STEM Action Center Program Evaluation

Academic Year 2016-17

THE UNIVERSITY OF UTAH
UTAH EDUCATION POLICY CENTER

in partnership with

UVU School of EDUCATION
UTAH VALLEY UNIVERSITY

THE UNIVERSITY OF UTAH

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

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

Project Staff

STEM Action Center

Tamara Goetz, Ph.D., Executive Director
Sue Redington, M.P.A., Program Director
Kellie Yates, B.S., STEM Liaison
Clarence Ames, M.S., STEM Program Specialist

Utah Valley University

Vessela Ilieva, Ph.D., Associate Professor
Emily Swan, Ph.D., Evaluation Director

Utah Education Policy Center

Andrea Rorrer, Ph.D., Director, College of Education Dean,
Dept. of Education Leadership and Policy Professor
Stacy Eddings, Ph.D., Assistant Director
Xiangyang Ye, M.S., Database Manager
Yongmei Ni, Ph.D, Assistant Director, Associate Professor
Jeremy Franklin, Ph.D., Research Associate
Valerie Guerrero, M.Ed., Graduate Research Assistant
Sandra Leu, M.Ed, Graduate Research Assistant
Liliana Castrellon, M.A., Graduate Research Assistant
Elizabeth Walsh, M.S., Research Associate
Kristen Weissinger, M.S., Research Associate
Marina Lopez, Summer Intern

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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).

Utah Valley University's (UVU) School of Education (SOE), in partnership with the Utah Education Policy Center (UEPC) at the University of Utah, 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 2016-17 implementation year of these three programs. This is the first year of a five-year evaluation cycle for the UEPC and UVU team.

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

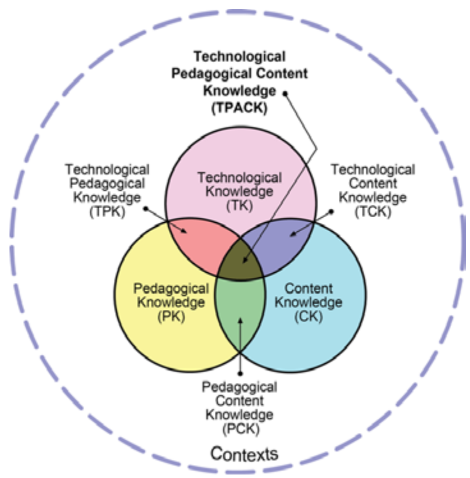
Evaluation Background

The 2016-17 evaluation process was built on two foundational frameworks that were applied as appropriate to each project's evaluation. These frameworks included the Pedagogical Content Knowledge (PCK) and the Technological, Content, and Pedagogical Knowledge (TPACK) frameworks. In addition, the evaluation team, along with the STEM AC, developed logic models for each program 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 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 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 used as a guide to 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 attempt 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

This five-year evaluation methodology will consist 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 Grant and the STEM Professional Learning Program. Vendors that provide software for the programs 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, we reviewed existing surveys from the research literature on TPACK and STEM education. Surveys for the three STEM AC programs to be evaluated were then developed using the logic model. Furthermore, surveys were aligned across groups of participants to provide comparable data on the project components and their perceived impact.

SAGE data for the 2016-17 school year have not yet been provided to the evaluation team; analyses from those data will be provided in an addendum as they become available.

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 Three of the K-12 Mathematics Personalized Learning Software Grant (2016-17). In the first year of the grant, there were 11 software products available to schools and LEAs. In year three, those initial programs had been reduced to five and one new program was added, for a total of six software options. Schools and LEAs applied to utilize the programs through a competitive grant application released in January of 2016 and awarded in spring 2016.

Program Overview

The mathematics software programs are intended to improve student math performance. Specifically, the software is 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. The software is adaptive and provides students with problems that are suited to each individual's ability. Moreover, the software aids in showing steps to solving the problems, and provides 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. Students who meet fidelity recommendations for minimum amounts of time on the software have been shown in previous evaluations to have increased SAGE scores (https://stem.utah.gov/k12mathpersonalizedlearning/).

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; teacher 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 below) 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 math performance by program use at the classroom level, as these data become available.

Data sources included participation records, vendor data (including usage), and year-end surveys of administrators, teachers, and students who used the program during the 2016-17 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 program as a whole, aggregated across all the programs. Vendor results are presented alphabetically, except in figures where results are presented in rank order. Qualitative data from the surveys were analyzed by a team of trained qualitative data analysts who used HyperResearch software to categorize each comment and synthesize the results into 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

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

Table 2. Statewide Distribution by Schools and Districts

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

Sources: STEM AC data and annual reports

- ✓ In 2016-17, the requests for student licenses increased while the number of STEM AC funded licenses decreased relative to 2015-16.
- ✓ In 2015-16, 91% of license requests were met. In 2016-17, 60% of license requests were met.

[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. 2016-17 License Statewide Distribution by Product

	ALEKS	*Ascend Math*	*iReady*	*MathiaX*	*ST Math*	*Imagine Math*	**Combined Programs**
Licenses requested	114,087	10,380	34,382	195	38,609	25,970	**223,623**
Percent of total licenses requested	51%	5%	15%	0%	17%	12%	**100%**
Initial licenses awarded	67,139	6,511	21,016	129	23,546	15,928	**134,269**
Percent of total licenses awarded	50%	5%	16%	0%	18%	12%	**100%**
Percent of awarded licenses compared to requested licenses	59%	63%	61%	66%	61%	61%	**60%**
Number of districts with awarded licenses	57	13	20	2	18	12	**72**
Number of schools with awarded licenses	273	31	94	2	113	81	**594**
Adjusted licenses awarded (STEM AC funded student licenses) by school level							
Elementary (267 schools)	9,300	457	12,704	NA	24,369	10,949	**57,779**
Secondary (172 schools)	28,421	222	424	NA	483	1,454	**31,004**
Mixed (128 schools)	25,636	5,862	8,059	NA	1,766	3,705	**45,028**
Unclassifiable (6 schools)	700	0	500	NA	0	76	**1,276**
Overall	64,057	6,541	21,687	NA	26,618	16,184	**135,087**
Total students who used the product (licenses from STEM AC and other sources) by school level							
Elementary	17,619	5,503	27,993	NA	33,731	17,186	**102,032**
Secondary	36,764	669	2,974	NA	756	4,043	**45,206**
Overall	54,383	6,172	30,967	NA	34,487	21,229	**147,238**
Average minutes of use per year per student by school level							
Elementary	1,328	301	840	NA	1,317	2,080	**1,173**
Secondary	1,644	1,083	873	NA	1,350	1,361	**1,262**
Overall	1,542	386	843	NA	1,318	1,943	**1,206**

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

- ✓ In 2016-17, more than half of the requested licenses were for *ALEKS.*
- ✓ STEM AC met 60% of product requests.
- ✓ Based on a 40 week academic year, elementary students spent an average of 29 minutes and secondary students spent an average of 32 minutes per week on the programs.

Table 4. Fidelity Recommendations by Product

Product	Publisher	Supported	Fidelity Requirements
ALEKS	*McGraw-Hill*	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
iReady	*Curriculum Associates*	K-8	45 minutes per week
MathiaX	*Carnegie Learning*	6-8	90 minutes per week
ST Math	*MIND Research Institute*	K-12	K-1: 60 minutes per week 2-8: 90 minutes per week
Imagine Math	*Imagine Learning*	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

Source: STEM AC records

Table 5. Teacher, Student, and Administrator Survey Response Rates for the Math Personalized Learning Software Grant

	ALEKS	*Ascend Math*	*iReady*	*MathiaX*	*ST Math*	*Imagine Math*	Two or more	Total
Teacher Ns	**372**	**23**	**319**	**1**	**309**	**270**	**33**	**1,327**
% Using Each Program	28%	2%	24%	0%	23%	20%	2%	**100%**
Teacher Grade Level Distributions within Each Program[2]								
K - 2nd	1%	12%	34%	0%	46%	1%	31%	**25%**
3rd - 6th	30%	73%	59%	0%	52%	84%	56%	**55%**
7th - 8th	32%	8%	4%	0%	1%	10%	23%	**10%**
9th - 12th	43%	15%	1%	0%	1%	2%	13%	**10%**
Student Ns	**16,378**	**667**	**6,673**	**20**	**3,527**	**5,273**	**--**	**32,518**
% Using Each Program	50%	2%	21%	0%	11%	16%	--	**100%**
Student Grade Level Distributions within Each Program								
3rd - 6th	24%	86%	89%	75%	95%	91%	--	**57%**
7th - 8th	46%	6%	10%	15%	4%	7%	--	**27%**
9th - 12th	31%	8%	1%	10%	1%	2%	--	**16%**
Administrator Ns	**55**	**3**	**77**	**0**	**62**	**18**	**55**	**270**
% Using Each Program	20%	1%	29%	0	23%	7%	20%	**100%**

Source: Administrator, Teacher, and Student Surveys Spring 2017

- ✓ The majority of teacher respondents taught elementary classes (80%). Student respondents were more balanced between elementary (57%) and secondary (43%).
- ✓ There were not enough responses from administrators (n<10) to provide results for *Ascend Math*. There were not enough responses from teachers, students, or administrators to provide results for *MathiaX*.
- ✓ For secondary students, 90% of responses came from users of *ALEKS*. For elementary students, responses were more balanced between *iReady* (32%), *Imagine Math* (26%), *ALEKS* (21%), and *ST Math* (18%).

[2] 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 2016-17 Student Program Use Reported by Teachers

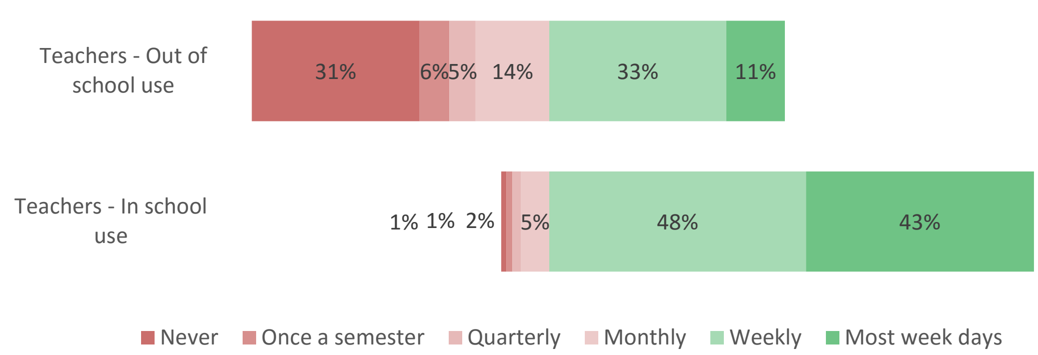
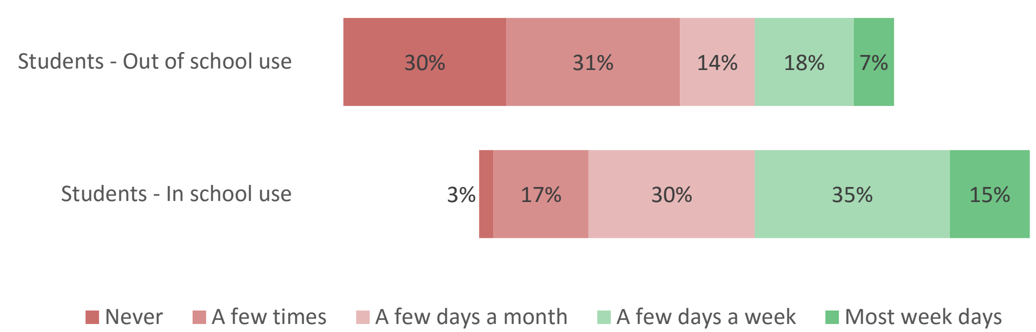


Figure 4. Frequency of 2016-17 Student Program Use Reported by Students



Sources: Teacher and Student Surveys Spring 2017

- ✓ 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 students.
- ✓ 91% of teachers and 50% of secondary students reported using the program at school at least weekly.
- ✓ *Not displayed:* Teachers reported having students use the software an average of 66 minutes per week. Reported average use did not differ by years of teaching or years of program use.

Table 6. Frequency of 2016-17 Program Use by Program Type

Percentage of teachers reporting student use *weekly* or *most week days*
Percentage of students reporting use *a few days a week* or *most week days*

	ALEKS	***Ascend Math***	***iReady***	***ST Math***	***Imagine Math***	**Combined Programs**
Teachers						
In school	83%	76%	93%	96%	90%	**91%**
Outside of school	64%	29%	35%	37%	48%	**44%**
Secondary students						
In school	49%	80%	64%	55%	54%	**50%**
Outside of school	27%	30%	10%	31%	11%	**25%**

- ✓ Student use reported by both teachers and students varied by program.
- ✓ All programs were used primarily in school.

