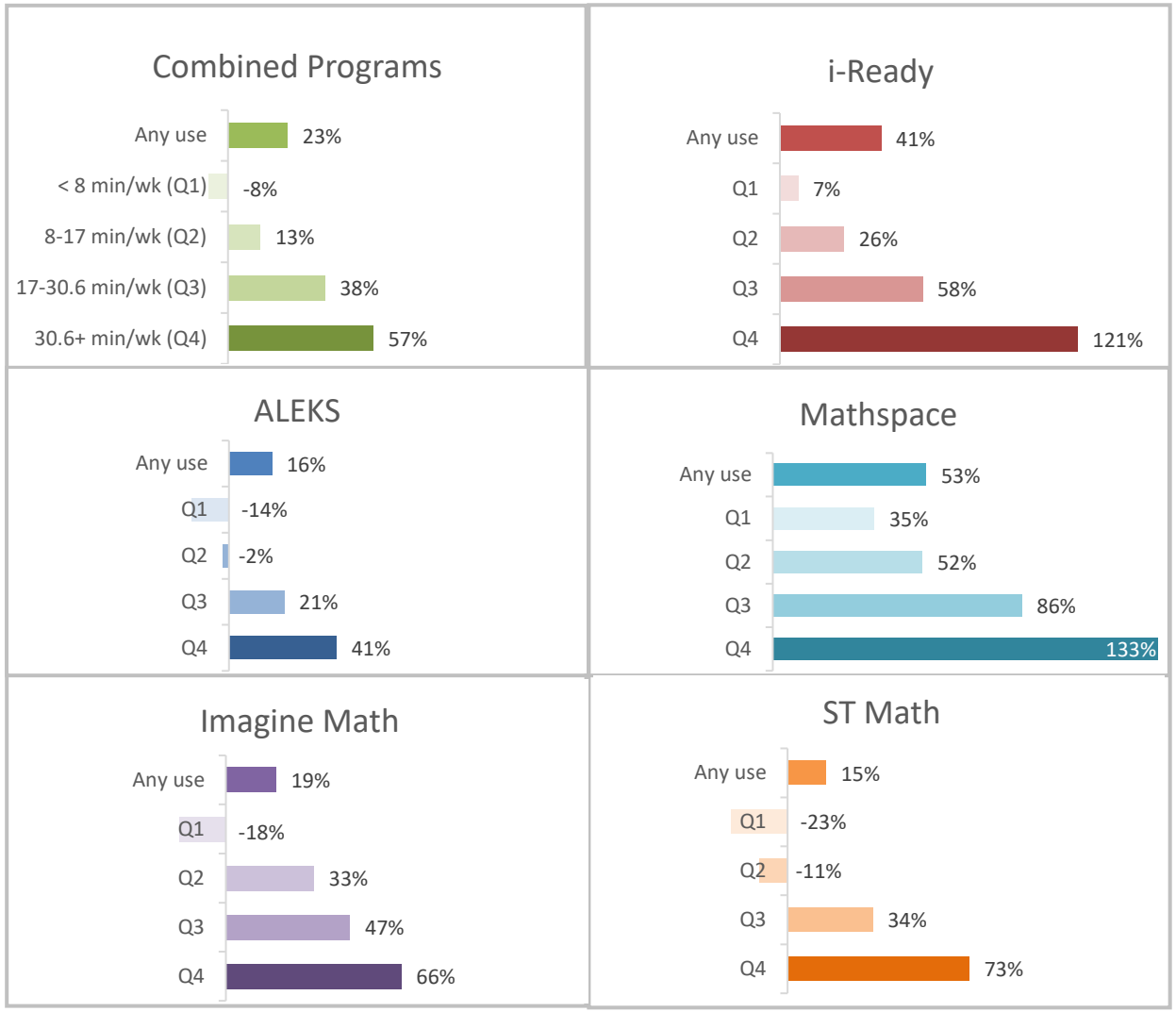
Increase in Likelihood of Proficiency by Use Quartile for Each Program. Figure 7 provides the change in likelihood of proficiency for each use quartile for the combined programs and for each vendor.

Students who used the software 30.6 minutes or more per week were over 57% more likely to be proficient in mathematics than similar peers.

For the most part, a similar pattern can be seen among the different software programs. The more that students used the programs, the greater their likelihood of math proficiency after taking into account previous year math proficiency and demographics.

Again, programs should not be compared to each other because they have different target populations and grade levels.

Figure 7. Increase in Likelihood of Math Proficiency for Students in Each Use Quartile for Each Software Type



Source: Vendor Usage Data and Student Education Data
Variables held constant include school type (elementary or secondary), math Title I status, free or reduced lunch eligibility, race/ethnicity, gender, and 2017 SAGE math proficiency.
See also appendix Tables 18 through 23 (pp. 131-133). Figure 10 on page 134 provides the same figures with error bars.

Conclusions

Overall, our analyses indicated that for two SAGE math outcome measures (likelihood of proficiency, and standardized growth percentile), program use was associated with better outcomes. For raw scores, averages were higher for non-users than for users; however, previous year SAGE scores indicate that users started out lower than non-users. For proficiency, among students who were proficient in math in 2017, fewer users became non-proficient in 2018 than non-users. Among students who were not proficient in 2017, more users became proficient in 2018 than non-users. Finally, on average, users' math SGPs were 0.9 percentile points higher than non-users. Improved outcomes associated with program use was even stronger when use levels were taken into consideration. The relationship between use and math outcomes were strongest for students who used the programs 17.4 minutes or more per week, and students who used the program more than 30.6 minutes per week had SGPs that were 4.6 percentile points higher than non-users. All reported differences and relationships were statistically significant, indicating they were unlikely to have occurred by chance.

Predictive analyses were also very positive. After controlling for previous year math SAGE proficiency and demographic variables (including school type, student Title I status, student free or reduced lunch eligibility, student race or ethnicity, and student gender), software users were 23% more likely to be proficient in math than non-users. Again, taking use levels into account showed that greater use was associated with more positive outcomes. Students who used the software 17.4 minutes or more per week were 38% more likely to be proficient than non-users, and students who used the software 30.6 or more minutes per week were 57% more likely to be proficient. The results of the predictive analyses were consistent with analyses presented for the 2016-17 school year.

As an important note, comparisons between the five vendors is not recommended due to differences between the programs. Programs had different sample sizes, different levels of use, and in some cases were used predominantly by different grade levels. Instead, interpretation of findings should be based on the value of each program independently and relative to the student who participated in that particular program.

Appendix A. Detailed Methods, Analyses, Data Tables, and Statistics

Data Collection Channel

The UEPC set up a dedicated secure FTP (sFTP) server and a secure web portal for software vendors. All data exchanges between the UEPC and the vendors, schools, school districts, and USBE were compliant with FERPA and other federal and local privacy and confidentiality laws and regulations.

Data Disposition

This is a longitudinal study. All data that the UEPC received and derived from the received data will be used solely for this project and will be kept until the project ends. The UEPC will not share the linked data to any third party under any circumstances. The UEPC will not share any data components to any third party without formal written authorization by those who own the data components along with documentation of IRB approval from the third party's institution.

Once the project ends, all data will be sanitized and destroyed following the guideline of the University of Utah (http://regulations.utah.edu/it/guidelines/G4-004N1.pdf) and the Federal regulations (http://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-88r1.pdf, pp 22-23).

Data Source Security

All data were securely encrypted, transmitted, and stored according to industry and University of Utah standards.

Data Sources

Vendor Data

Five math learning platforms were included in the evaluation, including ALEKS, Imagine Math, i-Ready, Mathspace and ST Math. Student usage from vendors were collected every month for the current evaluation cycle starting in September 2017 and going through June 2018.

USBE Database

After data sharing agreements were signed by the appropriate staff at the USBE and the UEPC, the USBE data needed for the evaluation of the software were transferred to the UEPC via the USBE's secure FTP server.

Data Storage

The Utah Education Policy Center (UEPC) considers the security and protection of data to be of the utmost importance. Encrypted data are stored on secure hardware, maintained by highly trained computer professionals, and safeguarded by the University of Utah's network security, Virtual Private Network (VPN), and firewall. The UEPC protects data in compliance with the Family Educational Rights and privacy Act, 20 U.S. Code §1232g and 34 CFR Part 99 ("FERPA"), the Government Records and Management Act U.C.A. §62G-2 ("GRAMA"), U.C.A. §53A-1-1401 et seq, 15 U.S. Code §§ 6501-6506 ("COPPA") and Utah Administrative Code R277-487 ("Student Data Protection Act").

The UEPC limits and restricts data access to leaders in charge of the day-to-day operations of the research, and professional and technically qualified staff who conduct research. All UEPC staff receive FERPA and CITI trainings and certification, which cover issues of data privacy, security, and protections, and ethics of data management and use. UEPC employees who have access to data are required to sign a Non-Disclosure Agreement. Access to data is controlled by password protection, encryption, and/or similar procedures designed to ensure that data cannot be accessed by unauthorized individuals.

The UEPC maintains a data sharing agreement (DSA) with the Utah State Board of Education (USBE) wherein the USBE shares data with the UEPC for the purposes of state, district, and federal evaluations.

Data Samples

The sample used for the analyses included all students whose data from the five vendors matched with the USBE database. Students were in grades 3 through 12 because those grades completed SAGE testing. Samples in the analyses varied depending on the outcomes of interest. Those outcomes included software usage level, SAGE scaled (raw) scores, standardized growth percentiles (SGPs), and proficiency level. The largest sample was for software usage, because it included all students documented in the vendor data that could be matched with 2018 student data regardless of whether they had values for other outcomes. The analysis of SAGE raw scores included a subset of the full population because it only included students who had SAGE math test scores. The SGP analysis was smaller still because it only included students in grade four or above who took the SAGE math test in at least one previous year and had an SGP for 2018. Finally, in the analyses where 2017 proficiency level was taken into account, only students who had both 2017 proficiency level information and 2018 outcomes were included in the sample.

Some students used more than one software program. Because these students represented only .65% of the total students who used the software, we did not think they would affect the outcome of the analyses. Therefore, we did not remove them from the analyses. A student using more than one program was considered as a specific program user in the program-specific analyses. For the analyses of the combined vendors, students were counted only once and their number of minutes on the software was combined across the software programs they used.

Data Analyses

Data Matching Methods

We linked the vendor data with USBE data using multiple criteria. First we collapsed students within the same school with the same name to single rows, allowing for partial name matching where multiple name parts were present, names were transposed, or nicknames and misspellings were used. To determine misspellings we computed the full Damerau-Levenshtein distance using the R package stringdist version 0.9.5.1 with a cutoff of 2. We then took this reduced data and linked it to the USBE data using the following methods respectively in order of priority; exact matching on district, school, and the present name parts (first, middle, last, and maternal), then partial matching of name within school, then fuzzy matching using the same string distance method and cutoff as for reduction.

Statistical Analyses

The following statistical methods were used in the analyses:

1. Means and standard deviations were reported to compare differences in data usage, scaled SAGE scores, and student growth percentiles (SGPs) across all vendors and overall, and by student grade level, type of school (elementary or secondary), student Title I math status, student low income status, student race/ethnicity, and student gender.

2. We considered usage greater than 3600 minutes in a single month to be unrealistic. Therefore, if a student had a monthly usage greater than 3600 minutes, his or her usage was recalculated based on other months of the same student. Thus the weighted total usage of those students was calculated as: $\frac{(TotalUsageAfterRemovedObservation(s))*(NumberOfTotalMonthsBeforeRemoving)}{NumberOfMonthsAfterRemoving}$. Students in the vendor data who had zero minutes of reported usage were considered non-users.

3. Wilcoxon Rank-Sum Tests were used to determine whether there were statistically significant differences in SAGE SGP scores between students who used any of the five software programs and students who did not use any of the five software programs.

4. Univariate and multiple linear regressions were used to compare program users to non-users on scaled SAGE scores. Student grade level, school type, student Title I math status, student low income status, student race/ethnicity, and student gender were held constant in the multiple linear regression for SAGE scores.

5. Linear regression was used to compare SGPs of students in different usage quartiles. Usage quartiles were defined as the ranges of minutes that divided the entire user population (all software programs combined) into four equal sized groups. School type, student Title I math status, student low income, student gender, and student 2017 math proficiency level (four levels) were controlled in models. Coefficients of program use, 95% confidence intervals, and p-values were reported.

6. Logistic regression was used to analyze whether software use predicted student math proficiency (two levels: proficient or not proficient). School type, student Title I math, student low income, student gender, and student 2017 proficiency level (four levels: below proficient, approaching proficient, proficient, and highly proficient) were controlled in models. Odds ratios of program users compared to non-users, 95% confidence intervals of odds ratios, and p-values were reported.

7. Logistic regression was used to analyze the relationship between different usage quartiles and proficiency (two levels). School type, student Title I math, student low income, student gender, and student 2017 proficiency level (four levels) were controlled in models. Odds ratios of program users in different use quartiles compared to non-users, 95% confidence intervals of odds ratios, and p-values were reported.

Limitations

1. Name spelling variations and typos in the data may impact matching.

2. Some students are duplicated in the analyses because they took multiple math tests. Approximately 0.3% of students in the analyses were duplicates. There might be within-student effects, but since the amount of duplicated students is small, the effects were not accounted for in this year's analyses.

3. Data on student usage were reported for the entire school year from September 2017 to June 2018, including usage that may have taken place after SAGE testing. Program use that took place after a student took the math SAGE test would have no relationship to SAGE results. Therefore, there was some amount of use data included in the analyses that were not relevant to the outcome variables.

Detailed Results Tables

Table 2. Sample Size (N), Average Minutes of Use per Week (M),[3] and Standard Deviation (SD) of Use by Demographics for Each Program (2017-18)

	Any Use			ALEKS			Imagine Math			i-Ready			Mathspace			ST Math		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
Overall	94,408	32	30	40,585	42	37	18,982	21	18	14,351	24	16	6,588	16	20	14,517	30	24
Grade Level																		
3	13,115	28	22	747	33	40	3,662	22	17	3,589	27	16	1,060	22	24	4,231	32	24
4	14,085	26	22	1,272	30	26	4,337	22	16	3,217	23	18	1,307	18	20	4,001	34	26
5	14,338	24	21	2,177	30	27	4,152	21	17	3,279	22	16	1,259	17	19	3,508	29	22
6	13,503	28	25	3,478	43	30	4,021	24	21	2,449	22	15	1,054	9	11	2,617	26	24
7	13,027	32	30	9,408	37	32	1,613	13	15	1,046	23	12	1,031	14	17	111	18	16
8	10,796	39	37	9,043	44	38	698	15	12	686	20	12	365	7	8	45	25	24
9	10,654	50	44	9,892	53	44	449	16	11	36	34	16	283	21	27	N<10	--	--
10	4,272	35	31	3,983	36	32	39	20	10	36	23	11	220	16	22	N<10	--	--
11	463	28	25	461	28	25	N<10	--	--	N<10	--	--	N<10	--	--	N<10	--	--
12	155	23	24	124	23	23	11	18	8	13	31	37	N<10	--	--	N<10	--	--
Type of school																		
Elementary (K-6)	55,041	26	22	7,674	36	30	16,172	22	18	12,534	24	16	4,680	17	20	14,357	31	24
Secondary (7-12)	39,367	39	37	32,911	43	38	2,810	14	14	1,817	22	13	1,908	14	19	160	20	19
Title I Math																		
No	93,380	32	30	40,490	42	37	18,945	21	18	13,681	24	16	6,392	16	20	14,487	30	24
Yes	1,028	17	18	95	53	29	37	24	14	670	15	12	196	6	6	30	14	11
Low income																		
No	60,187	33	31	27,188	43	37	14,643	22	17	7,636	23	16	4,247	17	20	6,825	34	26
Yes	34,221	30	29	13,397	40	37	4,339	19	18	6,715	25	16	2,341	14	18	7,692	28	22
Race/Ethnicity																		
African American	1,511	27	29	410	39	40	219	20	22	276	23	15	75	10	16	544	25	22
Am. Indian/Alaskan	935	30	29	403	43	37	64	20	16	247	18	12	54	11	11	172	23	17
Asian	1,433	33	35	463	47	45	229	26	29	171	23	19	97	15	21	488	30	27
Hispanic/Latino	15,890	29	29	5,801	39	37	2,052	19	18	3,135	24	16	745	12	19	4,272	27	22
Multiple race	2,242	29	29	852	40	36	579	22	19	360	21	16	145	16	22	318	28	24
Pacific Islander	1,385	30	28	448	42	39	249	21	18	148	23	15	65	12	13	488	27	20
White	71,012	32	30	32,208	42	37	15,590	21	17	10,014	24	16	5,407	16	20	8,235	33	25
Gender																		
Female	46,106	33	31	19,774	44	38	9,211	22	18	6,969	24	16	3,261	16	21	7,160	31	25
Male	48,301	31	29	20,810	40	36	9,771	21	18	7,382	24	16	3,327	15	19	7,357	30	24