Sources: Teacher and Student Surveys Spring 2017

Table 7. Faculty Intentions to Meet Fidelity Requirements

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

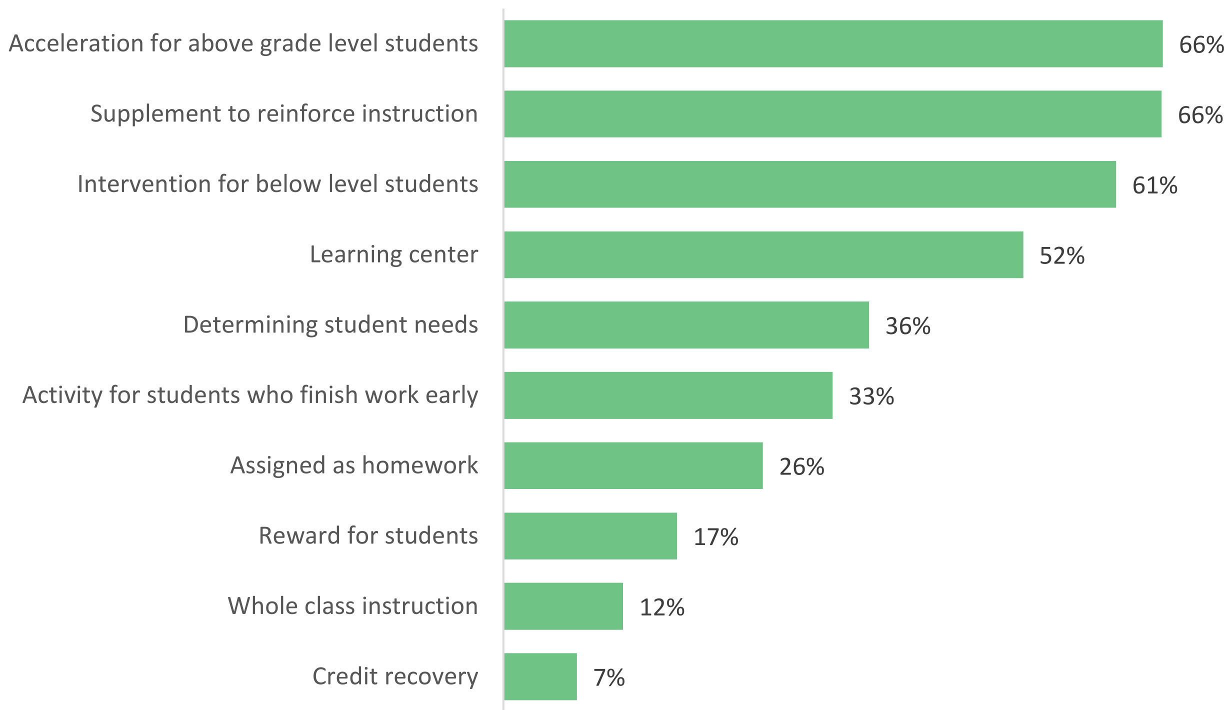
	ALEKS	*Ascend Math*	*iReady*	*ST Math*	*Imagine Math*	**Combined Programs**
Administrators						
I encourage teachers to meet the fidelity recommendations for the math software.	93%	N<10	97%	100%	100%	97%
Teachers						
I try to make sure my students meet the fidelity recommendations.	79%	68%	83%	79%	82%	81%
I know the vendor fidelity recommendations of the math software.	72%	84%	77%	73%	79%	75%
I had enough time during the school day to accommodate the fidelity recommendations	59%	28%	51%	52%	66%	55%

Sources: Administrator and Teacher Surveys Spring 2017

- ✓ Almost all administrators indicated they encourage teachers to meet the fidelity recommendations.
- ✓ The majority of teachers (81%) reported they try to have students meet the fidelity recommendations.
- ✓ 25% of teachers across programs were not sure they knew the fidelity recommendations for their program. *Not shown:* Only 26% 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, with the exception of *Ascend Math*.
- ✓ Approximately half of the teachers indicated they had enough time during the school day to meet the fidelity recommendations.

Figure 5. Type of 2016-17 Use Reported by Teachers – All Programs Combined

Teachers using the method *regularly* or *most often*



- ✓ Teachers could select all that applied.
- ✓ Teachers are using the programs in a range of ways.
- ✓ The most common uses for the programs were acceleration, supplemental instruction, intervention, and learning center activities.
- ✓ *Other ways* that teachers listed included self-start activities, supplement to afterschool program enrichment, and one-on-one instruction with struggling students.

Source: Teacher Survey Spring 2017

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

Table 8. Type of 2016-17 Use Reported by Teachers by Program

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

	ALEKS	*Ascend Math*	*iReady*	*ST Math*	*Imagine Math*
Acceleration	60%	52%	68%	62%	80%
Supplement to reinforce instruction	77%	39%	57%	65%	67%
Remediation	67%	57%	65%	53%	60%
Learning center	44%	35%	52%	57%	50%
Tool for determining student needs	43%	26%	50%	24%	30%
Activity for students who finish work early	31%	22%	28%	33%	43%
Assigned as homework	48%	13%	14%	19%	31%
Reward for students	15%	4%	12%	20%	24%
Whole class instruction	12%	4%	13%	11%	10%
Credit recovery	14%	13%	5%	4%	6%

Source: Teacher Survey Spring 2017

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

- ✓ Teacher respondents who used *iReady* and *ALEKS* were most likely to use the program to determine student needs.
- ✓ Across the programs teachers generally did not use the programs for credit recovery or whole class instruction.
- ✓ *Ascend Math* was used less frequently than other programs as a supplement to reinforce instruction.

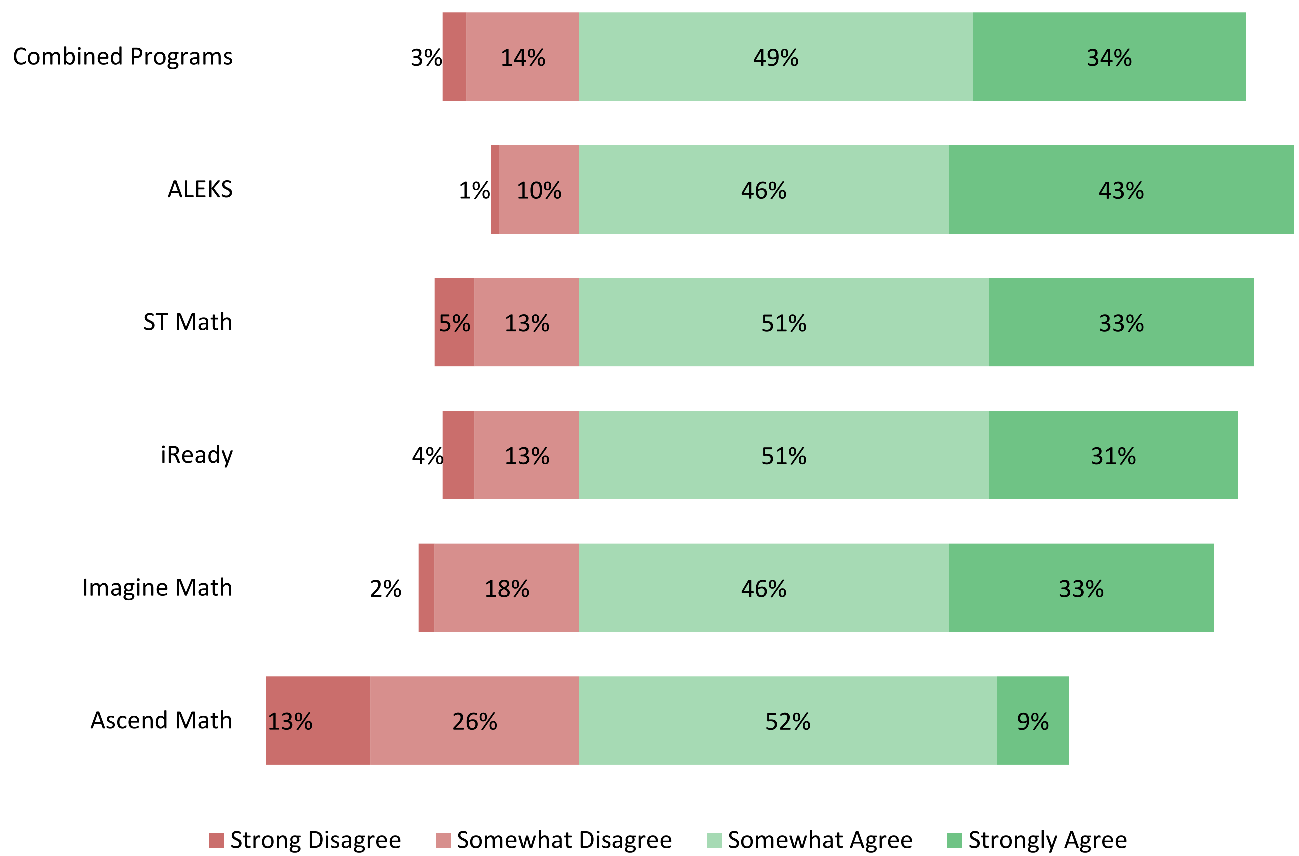
Table 9. Teacher Reported Frequency of Use of Data Reports by Program

	Never	Once a semester	Quarterly	Monthly	Weekly	Most week days
Combined Programs	**12%**	**10%**	**16%**	**26%**	**28%**	**7%**
ALEKS	8%	6%	13%	23%	40%	11%
Ascend Math	13%	17%	21%	21%	25%	4%
iReady	7%	9%	18%	29%	30%	7%
ST Math	19%	12%	14%	27%	23%	4%
Imagine Math	13%	14%	23%	24%	19%	7%

- ✓ For all programs combined, 35% of teachers were using the program data reports at least weekly to assess student learning.
- ✓ For all programs combined, 22% of teachers were using data reports once a semester or less.

SOURCE: TEACHER SURVEY SPRING 2017

Figure 6. Teacher Perceptions of Usefulness of Data Reports by Program

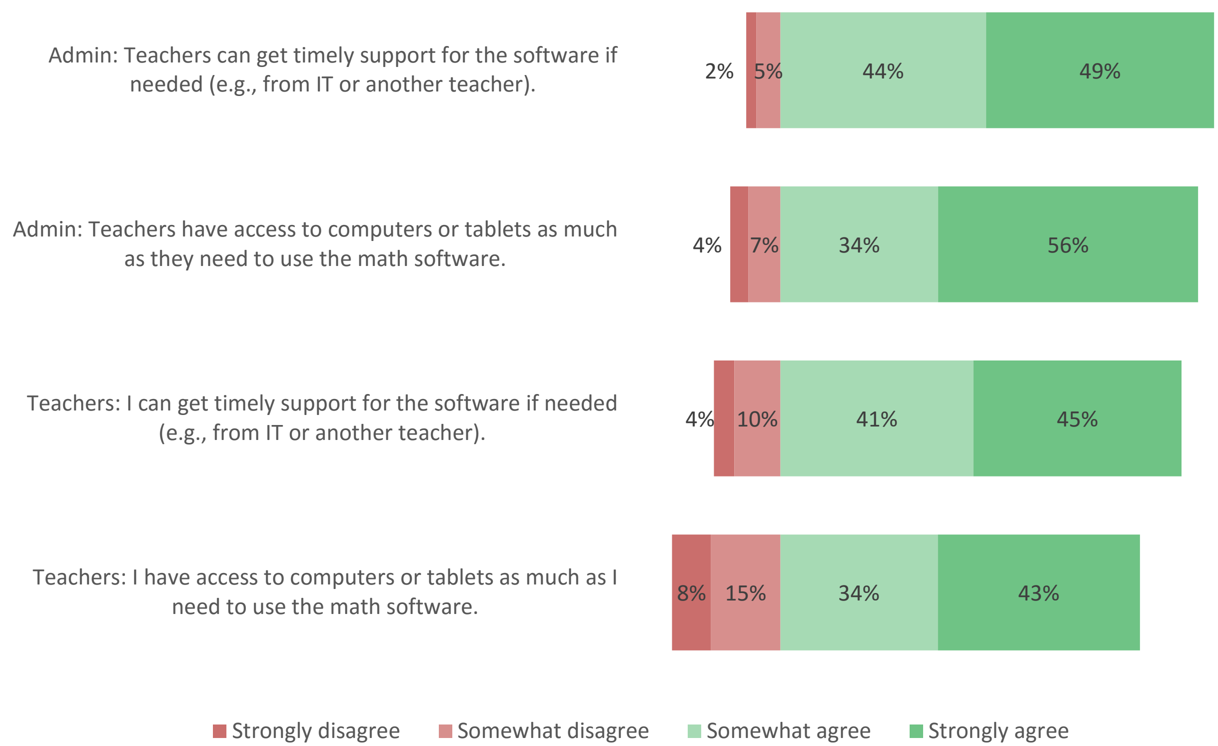


- ✓ 83% of teachers overall agreed the reports of student progress were useful.

Source: Teacher Survey Spring 2017

Access and Support

Figure 7. Teacher and Administrator Perceptions of Teacher Technology Access and Support

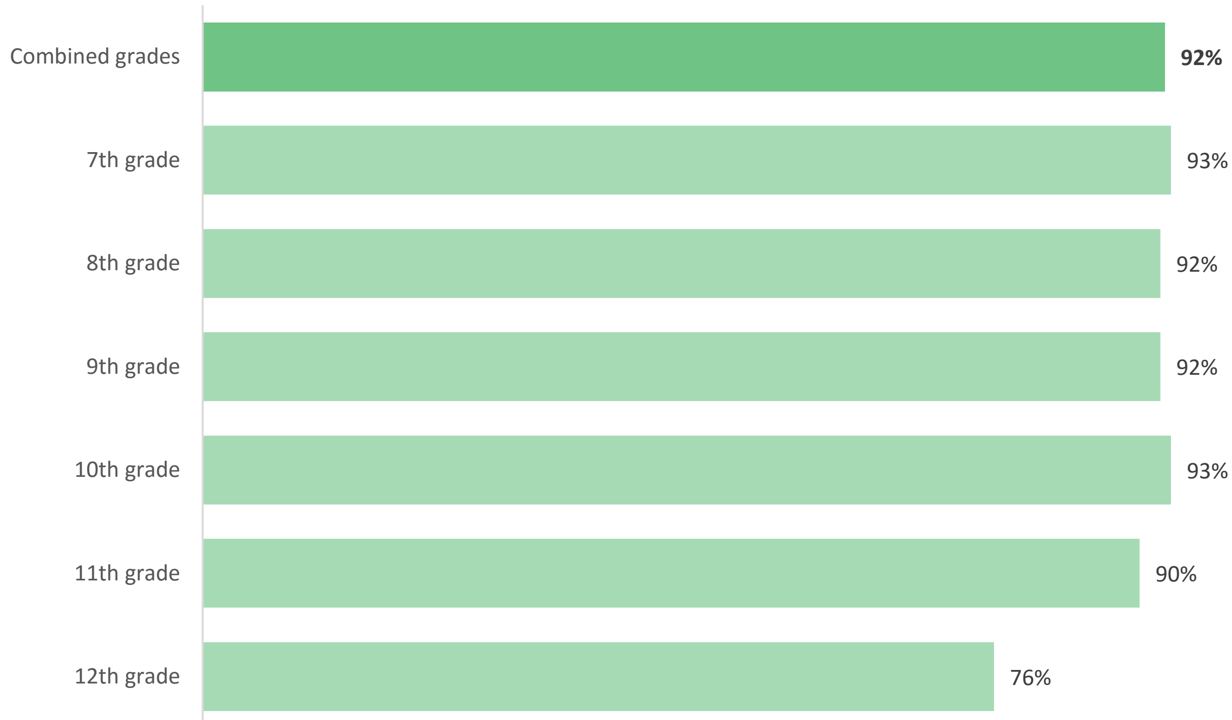


Sources: Administrator and Teacher Surveys Spring 2017

- ✓ 77% of teachers reported they had sufficient access to computers or tablets.
- ✓ Administrators reported greater access and support for teachers than teachers reported. Because the samples for teachers and administrators may represent different schools and districts, a direct comparison should be made with caution.

Figure 8. 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.

Source: Student Survey Spring 2017

Table 10. Teacher Professional Development and Training on the Programs

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

	ALEKS	*Ascend Math*	*iReady*	*ST Math*	*Imagine Math*	**Combined Programs**
Teachers						
I would benefit from additional training on ways to use the math software.	75%	62%	68%	69%	67%	**69%**
Administrators						
Teachers were provided with professional development on effective use of the math software.	77%	N<10	93%	85%	92%	**86%**
I was satisfied with the professional development provided to teachers.	81%	N<10	93%	84%	92%	**87%**

- ✓ The majority of teachers agreed they would benefit from additional training on the software.
- ✓ The majority of administrators were satisfied with the professional development provided to teachers.
- ✓ 14% of administrators indicated their teachers were not provided with professional development on effective use of the math software.

Sources: Administrator and Teacher Surveys Spring 2017

Table 11. Areas Requested by Teachers for Additional Training on the Software

The comments should not be seen as representing all teachers; however, they provide insight into the opinions of some teachers.

Areas of Support	**Example Quotes**
Teachers would like to know how to use the tools on their programs more effectively.	"I would like to know how to have the program read to students who need it read to them so they can focus on the math." "I would like to know how to use tools effectively so I can make assignments, give assessments, etc." "I would like to know how I can see what my students are doing online during a session so I can help them." "I would like to know how to set up a class, change student to a new grade, etc."
Teachers would like to know how to use the reports more effectively.	"I would like to know how to print reports, customize reports, understand them, and use reports to help my students more."
Teachers would like to know how to customize their programs to better meet the needs of their students.	"I would like to know how to meet the needs of my struggling students as well as push my students who need more of a challenge." "I would like to know how to assign individual paths and learn more about grading so I can help students to be more autonomous."
Teachers would like to be able to align the program to match the concepts they are teaching in class.	"I would like my students to be working on the same concepts we are covering in class. Sometimes they do not align and my students are working on concepts we have not covered in class yet." "I would like to be able to assign homework based on what I am teaching."
Teachers would like to know how to use the program to differentiate instruction better.	"I would like to know how to create and manage small groups." "I would like to know how to assign my students to the concepts that I am covering in class that day/week."
Teachers would like to know how to use the programs more in their daily instruction.	"I would like to know how to combine this with regular teaching." "How do I use the program as a whole group instructional tool?"

Source: Teacher Survey Spring 2017

Perceived Outcomes

Table 12. Stakeholder Opinions on Programs Providing New Ways to Solve Math Problems

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

	ALEKS	*Ascend Math*	*iReady*	*ST Math*	*Imagine Math*	**Combined Programs**
Teachers						
The math software helped students understand different ways to solve math problems.	84%	77%	86%	96%	90%	**89%**
Elementary Students						
The program showed me new ways to solve problems.	80%	62%	77%	79%	75%	**77%**
Secondary Students						
The program showed me ways to solve problems that my teacher didn't show me.	65%	39%	54%	41%	55%	**63%**
The program helped me understand different ways to solve math problems.	64%	36%	57%	49%	64%	**63%**

Sources: Teacher and Student Surveys Spring 2017

- ✓ Most teachers (89%) indicated the software provided new ways to solve math problems.
- ✓ The majority of students (77% of elementary and 63% of secondary students) agreed the software provided new ways to solve math problems.
- ✓ Secondary students were least likely to agree that *Ascend Math* and *ST Math* provided new ways to solve problems. (*ST Math* is used primarily by elementary students.)

Table 13. Stakeholder Opinions on Programs Building Student Confidence in Math

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

	ALEKS	*Ascend Math*	*iReady*	*ST Math*	*Imagine Math*	**Combined Programs**
Teachers						
The math software seemed to make students feel they could learn a lot in math.	80%	73%	76%	89%	76%	**81%**
Elementary Students						
The program helped me feel confident about math.	68%	56%	63%	69%	65%	**65%**
The program made me feel I could be good at math.	70%	54%	66%	73%	68%	**68%**
Secondary Students						
The program helped me feel more confident about math.	54%	38%	42%	41%	54%	**53%**
The program made me feel I could be good at math.	55%	36%	45%	42%	61%	**55%**
The program helped me feel I could learn a lot in math.	53%	31%	42%	39%	60%	**53%**

Sources: Teacher and Student Surveys Spring 2017

- ✓ A majority of teachers (81%) believed the software made 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 14. Teachers' and Elementary Students' Opinions on Which Programs Create Student Engagement in Math

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

	ALEKS	***Ascend Math***	***iReady***	***ST Math***	***Imagine Math***	**Combined Programs**
Teachers						
My students enjoy using the software.	72%	61%	71%	92%	86%	**81%**
The math software helped make math fun this year.	54%	43%	60%	88%	76%	**70%**
Elementary Students						
I liked using the program at school.	58%	46%	56%	73%	61%	**60%**
The program helped make math fun.	43%	35%	49%	65%	52%	**51%**
I spent more time on the program than my teacher required.	35%	19%	34%	38%	38%	**35%**
I liked using the program at home.	32%	17%	28%	41%	39%	**34%**
I looked for other math computer programs I could use.	21%	29%	26%	26%	24%	**25%**

Sources: Teacher and Student Surveys Spring 2017

- ✓ Elementary students were more likely than secondary students to report increased math engagement.
- ✓ 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.
- ✓ While the majority of elementary students liked using the software overall, fewer students spent more time than required, liked using the program at home, or looked for other math computer programs.

Table 15. Secondary Students' Opinions on Which Programs Create Student Engagement in Math

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

	ALEKS	***Ascend Math***	***iReady***	***ST Math***	***Imagine Math***	**Combined Programs**
Secondary Students						
I liked the way my teacher had us use the program.	61%	56%	50%	61%	69%	**61%**
I liked using the program to work on math at school.	47%	31%	35%	41%	53%	**46%**
The program helped me want to learn more about math.	42%	30%	38%	39%	54%	**42%**
The program helped make math fun this year.	28%	25%	27%	36%	43%	**28%**
I spent more time on the program than my teacher required.	28%	26%	28%	40%	30%	**28%**
I liked using the program to work on math at home.	28%	23%	23%	22%	33%	**28%**
The program got me excited about taking more math classes.	24%	18%	25%	22%	39%	**24%**
I looked for other math computer programs I could use.	18%	23%	24%	21%	31%	**19%**

- ✓ Some secondary students reported that the programs increased their engagement in mathematics.
- ✓ Although these percentages may seem small, they represent an important outcome for the students who were affected positively.

Sources: Student Survey Spring 2017

Table 16. Student Opinions on Which Programs Increased Student Perceptions of Math Utility and Importance

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

	ALEKS	***Ascend Math***	***iReady***	***ST Math***	***Imagine Math***	**Combined Programs**
Elementary Students						
The program showed me ways math can be useful.	74%	57%	75%	75%	75%	**74%**
Secondary Students						
The program showed me ways math can be useful in everyday life.	48%	38%	53%	34%	57%	**48%**
The program made me realize how important math is.	45%	36%	40%	32%	52%	**45%**

- ✓ Nearly three-quarters of elementary students agreed the program showed them how math can be useful.
- ✓ Almost half of secondary students agreed the program showed them how math can be useful and made them realize the importance of math.

SOURCES: STUDENT SURVEY SPRING 2017

Table 17. Student Comments about What They *Liked* about the Way Their Teacher Used the Program

The comments should not be seen as representative of all students; however, they provide insight into the opinions of some students.

Student Comments on What they Liked	**Example Quotes**
Some students indicated their teacher implemented, organized, and structured program usage well.	“[Our teacher] told us to get on [the program] when we were finished with either a test or ahead on assignments, and it made us a little bit ahead of the class. She used it as an extra thing instead of a whole-year guide type of thing...” “I liked how my teacher kept track on the work we did to see areas that we have trouble in and areas we understand very well.”
Some students expressed that using the software program helped improve their overall math skills.	“It helped us practice the things she taught us in normal math class.” “I would have to ask for help on how to do specific things so I could expand my knowledge on that topic, but I did like figuring out how to more things in math, that my teacher never taught us this year, or having a new perspective on using math.”
Some students appreciated when their teacher helped them understand a problem or how to use the software.	“When there was a difficult topic she would load lessons for us to do to get a better understanding.” “I liked how she always explained things we didn't understand and I liked how we would review on the board the ones we didn't know.”
Some students felt the software program explained math well.	“[The software program] is somewhat fun to use it has your mind thinking in many ways. … It gives you many different ways to solve a problem or show you something you might of never knew.” “I like it a lot because it show me so many ways how to do math.”
Some students liked when teachers used incentives, goals, or competitions.	“[Our teachers] gave us extra credit if we did lots and then would encourage us to get more topics done.” “I liked how my teacher had us use it because she gave us a goal and we would get a reward after.”
Some students preferred using the program during school hours instead at home.	“I liked that my teacher allowed us to fulfill the required weekly time in class.” “I liked that she was able to set aside a day or two to do [the software program], and she encouraged us to use it as much as possible.”
Some students liked that the software program was self-paced.	"[The software program] was used as a way to work on going on *ahead* or to work on things I struggled with. I liked both of these things. I was able to do lessons I struggled with at school and could improve. We were also allowed to go ahead of the class if we wanted to.”
Some students valued the explanations given for missed problems and the opportunity to complete the questions again.	“I liked when she had us do assignments on [the software program]. It was easy to correct your mistakes and learn what you did wrong. " “I like the way [the software program] shows how to solve the problem and once you get it wrong it tells you what you did wrong, it also helps you what you need to do to get it right next time.”

Table 18. Student Comments about what they *Disliked* about the Way their Teacher used the Program

The comments should not be seen as representative of all students; however, they provide insight into the opinions of some students.

Student Comments on What they Disliked	Example Quotes
Some students expressed that the software program was boring, too easy, or unhelpful.	"I was not learning any new things and it takes away all math class just solving problems I already know." "It isn't that fun to just have to just sit there and listen to someone talk. I like to be doing things and not just to sit there and get bored of having no hands-on."
Some students felt that they did not have enough time to complete goals or spent too much time using the program.	"It was okay. I feel the 90 minutes time requirement was too long, I feel it should have been 60 minutes. I also think to make it more fun you should put the games that were down in base camp and put them in lessons so you can play a game when you pass a lesson." "I didn't like that we had to have a checkpoint that we had to have done and then we had no time to do the work."
Some students described the content as too difficult or confusing.	"[The software program], made math harder and more complicated for me." "It is a waste of time. I does not teach me anything it just asks me questions that I do not know anything about."
Some students did not like to use the software at home.	"I didn't like having to work on it at home, because, I have a lot going on, and it is hard to find time in my schedule to do it." "The only thing is since I didn't have a computer at home I had a hard time doing it at home, so I was always a little bit behind."
Some students indicated the program impacted their classroom grade.	"She graded us on it and If you didn't pass a lesson my grade would drop for stuff I didn't understand. I don't like that." "The teachers used [the software] on our grades, and some people weren't very good at it and took their time so they didn't get a good grade."
Some students thought their teachers did not structure, organize, or implement the software program well.	"She never used it to assign lessons we were currently learning in class, instead to do random math lessons that weren't relevant at the time." "She never really explained completely what we were supposed to do and I didn't know things that were really important information."
Some students thought the software required too many questions or topics to reach their goal.	"I didn't always have time to reach the amount of topics that our teacher assigned us and ended up having a lot missing by the deadline." "We had to do 10 topics a week, and sometimes the topics get hard so you get behind the goal. This makes it so you have to spend a lot of your free time at home and school trying to catch up."