Source: Vendor Usage Data and Student Education Data

[3] Based on a 36-week year.

Table 3. Sample Size (N), [4] Average Math SAGE Scores (M), and SAGE Score Standard Deviation (SD) by Demographics for Users of Each Program and Non-users (2017-18)

	Any Use			ALEKS			Imagine Math			iReady			Mathspace			ST Math			Non Users		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
Overall - Students are in use categories in 2016-17 based on 2017-18 software use.																					
2017-18	89,488	412	92	37,948	466	92	18,194	385	73	13,651	369	67	6,235	399	78	14,036	348	58	285,187	431	108
2016-17	71,656	397	80	34,339	439	76	13,884	369	63	9,545	355	58	4,893	382	67	9,378	335	49	229,021	418	96
Grade Level																					
3	12,733	318	36	721	327	33	3,545	321	36	3,489	318	36	1,026	322	32	4,121	312	37	35,580	314	35
4	13,591	348	44	1,199	351	44	4,184	352	43	3,118	347	44	1,260	361	39	3,876	339	46	35,549	345	43
5	13,777	380	51	2,088	382	49	3,992	387	50	3,142	379	52	1,197	392	44	3,388	368	53	35,183	377	51
6	12,757	412	60	3,280	419	56	3,804	416	59	2,279	412	58	981	416	66	2,527	394	64	34,219	412	59
7	12,182	447	68	8,818	448	68	1,546	444	59	904	441	73	991	455	70	95	403	51	33,277	441	69
8	10,108	489	80	8,496	490	77	652	506	82	638	458	89	324	487	89	28	368	79	34,547	484	82
9	9,934	508	90	9,226	507	90	427	540	80	34	339	57	255	487	86	N<10	--	--	32,966	514	98
10	3,911	502	113	3,652	506	112	37	346	67	35	382	74	193	476	105	N<10	--	--	35,769	542	113
11	387	489	123	385	488	123	N<10	--	--	N<10	--	--	N<10	--	--	N<10	--	--	6,906	561	117
12	108	425	97	83	444	92	N<10	--	--	12	340	65	N<10	--	--	N<10	--	--	1,191	469	109
Type of school																					
Element. (K-6)	52,858	365	60	7,288	388	59	15,525	370	59	12,028	359	58	4,464	372	57	13,912	348	57	140,531	362	60
Secondary (7-12)	36,630	481	88	30,660	485	88	2,669	473	81	1,623	443	82	1,771	468	82	124	395	60	144,656	499	102
Title I Math																					
No	88,517	413	92	37,860	467	92	18,165	385	73	13,006	371	67	6,049	401	78	14,013	348	58	283,122	432	108
Yes	971	346	65	88	398	80	29	292	42	645	337	54	186	365	75	23	329	58	2,065	339	63
Low income																					
No	57,080	428	92	25,586	479	89	14,037	390	71	7,194	384	66	4,040	409	77	6,557	364	56	187,639	449	110
Yes	32,408	385	88	12,362	440	90	4,157	366	74	6,457	353	65	2,195	382	76	7,479	334	56	97,548	397	97
Race/Ethnicity																					
Afr.Amer.	1,429	352	81	364	411	95	213	345	66	260	344	65	70	370	71	535	317	57	3,796	383	94
Am. Ind/Al.	894	384	89	381	443	85	61	368	80	243	332	56	48	372	74	166	331	55	2,949	385	95
Asian	1,391	408	96	443	482	97	227	387	79	165	371	66	93	442	94	478	355	59	4,901	456	116
Hispanic	15,182	374	83	5,415	427	86	1,977	362	75	3,015	343	62	696	382	76	4,181	331	53	49,758	392	95
Multiple	2,130	404	87	796	455	91	553	378	71	349	368	60	138	403	87	306	356	59	7,888	429	106
Pac. Isl	1,342	377	83	420	438	87	246	365	70	147	363	76	59	363	78	483	337	53	4,510	402	93
White	67,120	424	92	30,129	475	90	14,917	389	72	9,472	379	66	5,131	402	77	7,887	360	57	211,385	442	109
Gender																					
Female	43,691	413	91	18,454	469	88	8,826	383	72	6,626	369	66	3,099	399	78	6,934	347	56	138,588	432	106
Male	45,797	412	93	19,494	464	95	9,368	386	74	7,025	370	68	3,136	400	78	7,102	349	59	146,596	430	110

Source: Vendor Usage Data and Student Education Data

[4] Sample sizes are smaller in Table 3 than in Table 2 because Table 3 only includes students for whom SAGE scores were available.

The top rows of Table 4 (Overall) provide the numbers of students in each proficiency category (proficient, not proficient, and missing) for users and non-users in the 2016-17 and 2017-18 school years. The bottom rows (2017-18 Proficiency by Status of Previous Year) provide 2017-18 proficiency by previous year proficiency category.

Table 4. Proficiency Comparison Between 2016 and 2017, and 2018 Proficiency by Proficiency Status in Previous Year

	Is Proficient	Non-users Frequency	Non-users Percent (%) Proficient	Users Frequency	Users Percent (%) Proficient
Overall					
Year 2018	No	155,471	50	46,523	49
	Yes	129,716	42	42,965	46
	Not reported	24,751	8	4,670	5
Year 2017	No	125,009	40	38,069	40
	Yes	115,208	37	35,789	38
	Not reported	69,721	23	20,300	22
2017-18 Proficiency by Status of Previous Year					
2017 - not proficient or missing proficiency	No	134,429	69	40,635	70
	Yes	38,904	20	13,673	23
	Not reported	21,397	11	4,061	7
2017 - proficient	No	21,042	18	5,888	16
	Yes	90,812	79	29,292	82
	Not reported	3,354	3	609	2
2017 - reported not proficient	No	103,396	83	31,582	83
	Yes	14,570	12	4,932	13
2017 - test not reported	No	7,043	6	1,555	4
	Yes	31,033	45	9,053	45
	Not reported	24,334	35	8,741	43

Source: Vendor Usage Data and Student Education Data

Table 5. Sample Size (N), Mean Growth Percentiles (M), and Mean Growth Percentile Standard Deviation (SD) by Demographics for Users of Each Program and Non-users (2017-18)

	Any Use			ALEKS			Imagine Math			iReady			Mathspace			ST Math			Non Users		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
Overall	81,065	51	29	39,704	51	29	15,308	51	29	10,713	51	29	5,522	54	29	10,255	48	29	272,498	50	29
Grade Level																					
4	12,861	49	29	1,126	50	29	3,962	49	29	2,955	48	29	1,178	59	28	3,682	47	29	33,432	50	29
5	13,091	51	29	1,981	51	29	3,814	51	30	2,997	53	29	1,141	53	28	3,187	48	29	33,024	50	29
6	12,024	50	29	3,057	51	28	3,604	47	29	2,155	52	29	927	46	28	2,389	50	30	32,017	50	29
7	11,084	53	29	7,981	52	29	1,461	56	28	807	59	28	911	60	29	88	45	28	29,364	49	29
8	9,143	51	29	7,684	50	29	577	65	28	582	48	27	303	59	28	25	40	30	30,582	50	29
9	9,099	52	29	8,453	52	29	404	56	28	23	43	24	228	47	27	N<10	--	--	29,530	51	29
10	3,235	51	29	3,042	51	29	N<10	--	--	22	50	25	174	40	28	N<10	--	--	30,820	50	29
11	81	45	29	80	45	29	N<10	--	--	N<10	--	--	N<10	--	--	N<10	--	--	5,538	49	29
Type of school																					
Ele (K-6)	37,976	50	29	6,164	51	29	11,380	49	29	8,107	51	29	3,246	53	28	9,258	48	29	98,473	50	29
Sec (7-12)	32,649	52	29	27,244	51	29	2,442	58	28	1,437	54	28	1,617	56	29	113	44	28	125,944	50	29
Title I Math																					
No	69,893	51	29	33,324	51	29	13,805	51	29	9,116	52	29	4,681	55	28	9,350	48	29	222,897	50	29
Yes	732	39	29	84	35	27	17	32	29	428	43	29	182	30	28	21	48	29	1,520	47	29
Low income																					
No	45,585	53	29	22,677	53	29	10,634	51	29	5,058	54	29	3,136	56	28	4,292	51	29	148,206	51	29
Yes	25,040	48	29	10,731	48	29	3,188	48	30	4,486	49	29	1,727	51	30	5,079	46	30	76,211	48	29
Race/Ethnicity																					
AfAm/Black	1,002	46	30	299	45	30	142	46	31	180	49	27	53	45	28	337	46	31	2,883	47	29
American Indian	662	50	29	318	52	29	48	53	29	149	48	29	35	51	31	115	46	30	2,268	49	29
Asian	1,044	54	30	389	53	30	173	54	31	103	54	31	76	53	31	317	54	30	3,722	56	29
Hispanic/Latino	11,744	47	29	4,752	46	28	1,526	47	29	2,088	48	29	601	47	30	2,852	46	29	38,932	47	29
Multiple Races	1,614	51	29	675	51	29	426	48	30	235	54	29	110	55	30	177	50	29	6,086	50	29
Pacific Islander	1,010	48	29	365	46	29	194	48	30	101	55	27	43	43	27	317	48	30	3,466	48	29
White	53,549	52	29	26,610	52	29	11,313	51	29	6,688	52	29	3,945	55	28	5,256	49	29	167,060	51	29
Gender																					
Female	34,452	52	28	16,312	53	28	6,677	51	29	4,609	52	28	2,425	54	28	4,597	48	29	109,244	51	28
Male	36,173	50	30	17,096	50	30	7,145	50	30	4,935	50	29	2,438	54	29	4,774	48	30	115,170	49	30

Source: Vendor Usage Data and Student Education Data

Table 6 displays the results of Wilcoxon Rank-Sum Tests of SAGE SGPs in each demographic category. For example, 5th grade students who used the software had math SGPs that were statistically significantly higher than 5th grade students who did not use the software (p<.001). In the 10th grade, there was no difference between the user and non-user groups (p=.644). In some categories program users have higher SGPs and in others non-users have higher SGPs.

Table 6. Statistical Tests for Students with SAGE SGP Scores

Variable	Use Status	N	Mean	STD Dev	STD Err	95% Confidence Limit		p-value
						Lower	Upper	
Overall	No	224,417	49.99	28.97	0.06	49.87	50.11	<0.001
	Yes	70,625	50.93	28.97	0.11	50.72	51.14	
By grade level								
4	No	33,432	50.18	28.87	0.16	49.87	50.49	0.001
	Yes	12,861	49.22	29.15	0.26	48.72	49.73	
5	No	33,024	49.67	28.84	0.16	49.36	49.98	<0.001
	Yes	13,091	50.85	29.2	0.26	50.35	51.35	
6	No	32,017	50.13	28.99	0.16	49.82	50.45	0.045
	Yes	12,024	49.51	28.91	0.26	48.99	50.03	
7	No	29,364	49.08	29.02	0.17	48.75	49.41	<0.001
	Yes	11,084	53.3	28.65	0.27	52.76	53.83	
8	No	30,582	50.24	29.02	0.17	49.91	50.57	<0.001
	Yes	9,143	51.41	29.09	0.3	50.81	52	
9	No	29,530	50.5	29.12	0.17	50.17	50.83	<0.001
	Yes	9,099	52.18	28.49	0.3	51.59	52.76	
10	No	30,820	50.26	28.96	0.16	49.93	50.58	0.644
	Yes	3,235	50.5	28.99	0.51	49.5	51.5	
11	No	5,538	49.37	28.93	0.39	48.61	50.14	0.196
	Yes	81	45.19	29.05	3.23	38.86	51.51	
12	No	110	40.81	29.11	2.78	35.37	46.25	--
	Yes	N<10	--	--	--	--	--	
School Type								
Elementary	No	98,473	50	28.9	0.09	49.82	50.18	0.498
	Yes	37,976	49.88	29.1	0.15	49.58	50.17	
Secondary	No	125,944	49.99	29.03	0.08	49.83	50.15	<0.001
	Yes	32,649	52.16	28.78	0.16	51.84	52.47	
Title I Math								
No	No	222,897	50.01	28.97	0.06	49.89	50.13	<0.001
	Yes	69,893	51.06	28.94	0.11	50.85	51.28	
Yes	No	1,520	46.64	29.04	0.74	45.18	48.1	<0.001
	Yes	732	38.51	29.38	1.09	36.39	40.64	