Source: Student Survey Spring 2017

Table 19. Perceived Effects on Student Math Performance

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

	ALEKS	*Ascend Math*	*iReady*	*ST Math*	*Imagine Math*	**Combined Programs**
Teachers						
The math software helped my students strengthen important skills.	96%	91%	91%	96%	93%	**94%**
The software increased my instructional effectiveness.	86%	45%	71%	83%	77%	**79%**
Admin						
The math software had a positive impact on students' math performance.	95%	N<10	93%	94%	100%	**93%**

- ✓ Nearly all teachers felt the software helped students strengthen important skills.
- ✓ 79% of teachers agreed that the software increased their instructional effectiveness, although fewer teachers using *Ascend Math* agreed.
- ✓ Nearly all administrators (93%) agreed the software had a positive impact on students' math performance.

Sources: Administrator and Teacher Surveys Spring 2017

Table 20. Teacher Perceived Ancillary Effects of the Software

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

	ALEKS	*Ascend Math*	*iReady*	*ST Math*	*Imagine Math*	**Combined Programs**
Teachers						
The math software increased my satisfaction with my job.	73%	59%	56%	75%	69%	68%
The math software increased parent engagement.	33%	5%	20%	31%	35%	29%

✓ Although not specific goals of the software, some teachers reported that the software increased their job satisfaction (68%) and parent engagement (29%).

Source: Teacher Survey Spring 2017

Table 21. Teacher Explanations of how the Software Increased Parent Engagement

The comments should not be seen as representative of all teachers; however, they provide insight into the experiences of some teachers.

Ways the Software Increased Parent Engagement	**Example Quotes**
Parents had access to their child's data, and could see where they needed help. This helped parents to support their child.	"Yes, because I can show parents exactly what students' strengths and weaknesses are. It also shows student growth in each area." "Parents starting taking note of the pie growing. Also how long their child was on it. Had more parents interested in their math scores this year and what holes their students had."
Parents liked that their child could work on homework from any device with internet. However, some teachers noted that not all their students had access to the internet at home.	"Parents really liked the concrete progression of levels, the ability for their student to advance and do work at home, and the ability for their child to progress at an accelerated rate if the child chose to work on it more. The parents were intrigued especially when they themselves found the 2nd Grade math challenging. My parents REALLY liked this program!" "Parents knew that students could work on [the software] assignments anywhere there was internet. They didn't have to have the book or a worksheet for the students to be able to do their missing work." "Internet and computers in the home is an issue where I teach. Very few students used the software at home and even fewer parents were involved at all with the software."
The software helped parents help their children with homework. The programs allow parents to see clear instructions and completed problems.	"My parents have really enjoyed being able to see a worked example when helping their student figure out the math. Parents also like being able to see the students' growth." "Sometimes parents don't know what to have their children do for homework, so they liked having this as an option (I work at a Montessori school where we don't assign specific homework)." "Parents are happy that students use quality time on iPads at home, learning math. They were glad to assist the children by providing time on computer, iPad, or telephone."
Students talked about showing their parents their work, and engaging in the work together. This also prompted parents to ask teachers about the program and how they could engage with it.	"Students go home wanting to play [the software]. They want to pass off their level and parents see high engagement in their child." "Parents were excited to have a learning program at home that was fun for their child. They commented at parent-teacher conference that it pulled their child away from video games and they loved that it challenged them." "Some of the parents who haven't been receptive to other software in the past have helped their children at home with [the software]. I've had several discussions with parents about their child's time on [the software]."

Source: Teacher Survey Spring 2017

Facilitators of Program Use

Table 22. Teacher Reported Facilitators of Software Use

Facilitators of Increased Use	Example Quote
Sufficient technology for all students	“Our school is one-to-one, so each student has their own Chromebook. Makes life great!”
Scheduled time to ensure student access to the software	“We set aside one day a week to specifically use the software.” “I did get an assigned lab day each week so that I could take my students in every week to use [the software program].”
On-site or web-related professional development	“Great trainer from [our software program]. She'd spend time with me just answering my questions. My school did differentiated training sessions for teachers based on their level of mastery of the program. It allowed teachers to get what they need at their level." “The initial training helped get me started and then the practice and experience improved it.”
On-site technology and math coaches	“We had a facilitator who took our classes while we did interventions with struggling students. This was HUGE!” “Our math coach was greatly helpful in navigating the software.”
Technical support of the software’s help department	“The support staff at [the software program] are EXCELLENT and always go the extra mile to solve problems quickly." “The customer service … is amazing. [Our contact person] is a wonderful rep and gets back to me within an hour or so when I email him with questions. I have never had a problem getting answers to my questions.”
Teacher mentors	“A training some teachers at my school attended opened doors for further use of the software this year.” “Other teachers coached me and answered questions but I was new to it”
Using the program time to work with groups	“It was a great activity for students to work on independently while I pulled small groups.” "Our school facilitates it nicely so that we can do small group instruction in the class while other students are working in the lab with a teacher."
Teacher mode	“Being able to log in as a teacher quickly and easily to display the in-game functions as a whole-class was so necessary and helpful.” “Being able to use the software in teacher mode so that I could see how it works.”

Source: Teacher Survey Spring 2017

Table 23. Administrator Reported Facilitators of Software Use

Facilitators	Example Quote
Sufficient technology for all students	"We are a 1:1 school with iPads, so classes are able to use the programs without waiting to get into the computer lab." "They had Chromebooks and iPads in the classrooms that helped so that we could make sure everyone had their minutes on [the software program]."
On-site or web-based professional learning provided by the software representatives	"The training was great. It was especially helpful when we had grade levels receive training together and not in the whole group." "The training with the [the software] representative was incremental in supporting, encouraging, and inspiring teachers to use the program."
Support and technical assistance	"Having a representative who was available and responsive in answering teacher questions and concerns was very helpful."
A strategic master schedule or intervention period to ensure all students have time to access the software	"We made sure that all the classes received enough time in the computer lab, in order to ensure that they received the needed time on [the software program]."
Chromebooks	"When we moved all of the students to the Chromebooks we had less issues."
Strategic use of the software while teachers work with smaller student groups	"We have a set computer lab schedule for teachers to have regular time for using the software. This creates semi-independent learning opportunities which provides time for classroom teachers to work on Tier 2 instruction with differing mini-groups of students."

Source: Administrator Survey Spring 2017

Barriers to Program Use

Table 24. Teacher Reported Barriers to Software Use

The comments should not be seen as representative of all teachers; however, they provide insight into the experiences of some teachers.

Problems	Example Quotes
Available time to use the programs	“We only have time with computers twice during the school week. We also need to do typing to get ready for SAGE writing tests, and 3rd graders are trying to acquaint themselves with the keyboard. This left very little time for [the software program] during the school day.” “There is not enough hours in the school day, so I preferred to have my students use it at home. Otherwise it took away from precious teaching time.” “I teach in a dual immersion classroom. My time is so limited, and I don't think this is the best use of my student's time.” “The barriers would be having enough time to use the software during school, as there are plenty of other things students need to do. Also, having enough access to computers.”
Insufficient computer or device access	“NOT ENOUGH LICENSES!!! / Limited computers available in the classroom and limited Wi-Fi available in student homes.” “Some students still don't have access to the internet and had to make arrangements to get their weekly points by arriving early or staying after school.” “The biggest barrier is access to technology in my school.”
Network or internet issues	“Network speed was really the main issue I encountered, which is a completely separate problem.” “Definitely access to computers and the capacity of our schools Wi-Fi.” “The school has limited Wi-Fi connections, so students are sometimes unable to access the internet.”
Student resistance	“It was hard to motivate my students.” “Some of the lessons are slow, long, and boring and it is frustrating for the students.”
Student problems with software	“We had a Flash player problem on some of our computers, which would stop students from being able to continue working on [the software program] when they reached a certain point.” “Language barriers.” “My fast learners were bogged down and frustrated that they couldn't skip the rest of the lesson or speed it up when they had mastered the concept.”

Source: Teacher Survey Spring 2017

Table 25. Administrator Reported Barriers to Software Use

The comments should not be seen as representative of all administrators; however, they provide insight into the experiences of some administrators.

Administrator Reported Barriers to Software Use	Example Quote
Difficult access to technology or connectivity issues at school sites, inability to use program on iPads, and lack of student internet access at home	"Just wish we had more Chromebooks so it could be used more efficiently from their own classrooms." "The [the software] program on the iPads proved to be cumbersome. The workaround (going through a third party website to use the Flash base application on the iPad) sold as a good solution the beginning of the year, was very frustrating for teachers because of consistent problems with latency issues, freezing up, and sound problems. In addition, the moving of some lessons to the app and leaving others on the web access site was not easy for young students to navigate on the iPad." "Yes, there are times when the site is unavailable to a large group of students. Your help dept. said it was our problem, our IT dept said it was your problem."
Time constraints	"It was hard making sure that each grade had enough time in a computer lab each week to get the required amount of time. This is something we are working on for next year." "Time slots and access to the technology required to participate in these programs." "Creating time within the schedule to provide adequate time to meet the fidelity requirements was difficult. There is a lot of content to cover and standards to teach, which becomes problematic when you are trying to fit everything into one day. Finding the right balance was difficult."
Initial delays starting the programs	"It took us a bit of time to get all of the licenses up and running for our school." "There were some issues first of the year with getting technology schedules straightened out. There were also some issues with the software but we were able to figure it out."
Lack of funding to purchase enough licensing and technology.	"One large one is that we are never granted enough licenses for the entire school so we then have to try to find money for the other licenses. We find the money and then after a couple of months we get the remainder of the licenses from those schools that are not following the guidelines. I wish there was a way that after so many years of being a school that does follow the guidelines that we could just be guaranteed the licenses - so we are not searching for money that we don't need each year." "The only barrier that prevented more students from using the software is money."
More professional development is needed	"Teachers need more professional development on the program" "Just those teachers who did not have/take the time to understand all of the features of the program, especially the reporting system, and also the customizable features of the program."

Source: Administrator Survey Spring 2017

Problems and Difficulties with the Software

Table 26. Difficulties Using the Programs

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

	ALEKS	*Ascend Math*	*iReady*	*ST Math*	*Imagine Math*	**Combined Programs**
Teachers						
Sometimes the math software was frustrating for students to use.	69%	95%	78%	77%	79%	**76%**
The math software works well on our devices (without crashing or slowing, etc.).	92%	92%	71%	90%	94%	**86%**
I would have used the math software more, but I had trouble getting it to work correctly.	8%	19%	23%	11%	10%	**14%**
Administrators						
The math software works well on our devices (without crashing or slowing, etc.).	95%	N<10	83%	100%	100%	**92%**
Elementary Students						
I had trouble using the program.	22%	22%	20%	21%	22%	**21%**
Secondary Students						
Sometimes the program was frustrating to use.	70%	74%	72%	73%	60%	**70%**
I would have used the program more, but I had trouble getting it to work correctly.	25%	27%	26%	25%	31%	**25%**

Sources: Administrator, Teacher, and Student Surveys Spring 2017

- ✓ Most principals (92%) and teachers (86%) agreed the software worked well on their devices.
- ✓ 70% of secondary students and 76% of teachers agreed the program could be frustrating for students.
- ✓ 25% of secondary students and 14% of teachers agreed they would have used the program more if they had not had trouble with it.

Table 27. Teacher Reported Problems with the Software

The comments should not be seen as representative of all teachers; however, they provide insight into the experiences of some teachers.

Teacher Problems with Software	Example Quote
Technical problems at the school level: school Wi-Fi problems (not enough depth of bandwidth for classes of students to be on computers at once), lost connections, program crashes or freezes, slow internet connections, browser problems, flash player problems	"The Wi-Fi system at my school was slow or didn't work on some days. Students could not log in." "The system would crash and the students' work was not saved so they had to start over. Very frustrating." "Our network was slow, so even when I had the technology, all the students could not work at the same time or 2-3 of their computers would be frozen at the same time." "It was mostly that the internet would crash."
Problems such as old computers, too few computers, or incompatible devices for their program	"Our computers are old; the keys stick." "Our computer lab always has computers that don't work so it was hard to have everyone working every time." "Our lab doesn't have enough computers, so some of my students were on tablets."
Lessons were confusing and students did not always know what was expected	"The lessons use different language from the quizzes." "Sometimes the wording to the questions made it hard to figure out what students were supposed to do." "Sometimes it was hard to understand the goal of the module."
Lesson difficulty and pacing	"The lessons got too difficult too quickly. I wish there was a way to review concepts in a different way rather than moving on to a new concept. Some students just needed to hear it in different ways; they were not necessarily ready to move on." "Some lessons were taught that my students had not learned." "There were not enough explanations for my students to figure out what the program was asking." "Some of the wording was too difficult, even for my very best readers." "… the high level puzzles were frustrating because it took several tries. My kids did not have the perseverance."
Frustrations with software	"Sometimes something would happen and the program would not respond as it should but the students and I could not fix it, so the students were stuck." "I didn't feel like I had good tech support from the district." "When the program froze, I did not know what to do. We had to reboot and then it lost the students' work and they had to start over. I wish I was more tech savvy so I could have fixed that." "Students get locked out of lessons; I had to go help them get back in."
Problems with the program features	"My students did not know how to use the graphing tool in [the software program]. Slope was clumsy to use." "Sometimes there weren't any boxes available for students to put their answers. "The tools didn't work all the time." "Fraction games were difficult to manipulate."

Continued from previous page

Teacher Problems with Software	**Example Quote**
Some teachers believed the programs were difficult for SPED students and struggling learner	"It was hard for my SPED students to find the right level." "The program needs an option so students can have directions read to them." "My SPED students and lower learners got frustrated by having to do the lesson over and over again." "The speech feature doesn't always work, which is frustrating for some students."
Tests or quizzes were frustrating	"Some of the quizzes were confusing." "The tests were too frequent. Students had to do multiple tests." "Some problems made no sense in how they were to be answered. Some students got the answers correct but the program was so specific about how it wanted students to answer the question that the student got marked wrong."
Difficulties with student or teacher logins, remembering passwords, or loading the programs	"The students kept forgetting their passwords. They were too long." "Sometimes the program would not allow all of the students to log in." "… very slow to load and run." "We had trouble logging in and remembering the codes." "There was no way for the teacher to see what the student is working on so I had a hard time helping them individually. " "Teacher login was frustrating."

SOURCE: TEACHER SURVEY SPRING 2017

Table 28. Secondary Student Reported Problems with the Software

All of the problems listed below were reported by less than 2% of the total number of secondary students who completed the survey. These issues should not be considered to be representative of all students' experiences. However, they may provide insight into areas of improvement and further study.

Secondary Student Problems	Example Quotes
Some students felt the math instruction was not helpful.	“It wouldn't explain how to do a problem step by step.” “The explanations often didn't make sense.” “I would get the same problem wrong over and over again and then it wouldn't explain why I got it wrong very well.” It did not teach me in a way I could understand.
Some students thought the program was boring.	“I didn't like it. It was boring and I think it was a waste of time."
Some students had problems logging in and the program crashing or freezing.	“I would put in my login over and over again and it wouldn't work then I asked my teacher to do it and that didn't work. I haven't done it since.” “Sometimes it would just randomly log me out and I lost my place in the lesson. Sometimes it wouldn't keep track of what I finished. Sometimes it would say ‘There's a problem, talk to your teacher for help’ and then it would log me out.” “It would kick me out all the time and would not save my work.”
Some students felt the program was slow.	“It took too long to load and sometimes it didn't let get in because it said I didn't have a flash player but I did and I couldn't do it at home and I couldn't do it at school.”
Some students reported inconsistencies between the students' results, the software answer, and the explanation.	“I would put the correct answer, and it would tell me it was wrong. I asked my teacher and she said that the answer was correct." “I put the right answer and it tells me I’m wrong. Then it tells me the answer and it is the same.”
Some students had frustrations about retaking lessons.	“If you failed one lesson, it would make you retake the whole entire thing.” “When I got the lesson wrong it would repeat the exact same lesson which isn't going to help me understand I think if I got the first lesson wrong they should show a different way of teaching it so I understand better.”
Some students felt the material did not reflect their knowledge and course work.	“It goes over curriculum we already know. When we start a new cone and get all the answers to the pre-test right it sometimes still makes us do the cone, even though it may already be review for us.” “The problems were too hard for me.”
Some students felt the interface was difficult to navigate or not intuitive.	“It was hard to move the pieces in the correct places.” “When it comes to graphing, or writing out long complex equations, the software just makes it more complicated than I believe it needs to be.”

Continued from previous page

Secondary Student Problems	**Example Quotes**
Some students were frustrated that the program was inflexible in accepting answers.	"It only accepted steps in a way that it wanted, and wouldn't accept my answer if you had to put in steps in a different order than what they required." "Sometimes would not take answers unless a space was entered after the correct answer." "If I didn't put capital letters in an equation or didn't make the answer exactly what they wanted it marked me incorrect."
Some students prefer to learn from the teacher.	"I prefer in class learning with a teacher because you have to ability to work through questions and ask about anything you don't understand."
Some students noted the programs should consider accessibility for students with disabilities or English language learners.	"I am an ESL student and it would have been helpful to have a Spanish version of the lessons."

SOURCE: TEACHER SURVEY SPRING 2017

Table 29. Negative Reactions to the Program

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

	ALEKS	*Ascend Math*	*iReady*	*ST Math*	*Imagine Math*	**Combined Programs**
Teachers						
The math software was a waste of time.	4%	9%	12%	5%	13%	**8%**
The math software takes time away from instruction.	17%	23%	29%	17%	20%	**21%**
The math software is an added burden.	9%	27%	23%	10%	14%	**15%**
The math software is not worth it.	5%	9%	13%	6%	12%	**9%**
Elementary Students						
The program was boring.	57%	62%	57%	41%	48%	**52%**
Secondary Students						
The program was a waste of time.	47%	62%	57%	59%	38%	**47%**
The program was boring.	73%	74%	75%	74%	60%	**73%**

Sources: Teacher and Student Surveys Spring 2017

- ✓ Approximately three-quarters of secondary students and half of elementary students indicated the software was boring.
- ✓ 21% of teachers indicated the software took time away from instruction, and 15% indicated it was an added burden.
- ✓ Despite some negative reactions to the software, few teachers indicated the software was not worth it (9%) or was a waste of time (8%).

Table 30. Teacher and Administrator Overall Assessment of the Program

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

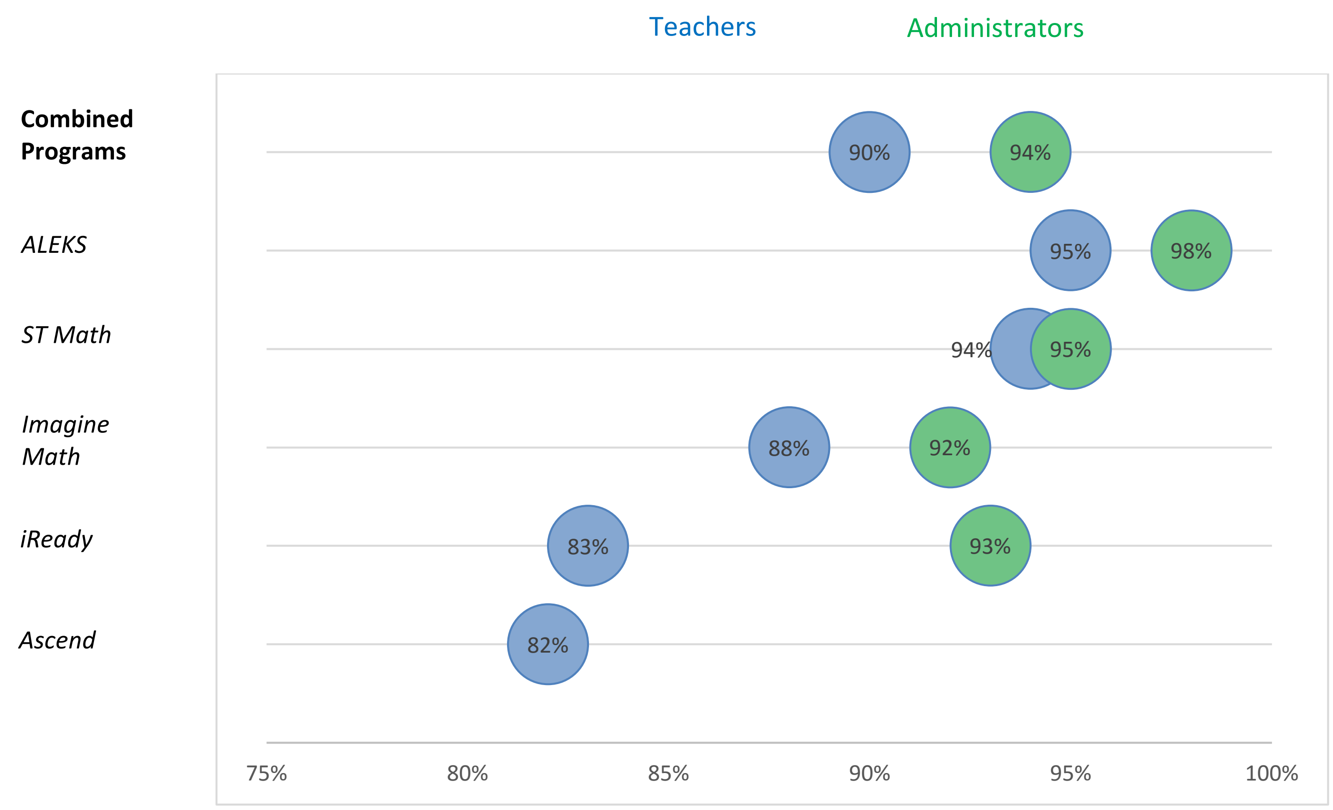
	ALEKS	*Ascend Math*	*iReady*	*ST Math*	*Imagine Math*	**Combined Programs**
Teachers						
The software was a good complement to classroom instruction.	94%	70%	82%	93%	87%	**89%**
The content of the software was well-aligned with Utah Core Standards.	91%	91%	90%	96%	94%	**93%**
Administrators						
Overall, I am satisfied with the math software.	95%	N<10	91%	95%	100%	**93%**

- ✓ Most teachers felt the software complemented classroom instruction (89%) and was well-aligned with the Utah Core Standards (93%).
- ✓ Nearly all administrators were satisfied with the math software.

Sources: Administrator and Teacher Surveys Spring 2017

Figure 9. 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



- ✓ 90% of teachers would recommend the program to another teacher.
- ✓ 94% of administrators would recommend the program to another school.

SOURCES: ADMINISTRATOR AND TEACHER SURVEYS SPRING 2017
NOTE: FIGURE DOES NOT INCLUDE RESPONSES FROM TEACHERS OR ADMINISTRATORS USING MATHIAX OR MULTIPLE PROGRAMS.

Table 31. Teacher Reasons They Would Recommend the Software to Another Teacher

The comments should not be seen as representative of all teachers; however, they provide insight into the experiences of some teachers.

Teacher Reasons They Would Recommend the Software	Example Quotes
Software is adaptive to the students' levels	"I like how the program is based on the students' abilities. I also like how motivated my top students become to reach the end of their grade level pathway." "I love how my students can work at their own pace. I have the time to help students individually because the other students are able to work independently." "I like how is differentiates math concepts to students ability. My students always seemed engaged and interested in the math." "It is a great tool to help the lower end students fill in their gaps in knowledge without making them fill singled out. It also helps the higher achievers be pushed with deeper material that that progresses at their own level."
Students are able to work at their own pace and track progress	"This program allowed students to receive immediate feedback as to how they were doing on an assignment. It also allowed me to have students practice content I had taught while I worked with small groups of students who needed extra help." "It is very engaging and the students can move at their own pace. It allows me freedom to set up a blended learning model in my classroom to personalize instruction."
The software complements in-class teaching	"The software was nice to use as a supplement to my teaching. It helped reinforce concepts in a fun way." "It adds to the instruction. I found when students would work through the lessons, before, during and prior to the instruction they seemed to grasp the concepts faster."
Programs support the CORE curriculum.	"It is aligned well with what the students learn in their core instruction as well as what they will see on end of year assessments. While teaching to the test is not something I agree with, I feel like the content is wonderful and helps to prepare students for it. The standards mastery is amazing also, great tool for teachers to control their mastery/pacing/re-teaching."
Students find the software program engaging.	"I would recommend this software to another teacher because it solidified concepts for students. It was a fun way to engage students in learning new math concepts and reviewing previously learned concepts." "I think the software was engaging for students and helped them to be persistent. They did get frustrated at times, but I think it was good."
The programs help students think mathematically and solve problems in multiple ways.	"It helps the students with problem solving and conceptual knowledge. They were able to look at cause and effect actions to figure out how to solve the puzzle. It also increased their conceptual knowledge or visual knowledge of math concepts instead of procedural knowledge." "It's a great tool to strengthen math skills and helps students think outside the box to figure out a puzzle." "The program helps the kids think deeper into math concepts, and also helps solidify concepts taught in the class."

Continued from previous page

Teacher Reasons They Would Recommend the Software	**Example Quotes**
Students may benefit from the visual components, especially language learners	"[The software program] engages students in math in a totally different format than what is usually taught. It is good for them to figure it out and see it presented in a visual way." "This software is all pictorial, so it is excellent for students with no or limited English proficiency." "Because it does not require using language skill to access it, the low readers in my class have been able to feel successful and increase their math skills using [the software]."
Data reports	"It gives a lot of great data so you can track where each student is in their understanding and competency of concepts. It helps to pinpoint where students are struggling and makes small group instruction more effective."
Regular use is associated with academic gains	"It helped to increase their understanding of the math concepts that we were learning in the classroom." "My students have shown growth in their understanding of math concepts as they were forced to try different strategies and ways of thinking."
The programs are helpful for students with special needs	"For Special Ed teachers, it's a great tool for listing strengths and weaknesses for PLAAFP's and goals in the IEP." "It is a great program for students with disabilities to access - very visual and reinforcing."

Source: Teacher Survey Spring 2017

Table 32. Teacher Reasons They Would Not Recommend the Software to Another Teacher

The comments should not be seen as representative of all teachers; however, the comments provide insight into the experiences of some teachers.