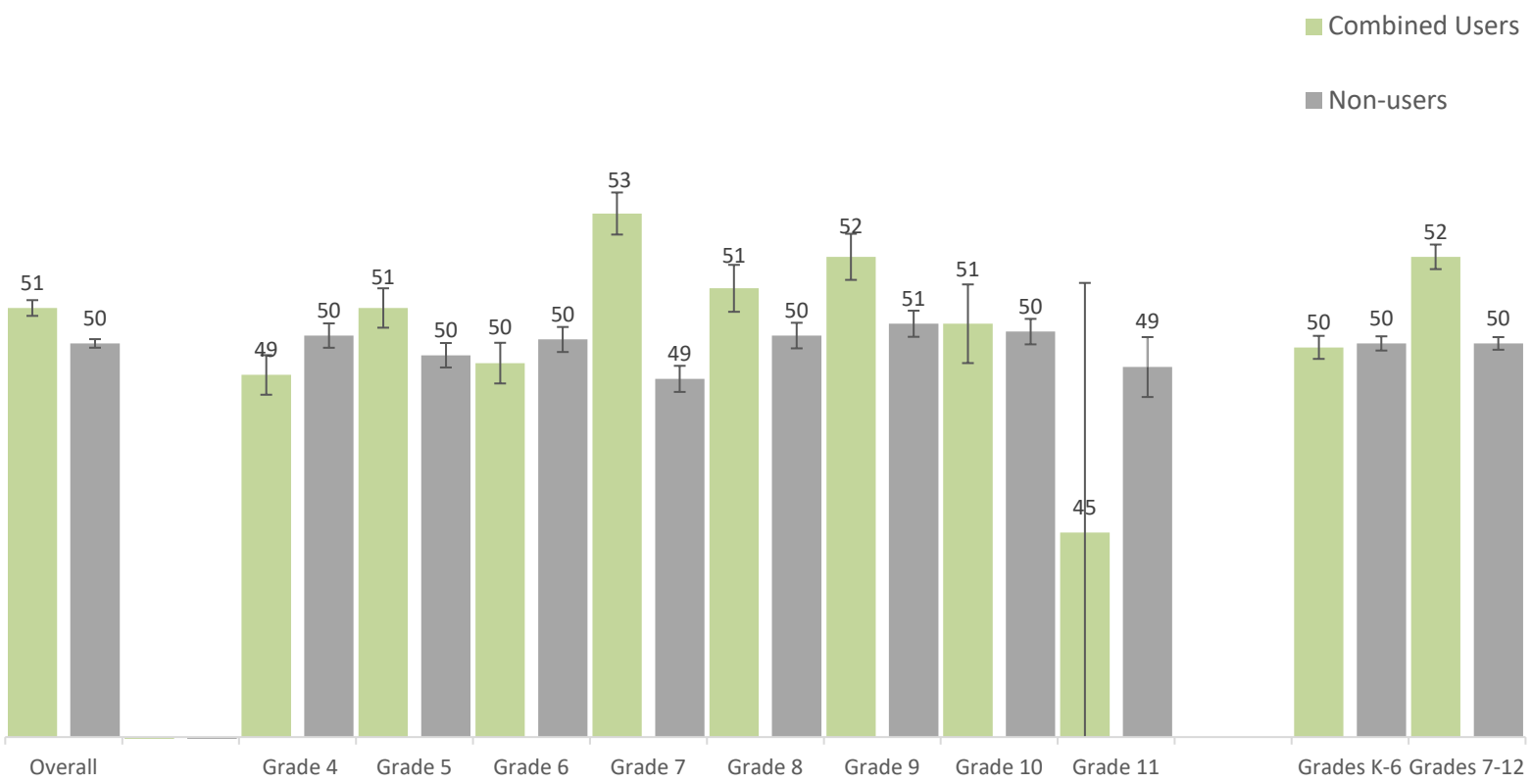
Table 6. Statistical Tests for Students with SAGE SGP Scores (continued from previous page)

Variable	Use Status	N	Mean	STD Dev	STD Err	95% Confidence Limit		p-value
						Lower	Upper	
Low income								
No	No	148,206	51.07	28.89	0.08	50.92	51.22	<0.001
	Yes	45,585	52.61	28.79	0.13	52.35	52.87	
Yes	No	76,211	47.89	29.02	0.11	47.69	48.1	0.913
	Yes	25,040	47.87	29.06	0.18	47.52	48.23	
Race/Ethnicity								
AfAm/Black	No	2,883	46.95	28.83	0.54	45.9	48	0.522
	Yes	1,002	46.38	29.72	0.94	44.54	48.22	
American Indian	No	2,268	49.32	29.06	0.61	48.12	50.51	0.475
	Yes	662	50.23	29.22	1.14	48	52.46	
Asian	No	3,722	55.58	28.59	0.47	54.66	56.5	0.159
	Yes	1,044	53.89	30.28	0.94	52.05	55.72	
Hispanic/Latino	No	38,932	47.08	28.81	0.15	46.8	47.37	0.046
	Yes	11,744	46.48	28.81	0.27	45.96	47	
Multiple Races	No	6,086	50.17	29.18	0.37	49.44	50.91	0.371
	Yes	1,614	50.89	29.44	0.73	49.46	52.33	
Pacific Islander	No	3,466	48.37	28.78	0.49	47.41	49.33	0.532
	Yes	1,010	47.74	29.04	0.91	45.95	49.53	
White	No	167,060	50.63	28.96	0.07	50.49	50.77	<0.001
	Yes	53,549	52	28.84	0.12	51.76	52.25	
Gender								
Female	No	109,244	50.86	28.23	0.09	50.69	51.03	<0.001
	Yes	34,452	52.03	28.28	0.15	51.73	52.33	
Male	No	115,170	49.16	29.64	0.09	48.99	49.34	<0.001
	Yes	36,173	49.88	29.58	0.16	49.58	50.19	

Source: Vendor Usage Data and Student Education Data

Figure 8 provides a graphical representation of the mean SGP data provided in Tables 6.

Figure 8. Comparison of Average SAGE SGP Between Users and Non-users by Grade Level Categories



Source: Vendor Usage Data and Student Education Data

Figure 9. Comparison of Average SAGE SGP Between Users and Non-users by Demographic Categories

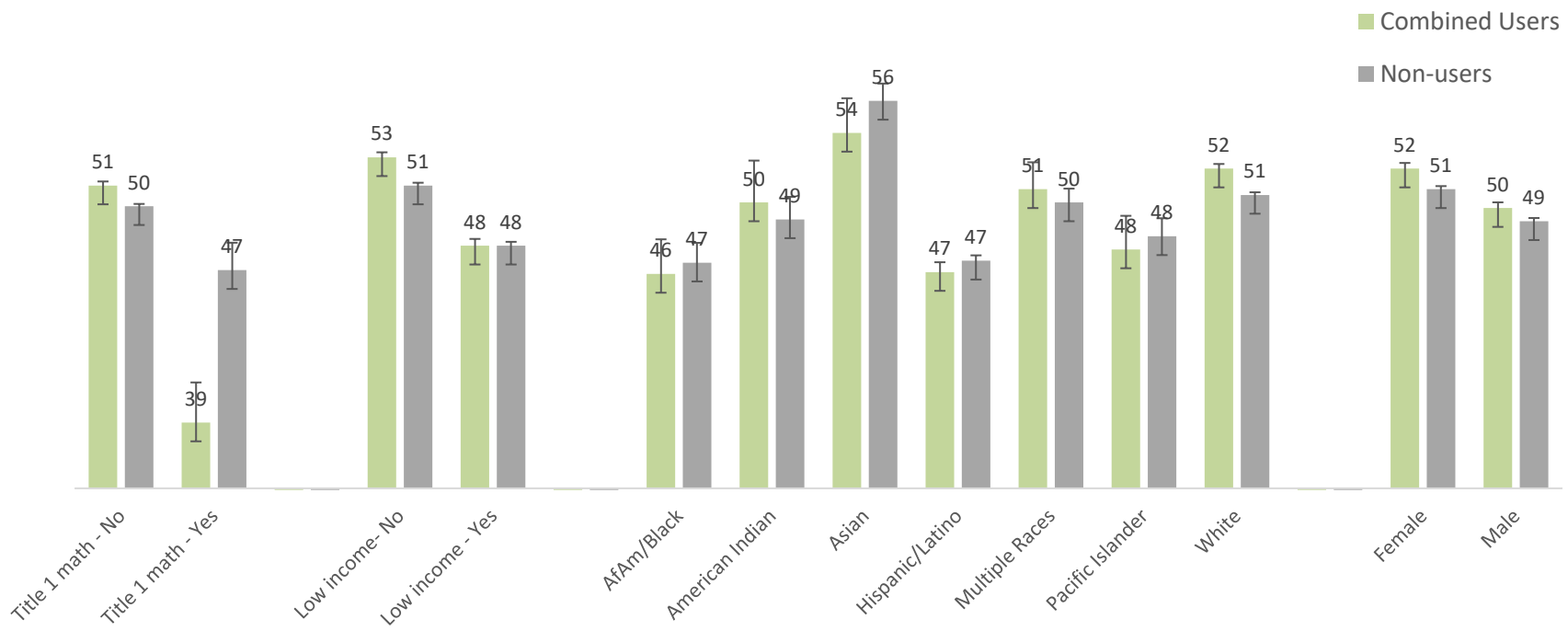


Table 7 provides the difference between the average math SGP for students who used each software program compared to students who did not use any of the programs, and the p values based on Wilcoxon Rank-Sum Tests.