Teacher Reasons They Would Not Recommend the Software	**Example Quote**
Time needed to learn and integrate the software into their class day	“Too much hassle to fit it into my day and my students didn't benefit from the amount of time I give it.” “Too much of an investment of time and a lack of training.” “I feel like the tool is useful, however time constraints make fidelity a struggle.”
Frustrations due to confusing platforms, poor directions, and lack of training	“Most students did not really like the software. There was too much "fluff" and it was confusing for many.” “As a teacher I went in and did some of the lessons, I found them to be frustrating, there was no real help or instructions, some of them were wrong, and I could not align to what I was teaching at the time.”
Technical issues, especially for teachers trying to use the software on iPads.	“We were told the software would work on iPads. There was not an app. We were told we would get one. We did not. It crashed and was so slow that it became pointless to try because I was only problem solving, and re-loading the software. Eventually we stopped using it.” “Half the time it didn't work. The iPads would freeze and the kids would get kicked out of their lessons.”
Need for professional training	“I think there is a lot of potential in this program but teachers were not given all the tools necessary to use this program to its full potential.” “I needed more time and training on the program. I would have liked to know why it picked certain lesson for students and how to read the data.”

Source: Teacher Survey Spring 2017

Table 33. Administrator Reasons They Would or Would Not Recommend the Software to Another School

The comments should not be seen as representative of all administrators; however, they provide insight into the experiences of some administrators.

Administrator Reasons	Example Quotes
Student academic gains	“Teachers shared with me the benchmark scores of their students. Growth is very visible for all students.” “Many students showed an increase in understanding math concepts.”
Adaptive nature of the software	“I like that it works on a student's current level and moves up from there. Students are engaged and like using [the software] because they see their own improvement.” “I love that students are able to work at their own pace with this program.”
The software is engaging for students.	“The students were engaged when using it.”
Data reports provided to teachers are useful	“The amount of data the software returns is a definite plus. I also enjoy the lessons that are available as a resource for small group instruction.”
The software supports teacher instruction	“Teachers are able to increase differentiation in the classroom using [software] and small intervention groups.” “The software has proven effective to refine instructional practices and differentiate teaching.”
The software facilitates student ability to think through and solve multi-step problems	“[The program] helps students conceptualize mathematics concepts in a unique way that deepens understanding.”
Teachers find the software to be a useful supplementary tool	“[The software program] is a great supplement in the classroom. Teachers can assign practice that targets key concepts and standards that they would like students to practice. The student receive immediate feedback on their work.”
The software motivates students to accomplish grade level work and persist	“I would recommend it because the tracking of the topics is easy for students and they are motivated by it.” “This has been a great tool to motivate students to enjoy math again. Most of our students who are using the program ask to use it for their reward for completing difficult or unwanted assignments.”
The software is easy for students to navigate	“It is easy to use. It instructs the student at their level.”
Use increases student familiarity with computers, resulting in improved test scores	“The software helps with SAGE preparation (i.e., math and a computer interface), however there is insufficient evidence how this translates to non-computer interface mathematics performance.” “The program does help students learn how to do math on a computer vs. paper and pencil.”
The visuals support students learning to read in English or non-readers	“I think this is a great math program, especially for younger grades that cannot read yet.” “The math software is good for ELL learners because it does not depend on words”
Allows students to track their own progress in a useful way.	“…the older kids enjoy this format a lot more. It allows them to think and work through the problem and rewards them instantly when they completed a section by showing them in a pie form.”
Frustrations with technical issues and lack of resources	"Our administrators and district encourage fidelity with these programs yet lack the resources and time slots available to meet fidelity.” “The way this software tracks usage minutes is very frustrating to teachers and they pass this frustration on to their students. We have an amazing IT department who is very responsive and we still had a lot of technical issues that were beyond our control adding even more frustration to the teachers.”

SOURCE: ADMINISTRATOR SURVEY SPRING 2017

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 (93% and 94%, 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 90% of teachers and 94% of administrators indicating they would recommend the program to other teachers or schools. Student perceptions were not as strongly positive, but still a 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.

Despite the positive opinions expressed by teachers, administrators, and students, respondents also indicated some concerns and frustrations. In addition, teacher use may be lower than teachers realize. Similarly, although most teachers (83%) feel the data reports are helpful, 38% of teachers were using the data reports quarterly or less. The following considerations are provided for the purpose of improving the math personalized learning software program.

Findings	Considerations for Improvement
The majority of teachers (81%) indicated they try to have their students meet fidelity recommendations. However, only 26% of teachers strongly agreed they knew the fidelity recommendations. Vendor data indicated that average student use was 30 minutes/week. Teachers reported having students use the software an average of 66 minutes/week. (*iReady*, *ALEKS*, *ST Math*, and *MathiaX* should be used between 30 and 90 minutes weekly to meet fidelity recommendations. *Ascend Math* and *Imagine Math* have goals based on months or quarters.) 91% of teachers reported having students use the program in class at least weekly, but only 50% of secondary students reported using the program in class at least weekly. Almost half of the teacher survey respondents indicated they do not have enough time in the school day to meet the fidelity recommendations. 35% of teachers were using data reports at least once a week, while 22% of teachers were using data reports once a semester or less.	**To increase utilization of math personalized learning software programs:** • Provide regular reminders of fidelity recommendations to teachers along with the importance of meeting those recommendations to improve math performance. • Provide teachers with student use reports so that they can accurately assess the degree to which they using the software with fidelity. • Assist teachers in integrating the software to support teacher-based instruction and adjusting use to address identified student math needs.

Findings	Considerations for Improvement
The majority of teachers (69%) indicated they would benefit from additional training on the software. Teacher comments indicated they would like more training on a variety of issues, including using tools and features of the software, using data reports, customizing the programs, and using the programs in their daily instruction.	**To increase training for effective use of math personalized learning software programs:** • Focus trainings on identified needs of teachers (e.g., grade level specific, use of data to identify student needs, example lessons). • Provide trainings at multiple levels (beginner, intermediate, advanced). • Provide trainings and examples of how to explicitly integrate software to support instruction and learning. • Expand training opportunities to ensure teachers know how to use all aspects of the software. • Trainings should be distributed over time rather than presenting all features at one 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.
The majority of teachers (77%) have sufficient access to computers or tablets. Most secondary students (70%) and teachers (76%) agreed the software could be frustrating for students. 25% of secondary students and 14% of teachers reported they would have used the programs more if they had not had trouble with it. The frustrations described by teachers and students include a wide range of issues, including software-specific problems, device compatibility issues, and internet connectivity problems.	**To resolve issues regarding access to software and hardware:** • Eliminate barriers to compatible hardware such as Wi-Fi bandwidth, program crashes or freezes, flash player problems, etc. • 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 to begin 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 focused 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. Student outcomes will be further assessed by analyzing student math performance of participating teachers at the classroom level, as these data become available.

Data sources included participation records, implementation data, program completion data, and a survey administered to all teachers participating in the first cohort. The survey was administered after program completion to reflect participant perceptions of the 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 a team of trained qualitative data analysts who used HyperResearch software to categorize each comment and synthesize the results into major themes.

Figure 10. 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 34. Elementary STEM Endorsement Participants Who Completed the Program

Partner IHE	Participants by Cohort	Partner Districts by Cohort	Participants by Partner
Brigham Young University (BYU)	50	Alpine SD	29
		Charter	3
		Nebo SD	18
Dixie State University (DSU)	30	Washington County SD	30
Southern Utah University (SUU)	82	Alpine SD	1
		Canyons SD	16
		Garfield SD	7
		Iron SD	32
		Jordan SD	21
		Kane SD	3
		Millard SD	2
University of Utah (UU)	35	Charter	1
		Granite SD	25
		Salt Lake City SD	9
Utah State University (USU)	47	Cache SD	5
		Carbon SD	7
		Grand SD	2
		Logan SD	3
		Ogden SD	15
		Uintah SD	4
		Weber SD	11
Utah Valley University (UVU)	28	Park City SD	10
		Provo SD	15
		South Summit SD	3
Weber State University (WSU)	61	Charter	16
		Davis SD	45
Total	**333**	**22 School Districts plus Charter Schools**	**333**

SOURCE: STEM AC DATA

Table 35. Survey Response Numbers for the STEM Endorsement Program

	BYU	DSU	SUU	USU	UU	UVU	WSU	Total
Teacher Ns	24	7	40	22	16	19	30	**158**
Response rate	48%	23%	49%	47%	46%	68%	49%	**47%**
Grade Levels Taught within each Institution of Higher Education[3]								
K	4%	0%	10%	5%	13%	11%	3%	**7%**
1st	13%	0%	13%	5%	19%	21%	7%	**11%**
2nd	13%	29%	20%	5%	19%	21%	13%	**16%**
3rd	21%	14%	23%	5%	38%	21%	10%	**18%**
4th	29%	14%	33%	23%	44%	42%	17%	**29%**
5th	21%	14%	25%	14%	44%	26%	20%	**23%**
6th	29%	14%	18%	32%	31%	0%	47%	**26%**
Admin/other	4%	14%	5%	23%	0%	11%	10%	**9%**
Subject Areas Taught within each Institution of Higher Education								
Science	92%	86%	93%	77%	94%	79%	90%	**88%**
Technology	67%	71%	65%	59%	81%	68%	57%	**65%**
Engineering	58%	71%	48%	50%	75%	68%	53%	**57%**
Mathematics	92%	71%	90%	73%	94%	95%	87%	**87%**

Source: Teacher Survey Spring 2017

- ✓ The majority of respondents taught multiple STEM areas.
- ✓ There were not enough respondents from the Dixie State University program to provide analyses for that program in the rest of the report.

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

Teacher Preferred Format and Motivation

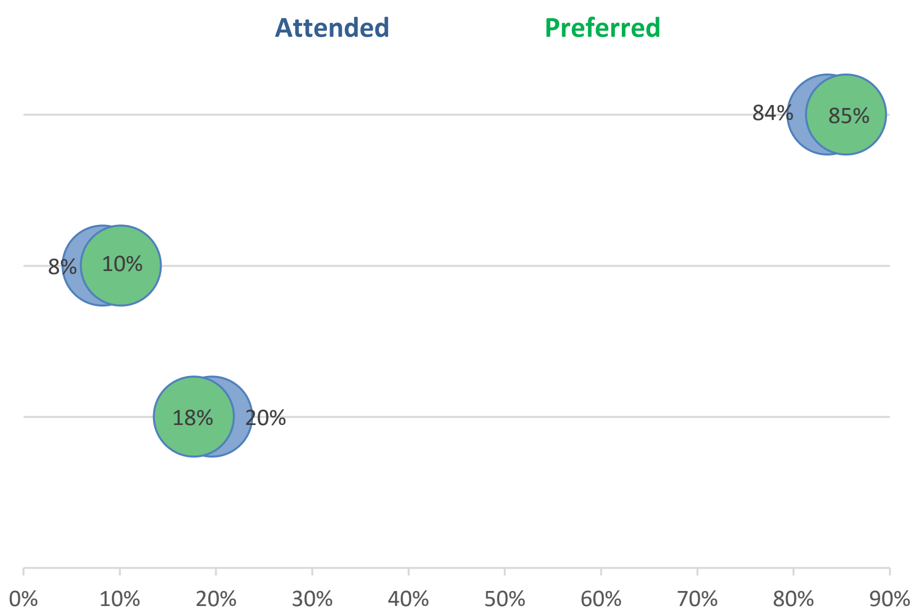
Figure 11. Teacher Attended and Preferred Format of Endorsement Courses

Teachers indicated what formats they attended and what formats they prefer

Face-to-Face
Instructor and students present in the classroom

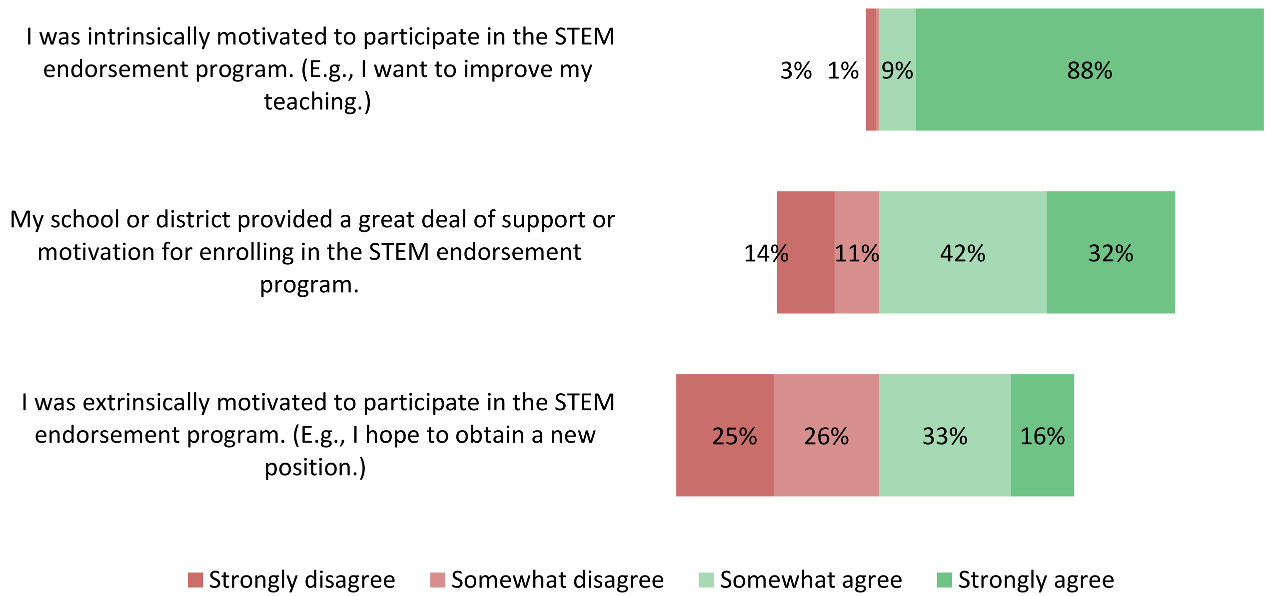
Distance
Instructor broadcasts to multiple classrooms across the state

Blended
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.
- ✓ Most teachers preferred face-to-face classes.
- ✓ Teacher preferred formats mirrored their attended formats.

Figure 12. Teacher Motivation for Pursuing the STEM Endorsement



- ✓ Teachers indicated they were primarily intrinsically motivated to pursue the STEM endorsement (97%), although extrinsic motivations also played a part (49%).
- ✓ Teachers in the program agreed that their LEA provided strong support or motivation for the STEM endorsement.

Source: Teacher Survey Spring 2017

Table 36. Teacher Motivation for Pursuing the STEM Endorsement by Institution

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

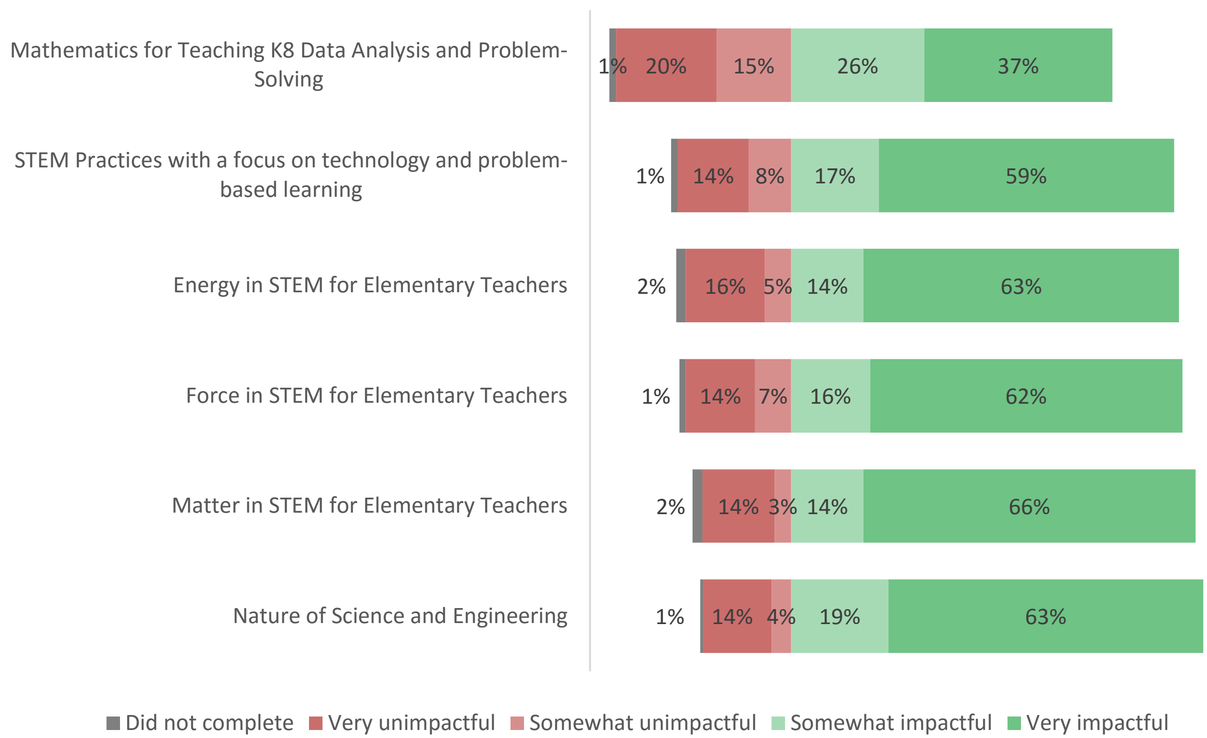
	BYU	SUU	USU	UU	UVU	WSU	Total
I was intrinsically motivated to participate in the STEM endorsement program (e.g., I want to improve my teaching.)	96%	93%	100%	100%	100%	96%	97%
I was extrinsically motivated to participate in the STEM endorsement program (e.g., I hope to obtain a new position.)	48%	64%	38%	31%	53%	43%	49%
My school or district provided a great deal of support or motivation for enrolling in the STEM endorsement program.	70%	78%	76%	50%	76%	79%	74%

- ✓ 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.

Source: Teacher Survey Spring 2017

Perceived Outcomes of the STEM Endorsement

Figure 13. Teacher Opinions on the Impactfulness of Courses in the STEM Endorsement



- ✓ The majority of teachers found five of the six courses to be *very impactful*.
- ✓ Teachers were least likely to indicate that Mathematics for Teaching K8 Data Analysis and Problem-Solving was impactful.

Source: Teacher Survey Spring 2017

Table 37. Teacher Opinions on the Impactfulness of Courses in the STEM Endorsement by Institution

Percentage selecting *somewhat impactful* or *very impactful* for each course

	BYU	SUU	USU	UU	UVU	WSU	Total
STEM Practices with a focus on technology and problem-based learning	78%	75%	68%	88%	83%	85%	77%
Nature of Science and Engineering	91%	73%	82%	88%	82%	90%	82%
Matter in STEM for Elementary Teachers	87%	78%	82%	88%	83%	92%	82%
Force in STEM for Elementary Teachers	87%	78%	77%	63%	82%	88%	79%
Energy in STEM for Elementary Teachers	87%	78%	52%	88%	82%	88%	79%
Mathematics for Teaching K8 Data Analysis and Problem-Solving	48%	75%	45%	53%	78%	86%	65%

- ✓ There was some variation in the perceived impactfulness of the courses by institution.
- ✓ UVU and SUU were seen as impactful on Mathematics for Teaching K8 Data Analysis and Problem-Solving.

Source: Teacher Survey Spring 2017

99% *of respondents indicated they had started using what they learned in the STEM endorsement program in their classrooms.*

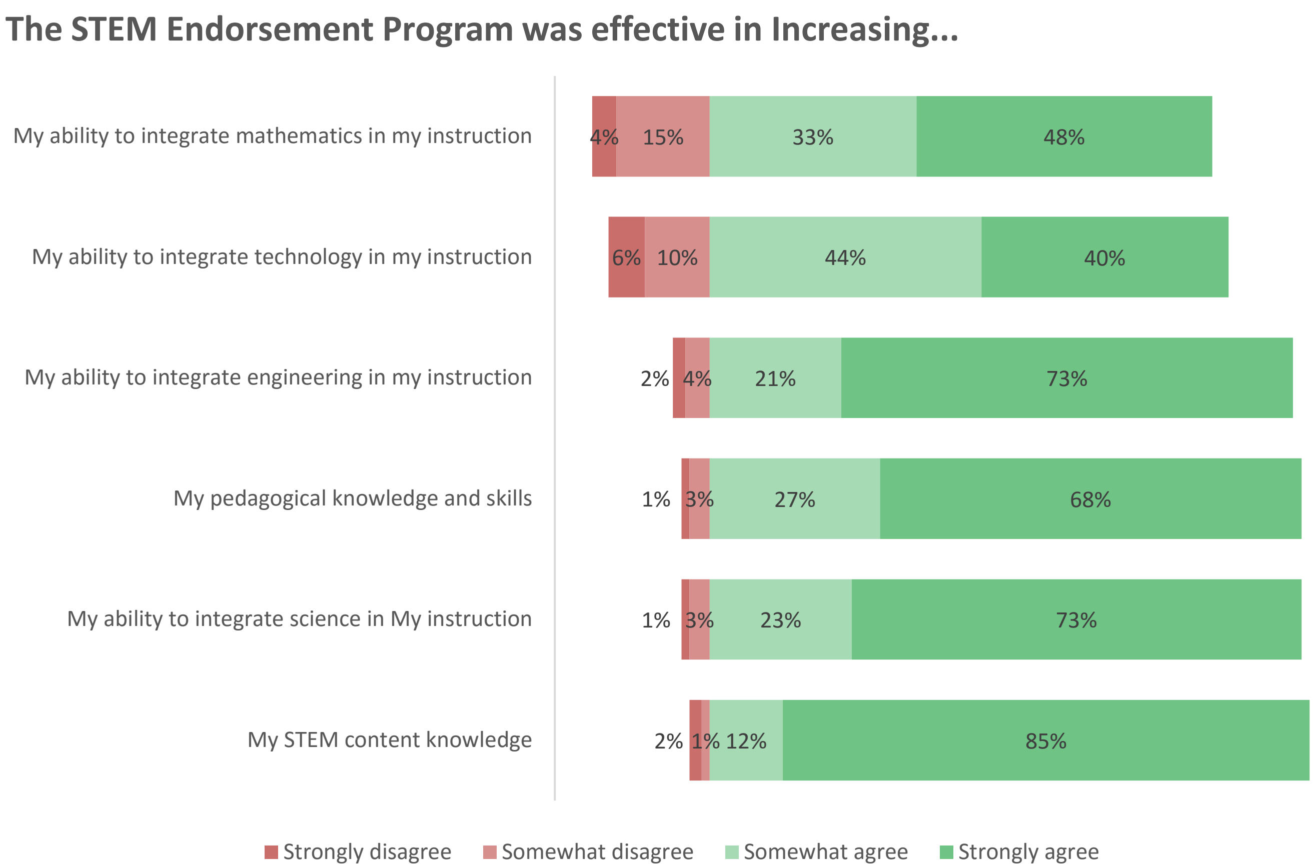
Table 38. How Did Teachers Implement What Was Learned in the STEM Endorsement Program into their Classrooms?

The comments should not be seen as representative of all teachers; however, they provide examples of teacher instructional changes.

Teacher Reported Instructional Changes	Example Quotes
Increased curriculum integration	"There has been more integrating of curriculum within my classroom. I have tried to stop the compartmentalizing that has occurred in education." "My ability to integrate subjects has increased dramatically. This integration has led to higher engagement levels and a positive learning environment within my classroom."
Addition of STEM content to existing lesson plans	"I understand what STEM education is and how to take my former lesson plans and add STEM qualities to them. I know how to ask better questions and set up STEM activities." "In addition to increased STEM time, the biggest change is that I try to incorporate more STEM vocabulary into everyday lessons. I try to point out connections and let students know when learning is related to a STEM content area."
Increased interactive or hands-on learning	"More hands on investigation in math and science and integrating them with my literature." "I have had my students create and build things and they then race against other students."
Increased student-centered learning and critical thinking	"I have seen opportunities to increase critical thinking and integration in all content areas." "I have transferred ownership of student learning and exploration to students, yielding higher levels of student engagement and tapping into greater depths of knowledge..."
Increased focus on STEM in the classrooms	"We have a significant focus now on engineering. We study phenomena in many of our lessons. The 5E model guides my planning and instruction." "I do a lot more engineering in my classroom. Additionally, chemistry is the first thing I will always teach because it lays the foundation for all other science."
Increased content knowledge	"I feel like the program has given me a deeper understanding of science concepts to help me more clearly understand them and be able to teach them more clearly."
Some teachers indicated the requirements of the endorsement program left little time for making changes to their instruction	"The STEM endorsement at [IHE] was so rigorous that it took a lot of time away from implementing my CORE concepts in the classroom. The endorsement was not treated as an endorsement but rather as a Master's Degree program. I felt it was much more rigorous than my Master Degree."

Source: Teacher Survey Spring 2017

Figure 14. Perceived Impact of the STEM Endorsement Program on Teachers



- ✓ Nearly all teachers agreed the STEM endorsement program was effective in increasing their STEM content knowledge and pedagogical knowledge and skills.
- ✓ Teachers also agreed the program was effective in increasing their ability to integrate STEM into instruction.

Source: Teacher Survey Spring 2017

Table 39. Perceived Impact of the STEM Endorsement Program on Teachers by Institution

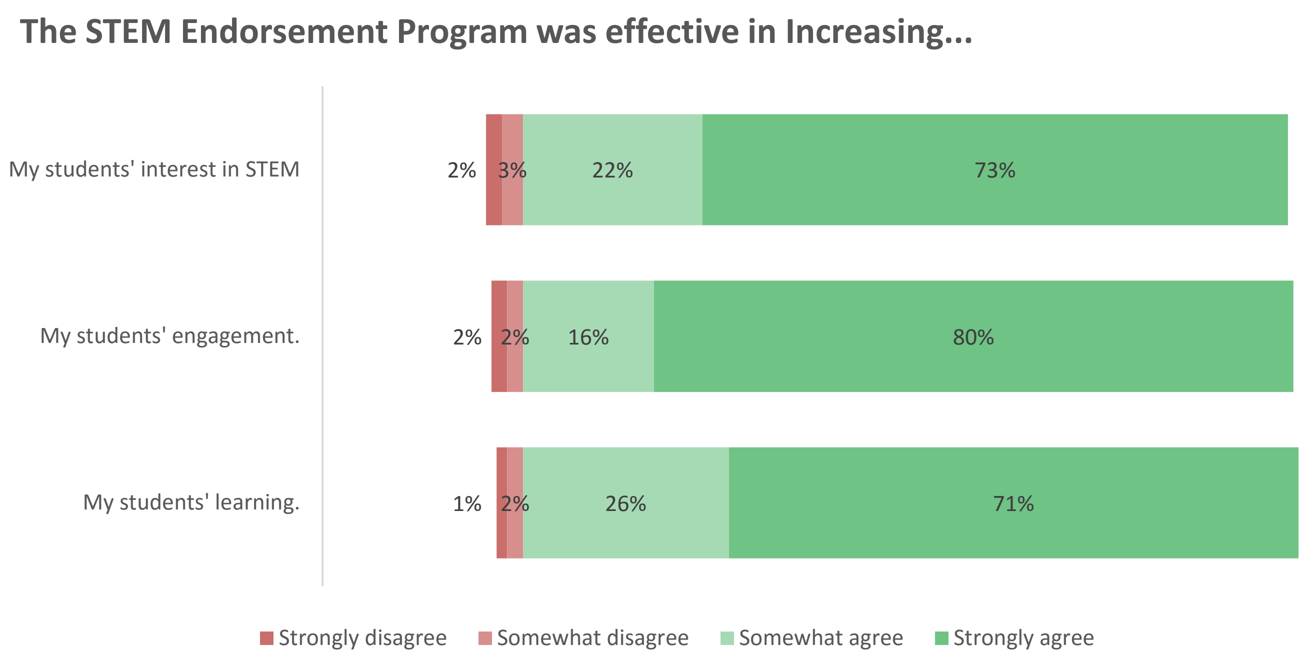
Percentage who *somewhat agree* or *strongly agree* with each statement