Table 7. SAGE SGP Comparison Between Individual Vendors to Non-users

Vendor	Estimated Difference	95% Confidence Limit		P-value
		Lower	Upper	
Overall	-0.06	-0.59	0.46	0.81
ALEKS	-3.35	-4.14	-2.56	<0.001
Imagine Math	0.34	-0.72	1.4	0.531
iReady	5.67	4.45	6.89	<0.001
Mathspace	4.81	3.04	6.58	<0.001
ST Math	1.82	0.61	3.04	0.003

Table 8 provides the regression coefficients and p-values for the regression equations predicting student growth percentiles in 2017-187 for each student usage quartile. By definition, the SGPs (student growth percentiles) take into account pre-existing differences between students by comparing students to academic peers from the previous year. In theory, model 1, the simple comparison of users to non-users is the best model. Model 2 is provided for reference only.

Table 8. Student Growth Percentiles for Program Users by Use Quartile Compared to Non-users (All Vendors Combined)

Model	Quartile	Coefficient	Lower Confidence Level	Upper Confidence Level	P-value
m1 – Simple comparison of users to non-users	1st Quartile	-2.39	-2.83	-1.94	<0.001
	2nd Quartile	-0.95	-1.4	-0.51	<0.001
	3rd Quartile	2.34	1.9	2.78	<0.001
	4th Quartile	4.59	4.15	5.03	<0.001
m2 – Controls for school type, Title I math, low income, race, gender, 2017 proficiency level	1st Quartile	-2.12	-2.57	-1.67	<0.001
	2nd Quartile	-0.83	-1.27	-0.39	<0.001
	3rd Quartile	2.4	1.95	2.84	<0.001
	4th Quartile	4.43	3.99	4.87	<0.001

Source: Vendor Usage Data and Student Education Data

Tables 9 through 13 provides the regression coefficients and p-values for the regression equations predicting student growth percentiles in 2017-18 for each student usage quartile for each software vendor.

Table 9. Student Growth Percentiles for ALEKS Users by Use Quartile Compared to Non-users

Model	Quartile	Coefficient	Lower Confidence Level	Upper Confidence Level	P-value
m1 – Simple comparison of users to non-users	1st Quartile	-2.89	-3.69	-2.1	<0.001
	2nd Quartile	-2.08	-2.77	-1.39	<0.001
	3rd Quartile	1.65	1.03	2.28	<0.001
	4th Quartile	4.61	4.09	5.12	<0.001
m2 – Controls for school type, Title I math, low income, race, gender, 2017 proficiency level	1st Quartile	-2.78	-3.57	-1.99	<0.001
	2nd Quartile	-2.09	-2.78	-1.39	<0.001
	3rd Quartile	1.52	0.89	2.14	<0.001
	4th Quartile	4.35	3.84	4.87	<0.001

Source: Vendor Usage Data and Student Education Data

Table 10. Student Growth Percentiles for Imagine Math Users by Use Quartile Compared to Non-users

Model	Quartile	Coefficient	Lower Confidence Level	Upper Confidence Level	P-value
m1 – Simple comparison of users to non-users	1st Quartile	-3.87	-4.7	-3.03	<0.001
	2nd Quartile	1.03	0.17	1.9	0.019
	3rd Quartile	4.26	3.26	5.26	<0.001
	4th Quartile	5.88	4.37	7.38	<0.001
m2 – Controls for school type, Title I math, low income, race, gender, 2017 proficiency level	1st Quartile	-3.96	-4.8	-3.12	<0.001
	2nd Quartile	0.63	-0.24	1.49	0.158
	3rd Quartile	3.88	2.88	4.88	<0.001
	4th Quartile	5.5	4	7.01	<0.001

Source: Vendor Usage Data and Student Education Data

Table 11. Student Growth Percentiles for i-Ready Users by Use Quartile Compared to Non-users

Model	Quartile	Coefficient	Lower Confidence Level	Upper Confidence Level	P-value
m1 – Simple comparison of users to non-users	1st Quartile	0.73	-0.4	1.86	0.204
	2nd Quartile	-0.39	-1.46	0.67	0.47
	3rd Quartile	1.96	0.93	2.99	<0.001
	4th Quartile	5.9	4.13	7.66	<0.001
m2 – Controls for school type, Title I math, low income, race, gender, 2017 proficiency level	1st Quartile	1.27	0.14	2.41	0.028
	2nd Quartile	0.27	-0.8	1.34	0.622
	3rd Quartile	2.6	1.56	3.63	<0.001
	4th Quartile	6.54	4.77	8.31	<0.001

Source: Vendor Usage Data and Student Education Data

Table 12. Student Growth Percentiles for Mathspace Users by Use Quartile Compared to Non-users

Model	Quartile	Coefficient	Lower Confidence Level	Upper Confidence Level	P-value
m1 – Simple comparison of users to non-users	1st Quartile	1.32	0.27	2.38	0.014
	2nd Quartile	8.17	6.25	10.08	<0.001
	3rd Quartile	9.43	7.13	11.73	<0.001
	4th Quartile	5.17	2.38	7.96	<0.001
m2 – Controls for school type, Title I math, low income, race, gender, 2017 proficiency level	1st Quartile	1.52	0.46	2.57	0.005
	2nd Quartile	8.17	6.26	10.08	<0.001
	3rd Quartile	9.19	6.89	11.48	<0.001
	4th Quartile	4.76	1.98	7.54	<0.001

Source: Vendor Usage Data and Student Education Data

Table 13. Student Growth Percentiles for ST Math Users by Use Quartile Compared to Non-users

Model	Quartile	Coefficient	Lower Confidence Level	Upper Confidence Level	P-value
m1 – Simple comparison of users to non-users	1st Quartile	-6.53	-7.78	-5.28	<0.001
	2nd Quartile	-5.19	-6.32	-4.07	<0.001
	3rd Quartile	0.56	-0.6	1.73	0.345
	4th Quartile	3.25	2.07	4.44	<0.001
m2 – Controls for school type, Title I math, low income, race, gender, 2017 proficiency level	1st Quartile	-5.65	-6.9	-4.39	<0.001
	2nd Quartile	-4.43	-5.57	-3.3	<0.001
	3rd Quartile	1.26	0.09	2.43	0.035
	4th Quartile	3.62	2.43	4.81	<0.001

Source: Vendor Usage Data and Student Education Data

In the first half, Table 14 provides SGPs by vendor and use quartile. In the second half, Table 14 provides the difference between the SGP in the 2nd, 3rd, and 4th quartiles compared to the first quartile.

Table 14. Student Growth Percentile (SGP) Differences by Use Level by Vendor

Vendor	**1st Quartile Use (<8 Hours per year)**	**2nd Quartile Use (8-17.3 hours per year)**	**3rd Quartile use (17.3-30.6 hours per year)**	**4th Quartile Use (30.6 + hours per year)**
Growth Percentile Comparison for Different Usage Dosage, by Vendor				
Vendor	Mean SGP	Mean SGP	Mean SGP	Mean SGP
Overall	47.61	49.04	52.33	54.58
ALEKS	47.1	47.91	51.64	54.6
Imagine	46.12	51.02	54.25	55.87
iReady	50.72	49.6	51.95	55.89
Mathspace	51.31	58.16	59.42	55.16
ST Math	43.46	44.8	50.55	53.25
Growth Percentile Increase Compared to Their Corresponding 1st Quartile				
Overall	Reference	1.43	4.72	6.97
ALEKS	Reference	0.81	4.54	7.5
Imagine	Reference	4.9	8.13	9.75
iReady	Reference	-1.12	1.23	5.17
Mathspace	Reference	6.85	8.11	3.85
ST Math	Reference	1.34	7.09	9.79

Source: Vendor Usage Data and Student Education Data

Table 15 provides the same growth percentile information as the first half of Table 16, with confidence intervals added.

Table 15. Student Growth Percentile (SGP) for Different Use Levels

	Hours during the school year	Mean Growth Percentile	95% Confidence Interval
Overall			
1st quartile use	<8.0	47.61	(47.17, 48.05)
2nd quartile use	8.0-17.3	49.04	(48.61, 49.47)
3rd quartile use	17.3-30.6	52.33	(51.91, 52.75)
4th quartile use	>30.6	54.58	(54.16, 55)
ALEKS			
1st quartile use	<8.0	47.1	(46.31, 47.89)
2nd quartile use	8.0-17.3	47.91	(47.24, 48.58)
3rd quartile use	17.3-30.6	51.64	(51.03, 52.25)
4th quartile use	>30.6	54.6	(54.11, 55.09)
Imagine Math			
1st quartile use	<8.0	46.12	(45.29, 46.95)
2nd quartile use	8.0-17.3	51.02	(50.16, 51.88)
3rd quartile use	17.3-30.6	54.25	(53.25, 55.25)
4th quartile use	>30.6	55.87	(54.38, 57.36)
iReady			
1st quartile use	<8.0	50.72	(49.58, 51.86)
2nd quartile use	8.0-17.3	49.6	(48.54, 50.66)
3rd quartile use	17.3-30.6	51.95	(50.95, 52.95)
4th quartile use	>30.6	55.89	(54.16, 57.62)
Mathspace			
1st quartile use	<8.0	51.31	(50.27, 52.35)
2nd quartile use	8.0-17.3	58.16	(56.35, 59.97)
3rd quartile use	17.3-30.6	59.42	(57.19, 61.65)
4th quartile use	>30.6	55.16	(52.4, 57.92)
ST Math			
1st quartile use	<8.0	43.46	(42.18, 44.74)
2nd quartile use	8.0-17.3	44.8	(43.69, 45.91)
3rd quartile use	17.3-30.6	50.55	(49.4, 51.7)
4th quartile use	>30.6	53.25	(52.06, 54.44)

Source: Vendor Usage Data and Student Education Data

Table 16 provides the odds ratios and p-values for the logistic regressions predicting math proficiency in 2017-18. The two models (m1 and m2) are described in the table. Model 2 was used in the main body of the addendum for changes in likelihood of attaining proficiency associated with software use.

Table 16. Likelihood of Attaining Proficiency – Results from Different Models

	Model	Effect	Odds Ratio	Lower Confidence Level	Upper Confidence Level	P-value
Overall	m1 – Simple comparison of users to non-users	use_yes 1 vs 0	1.166	1.149	1.183	<0.001
	m2 – Controls for school type, title 1 math, low income, race, gender, 2017 proficiency level	use_yes	1.233	1.209	1.258	<0.001
ALEKS	m1 – Simple comparison of users to non-users	use_yes 1 vs 0	1.021	1	1.042	0.055
	m2 – Controls for school type, title 1 math, low income, race, gender, 2017 proficiency level	use_yes	1.162	1.129	1.197	<0.001
Imagine Math	m1 – Simple comparison of users to non-users	use_yes 1 vs 0	1.499	1.456	1.544	<0.001
	m2 – Controls for school type, title 1 math, low income, race, gender, 2017 proficiency level	use_yes	1.19	1.144	1.238	<0.001
iReady	m1 – Simple comparison of users to non-users	use_yes 1 vs 0	1.271	1.229	1.315	<0.001
	m2 – Controls for school type, title 1 math, low income, race, gender, 2017 proficiency level	use_yes	1.411	1.349	1.475	<0.001
Mathspace	m1 – Simple comparison of users to non-users	use_yes 1 vs 0	1.55	1.476	1.627	<0.001
	m2 – Controls for school type, title 1 math, low income, race, gender, 2017 proficiency level	use_yes	1.53	1.434	1.633	<0.001
ST Math	m1 – Simple comparison of users to non-users	use_yes 1 vs 0	0.965	0.932	0.998	0.037
	m2 – Controls for school type, title 1 math, low income, race, gender, 2017 proficiency level	use_yes	1.154	1.103	1.207	<0.001

Source: Vendor Usage Data and Student Education Data

Table 17 provides the odds ratios and p-values for the logistic regressions predicting math proficiency in 2017-18 for students who were not proficient in the previous year (2016-17).

Table 17. Likelihood of Attaining Proficiency for Those who were not Proficient in the Previous Year (2017)

	Model	Effect	Odds Ratio	Lower Confidence Level	Upper Confidence Level	P-value
Overall	m1 – Simple comparison of users to non-users	Users to Non-users	1.128	1.09	1.168	<0.001
	m2 – Controls for school type, title 1 math, low income, race, gender, 2017 proficiency level	Users to Non-users	1.14	1.099	1.183	<0.001
ALEKS	m1 – Simple comparison of users to non-users	Users to Non-users	1.099	1.05	1.151	<0.001
	m2 – Controls for school type, title 1 math, low income, race, gender, 2017 proficiency level	Users to Non-users	1.051	1	1.104	0.049
Imagine Math	m1 – Simple comparison of users to non-users	Users to Non-users	1.283	1.194	1.38	<0.001
	m2 – Controls for school type, title 1 math, low income, race, gender, 2017 proficiency level	Users to Non-users	1.205	1.113	1.304	<0.001
iReady	m1 – Simple comparison of users to non-users	Users to Non-users	1.141	1.049	1.241	0.002
	m2 – Controls for school type, title 1 math, low income, race, gender, 2017 proficiency level	Users to Non-users	1.29	1.175	1.415	<0.001
Mathspace	m1 – Simple comparison of users to non-users	Users to Non-users	1.662	1.495	1.848	<0.001
	m2 – Controls for school type, title 1 math, low income, race, gender, 2017 proficiency level	Users to Non-users	1.663	1.481	1.867	<0.001
ST Math	m1 – Simple comparison of users to non-users	Users to Non-users	0.843	0.770	0.923	<0.001
	m2 – Controls for school type, title 1 math, low income, race, gender, 2017 proficiency level	Users to Non-users	1.053	0.953	1.163	0.313

Source: Vendor Usage Data and Student Education Data

Table 18 provides the odds ratios and p-values for the logistic regressions predicting math proficiency in 2017-18 for students based on their usage quartile.

Table 18. Software Users Likelihood of Attaining Proficiency at Each Use Quartile Compared to Non-users (All Vendors Combined)

Model	Quartile Compared to No Use	Odds Ratio	Lower Confidence Level	Upper Confidence Level	P-value
m1 – Simple comparison of users to non-users	Q1 vs No Use	0.881	0.857	0.905	<0.001
	Q2 vs No Use	1.123	1.093	1.153	<0.001
	Q3 vs No Use	1.327	1.292	1.363	<0.001
	Q4 vs No Use	1.399	1.362	1.436	<0.001
m2 – Controls for school type, title 1 math, low income, race, gender, 2017 proficiency level	Q1 vs No Use	0.924	0.891	0.959	<0.001
	Q2 vs No Use	1.127	1.088	1.168	<0.001
	Q3 vs No Use	1.379	1.331	1.428	<0.001
	Q4 vs No Use	1.568	1.514	1.625	<0.001

Source: Vendor Usage Data and Student Education Data

Tables 19 through 23 provide the odds ratios and p-values for the logistic regressions predicting math proficiency in 2017-18 for students based on their usage quartile for each software vendor.

Table 19. ALEKS Users Likelihood of Attaining Proficiency at Each Use Quartile Compared to Non-users

Model	Quartile Compared to No Use	Odds Ratio	Lower Confidence Level	Upper Confidence Level	P-value
m1 – Simple comparison of users to non-users	Q1 vs No Use	0.697	0.662	0.733	<0.001
	Q2 vs No Use	0.905	0.866	0.947	<0.001
	Q3 vs No Use	1.119	1.074	1.165	<0.001
	Q4 vs No Use	1.212	1.173	1.252	<0.001
m2 – Controls for school type, title 1 math, low income, race, gender, 2017 proficiency level	Q1 vs No Use	0.861	0.804	0.922	<0.001
	Q2 vs No Use	0.978	0.92	1.04	0.478
	Q3 vs No Use	1.209	1.143	1.278	<0.001
	Q4 vs No Use	1.407	1.346	1.471	<0.001

Source: Vendor Usage Data and Student Education Data

Table 20. Imagine Math Users Likelihood of Attaining Proficiency at Each Use Quartile Compared to Non-users

Model	Quartile Compared to No Use	Odds Ratio	Lower Confidence Level	Upper Confidence Level	P-value
m1 – Simple comparison of users to non-users	Q1 vs No Use	0.992	0.944	1.043	0.749
	Q2 vs No Use	1.721	1.634	1.813	<0.001
	Q3 vs No Use	1.926	1.814	2.044	<0.001
	Q4 vs No Use	2.141	1.961	2.338	<0.001
m2 – Controls for school type, title 1 math, low income, race, gender, 2017 proficiency level	Q1 vs No Use	0.823	0.77	0.88	<0.001
	Q2 vs No Use	1.333	1.244	1.427	<0.001
	Q3 vs No Use	1.47	1.361	1.587	<0.001
	Q4 vs No Use	1.663	1.482	1.866	<0.001

Source: Vendor Usage Data and Student Education Data

Table 21. i-Ready Users Likelihood of Attaining Proficiency at Each Use Quartile Compared to Non-users

Model	Quartile Compared to No Use	Odds Ratio	Lower Confidence Level	Upper Confidence Level	P-value
m1 – Simple comparison of users to non-users	Q1 vs No Use	0.993	0.929	1.062	0.847
	Q2 vs No Use	1.128	1.061	1.199	<0.001
	Q3 vs No Use	1.445	1.363	1.531	<0.001
	Q4 vs No Use	1.971	1.794	2.166	<0.001
m2 – Controls for school type, title 1 math, low income, race, gender, 2017 proficiency level	Q1 vs No Use	1.074	0.981	1.175	0.124
	Q2 vs No Use	1.26	1.164	1.363	<0.001
	Q3 vs No Use	1.578	1.465	1.7	<0.001
	Q4 vs No Use	2.207	1.957	2.487	<0.001

Source: Vendor Usage Data and Student Education Data

Table 22. Mathspace Users Likelihood of Attaining Proficiency at Each Use Quartile Compared to Non-users

Model	Quartile Compared to No Use	Odds Ratio	Lower Confidence Level	Upper Confidence Level	P-value
m1 – Simple comparison of users to non-users	Q1 vs No Use	1.296	1.215	1.381	<0.001
	Q2 vs No Use	1.772	1.586	1.981	<0.001
	Q3 vs No Use	2.184	1.903	2.507	<0.001
	Q4 vs No Use	2.235	1.907	2.62	<0.001
m2 – Controls for school type, title 1 math, low income, race, gender, 2017 proficiency level	Q1 vs No Use	1.351	1.238	1.475	<0.001
	Q2 vs No Use	1.517	1.317	1.747	<0.001
	Q3 vs No Use	1.86	1.561	2.218	<0.001
	Q4 vs No Use	2.329	1.904	2.849	<0.001

Source: Vendor Usage Data and Student Education Data

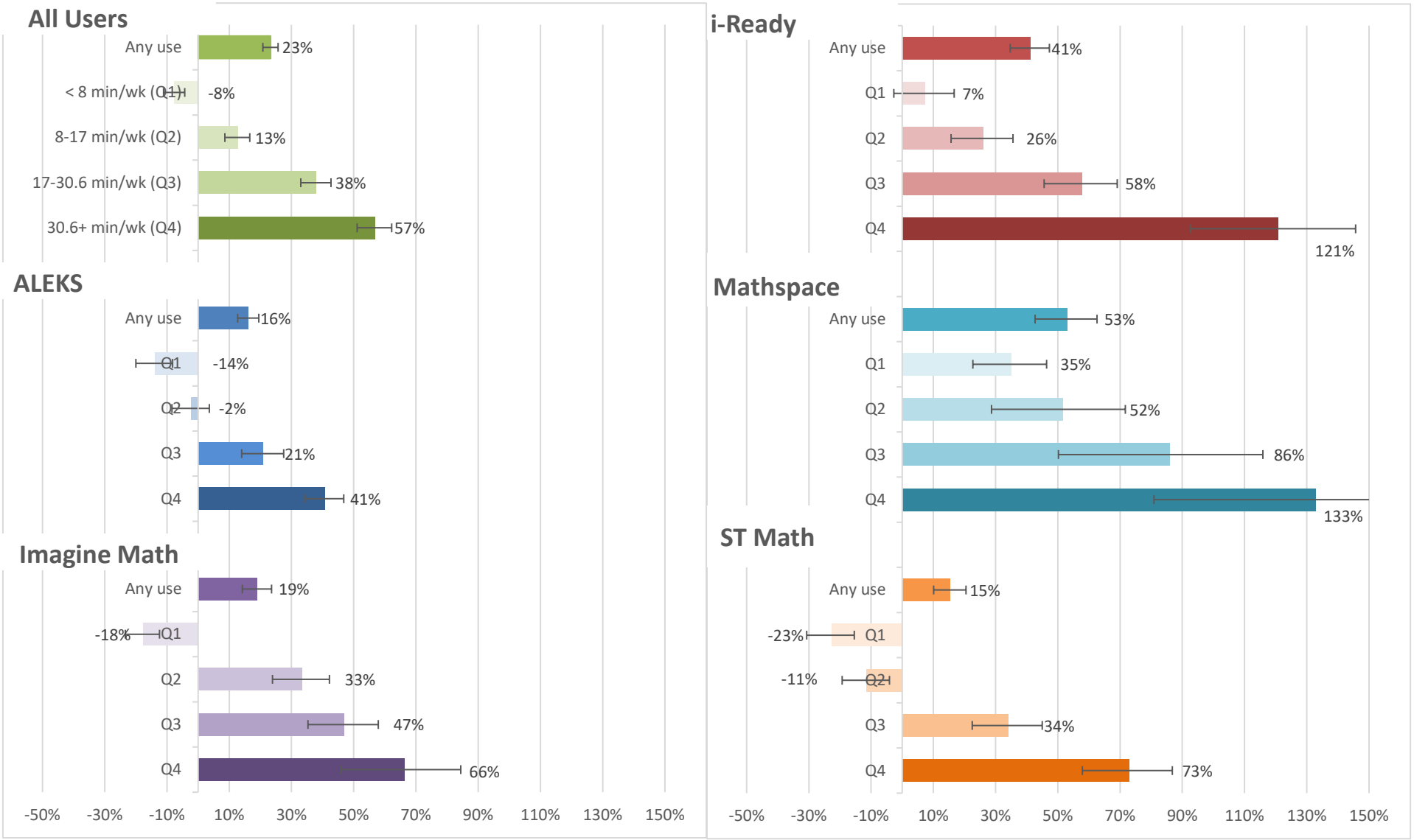
Table 23. ST Math Users Likelihood of Attaining Proficiency at Each Use Quartile Compared to Non-users

Model	Quartile Compared to No Use	Odds Ratio	Lower Confidence Level	Upper Confidence Level	P-value
m1 – Simple comparison of users to non-users	Q1 vs No Use	0.621	0.576	0.67	<0.001
	Q2 vs No Use	0.771	0.721	0.823	<0.001
	Q3 vs No Use	1.067	1	1.139	0.052
	Q4 vs No Use	1.559	1.461	1.664	<0.001
m2 – Controls for school type, title 1 math, low income, race, gender, 2017 proficiency level	Q1 vs No Use	0.773	0.7	0.853	<0.001
	Q2 vs No Use	0.886	0.813	0.965	0.006
	Q3 vs No Use	1.342	1.234	1.459	<0.001
	Q4 vs No Use	1.729	1.59	1.879	<0.001

Source: Vendor Usage Data and Student Education Data

Figure 10 provides the increase in likelihood of proficiency for each use quartile for each program. The error bars represent the 95% confidence intervals.

Figure 10. Increase in Likelihood of Math Proficiency for Students in Each Use Quartile for Each Software Type with Error Bars



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