The STEM endorsement program was effective in increasing…	**BYU**	**SUU**	**USU**	**UU**	**UVU**	**WSU**	**Total**
My STEM content knowledge.	96%	98%	95%	100%	100%	97%	97%
My pedagogical knowledge and skills.	91%	98%	100%	94%	100%	97%	95%
My ability to integrate science in my instruction.	91%	98%	100%	100%	100%	90%	95%
My ability to integrate mathematics in my instruction.	74%	90%	76%	56%	100%	90%	81%
My ability to integrate technology in my instruction.	70%	98%	81%	75%	94%	83%	84%
My ability to integrate engineering in my instruction.	87%	97%	95%	100%	94%	93%	94%

Source: Teacher Survey Spring 2017

- ✓ In general, teachers studying at each institution agreed that the programs were effective in increasing STEM content knowledge and pedagogical knowledge and skills.
- ✓ A majority of teachers studying at each institution agreed that the programs were effective in increasing their ability to integrate science into their instruction; however, there was variation among the institutions regarding the effectiveness of the programs to increase teachers' ability to integrate mathematics, technology, and engineering.
- ✓ Despite these differences, agreement was relatively high for all institutions.

Figure 15. Perceived Impact of the STEM Endorsement Program on Students



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

Source: Teacher Survey Spring 2017

Table 40. Perceived Impact of the STEM Endorsement Program on Students by Institution

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

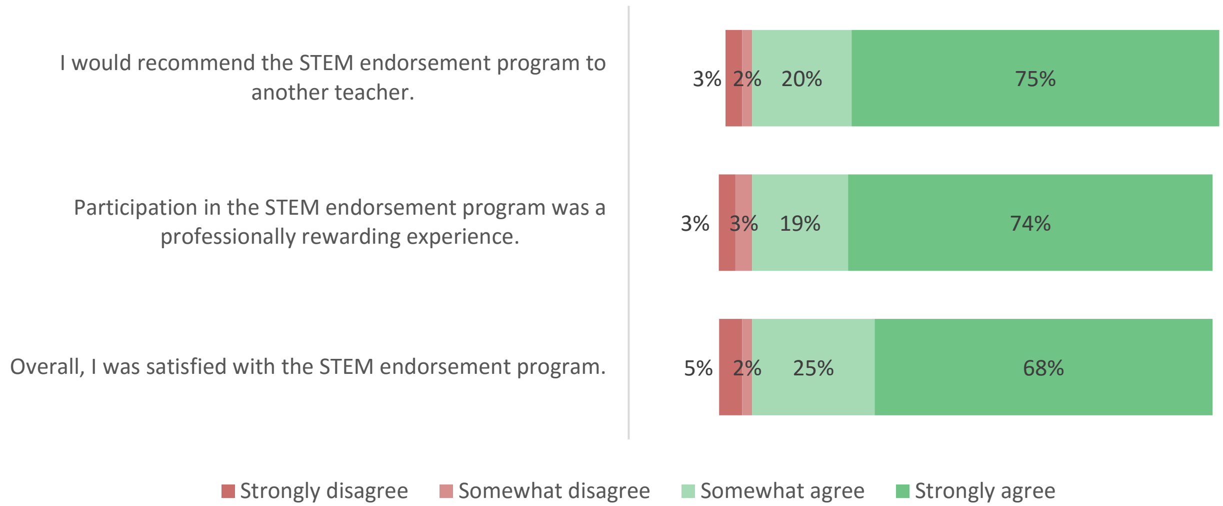
The STEM endorsement program was effective in increasing…	**BYU**	**SUU**	**USU**	**UU**	**UVU**	**WSU**	**Total**
My students' learning.	91%	100%	100%	100%	100%	97%	97%
My students' engagement.	96%	98%	100%	94%	100%	97%	96%
My students' interest in STEM	96%	98%	95%	94%	100%	96%	95%

- ✓ Teachers agreed that the endorsement program increased students' STEM interest, learning, and engagement was true across all of the participating institutions of higher education.

Source: Teacher Survey Spring 2017

Overall Assessments of the STEM Endorsement Program

Figure 16. Teachers' Overall Opinions on the STEM Endorsement Program



- ✓ 95% of teachers would recommend the program to another teacher.
- ✓ 93% agreed the STEM Endorsement Program was a professionally rewarding experience.
- ✓ 93% were satisfied with the program.

Source: Teacher Survey Spring 2017

Table 41. Teachers' Overall Opinions on the STEM Endorsement Program by Institution

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

	BYU	SUU	USU	UU	UVU	WSU	Total
Overall, I was satisfied with the STEM endorsement program.	91%	92%	95%	100%	94%	96%	93%
Participation in the STEM endorsement program was a professionally rewarding experience.	96%	95%	90%	100%	94%	93%	93%
I would recommend the STEM endorsement program to another teacher.	96%	95%	90%	100%	94%	100%	95%

- ✓ Over 93% of teachers across institutions were satisfied with the program, found the program professionally rewarding, and would recommend the program to another teacher. There were slight variations across institutions.

Source: Teacher Survey Spring 2017

Table 42. Teachers' Suggestions for Improvement to the STEM Endorsement Program

The comments should not be seen as representing all teachers; however, they provide insight into the opinions of some teachers.

Teacher Suggestions	Example Quotes
More face-to-face instruction	"It might be fun to do a little more online. However, the hands-on face to face experiences were the best! More of that, please!" "I have previously completed EdTech and ESL endorsements. Both of those courses were face-to-face. I am currently enrolled in a Master's program that is blended. The EdTech endorsement I completed has since moved to a blended and online format. The amount of learning that goes on is substantially lower in the newer format- I have discussed the content in depth with colleagues that are taking some of those courses. I strongly suggest that the face-to-face format continue for the STEM endorsement."
More blended or online instruction	"I loved the format but would have loved to have had the classes that went into June to be offered as blended face to face and online format so teachers who hold summer jobs could have participated. I know many who couldn't do the endorsement because they couldn't be there those few weeks in June."
More application and integration of the course content, especially for math and technology	"The instructor very seldom even made any suggestions or references toward integrating math." "There was zero technology integration or use taught. How about we add a technology course to the STEM endorsement? Also, it would have been really helpful to have course numbers and names. The 3 science content classes had some content repetition, and the 1st 2 classes wasted a lot of time trying to convince us that STEM was important. If we didn't think STEM was important, we wouldn't have applied for admittance to the endorsement! I enjoyed the learning but my objectives were not met." "Get rid of the math/stats class. This was not at all helpful in teaching any kind of STEM classes. It would have been better to have a class that showed how to integrate math into STEM practice. That class was a complete waste of time and effort." "I felt like the Math class was more jumping through hoops to prove we were in the class than stem learning being provided, I think the class could be taught better for hands on learning for math." "The math teacher was weak in our cohort. They need someone who will teach math as it integrates with science." "Make the program more applicable to my classroom and the projects we could do. The program was geared to an ongoing masters program rather than a k-12 endorsement. Having to do annotated bibliography's and case studies were not what was expected. When brought up in class, we were told this was a masters level program that could be applied later to a masters degree. Program felt as if they were more concerned with their future program then what was needed for teacher growth."
Make the content more directly applicable to the grade levels participants teach	"Tweaking of classes to make them more useful in my classroom." "More information focused on elementary instead of secondary grades. More focus on math that is relevant to the grades we are teaching."

Continued from previous page

Teacher Suggestions	Example Quotes
More technology content	"I think there should be a stronger technology component. I was surprised that there wasn't a technology class."
More curricular alignment across courses, years, and instructors	"The course instructors need to talk with one another to ensure consistency across the endorsement as a whole, and with other instructors teaching the same course." "The courses taught on the science content subjects (matter, energy, etc.) were very engaging and created enduring learning, but were not as rigorous as the Math, Engineering or Nature of Science classes that were more abstract and harder to create links of how to apply this in our everyday teaching. The difference in the rigor of the classes made life hard! They need more consistent expectations of rigor (some were WAY too much and some were WAY too little)"
Include resources and ideas to help link specific Utah Core content to STEM	"I would add in more hands on learning activities during the courses. Making each content more relevant to the different grade levels. Work more in grade level groups and discuss how to make the content fit to the Utah Common Core Standards. Maybe not so much terminology and more real life situations and examples."
The endorsement should not be taught as a Master's level program	"The program at [IHE] was used to try to get their accreditation to have Master Degree programs. The Professors did not treat it as an endorsement program, thus over half of the teachers dropped the course. The program at [IHE] needs to be ran like all the other Universities in Utah. This would have made it much more applicable to me and my classroom. I would suggest that that educators should be allowed to develop lesson plans based on their grade level and CORE content requirements."
Eliminate summer classes	"More flexibility. The gifted/talented teachers were a lot better. We NEVER had classes into the summer. We worked it out so we were finished. This going into summer is dumb!"
Instructors should be better prepared	"Please make sure the instructors are prepared, know how to use Canvas, have rubrics designed before assignments are given. I felt like several of the big projects were repetitive. Some instructors were ill prepared."
More instructor feedback and guidance	"The endorsement offered by [IHE] was very impractical. The distance learning was very monotonous. We were asked to present without feedback on project, or guidance from the instructor. It felt like the blind leading the blind."

Source: Teacher Survey Spring 2017

Considerations for Improvement for the Elementary STEM Endorsement Program

The STEM endorsement program was very popular among teachers responding to the survey. Almost all (93%) agreed that the program was professionally rewarding (93%) and that they would recommend it to a colleague (95%). Similarly, 99% of respondents indicated they had started using what they learned in the STEM endorsement program in their classrooms. Nearly all respondents indicated the program was effective in increasing their pedagogical knowledge and skills, their STEM content knowledge, and their ability to integrate STEM into their instruction. Most also indicated that the program increased their students' interest, learning, and engagement in STEM.

In addition to their positive reviews of the STEM Endorsement Program, teacher survey responses provided valuable insight into ways to make this program even better. The following considerations are provided for the purpose of improving the STEM Endorsement program.

Findings	Considerations for Improvement
333 teachers from charter schools and 23 school districts completed the STEM Endorsement in the initial cohort. We do not have information on program attrition for this cohort. Most teachers indicated they prefer face-to-face courses, although some appreciate the convenience of distance or blended classrooms. Teachers reported that the program was effective in increasing students' engagement, learning, and interest in STEM. Most of the teachers (93%) agreed the program is professionally rewarding and they would recommend it to another teacher. Analyses using SAGE data from the classrooms of participating teachers will provide additional information regarding the effectiveness of the program in increasing student performance in science and math.	**To increase the numbers of teachers working toward their endorsement:** • Track the numbers of teachers starting and finishing each class. Contact teachers who leave the endorsement program to find out why they leave. • Continue to offer face-to-face classes with distance and blended options for teachers who have scheduling or geographical challenges. • Make the STEM Endorsement accessible to more teachers through additional districts or charter schools that are not already involved. • Use teachers' positive overall assessment of the program to recruit additional teachers. • If the analysis of SAGE scores indicates that the STEM endorsement has an effect on SAGE scores, disseminate the results to schools to encourage other teachers to participate. • Strategically recruit teacher from schools with low scores in math and science.

Findings	Considerations for Improvement
Most teachers found five of the six courses to be very impactful. Teachers rated *Mathematics for Teaching K8 Data Analysis and Problem-Solving* as least impactful. In their comments, teachers also mentioned this course as being less impactful. Teachers' perceptions of impactfulness of each course varied quite a bit depending on the IHE. 99% of respondents indicated they had started using what they learned in their classrooms, although some students indicated the demands of the endorsement left little time to make changes in their classrooms. Nearly all teachers agreed that the program was effective in increasing pedagogical knowledge and skills, STEM content knowledge, and ability to integrate engineering and science into instruction. There was slightly less agreement that the program was effective in increasing teachers' ability to integrate math and technology into their instruction.	**To increase the impactfulness of the STEM endorsement program:** • Encourage endorsement instructors to provide clear connections from course materials to applications in the classroom. All courses should be tied to classroom content and pedagogy. • Encourage endorsement instructors to make course assignments or projects directly useable in the classroom (e.g., developing lesson plans or classroom projects). • Encourage endorsement instructors to provide more information and examples related to integrating math and technology into the classroom. • Share results of this evaluation with IHEs and instructors so that they can see where improvements are needed. • Facilitate sharing from instructors with highly rated courses to their counterparts at other IHEs. • Ask students to complete brief course evaluations (standardized across the IHEs) if they are not doing so already.

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 for the purpose of improving 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 selected Edivate by the School Improvement Network (SINET) as the platform that was best able to meet all of the legislative requirements. Edivate was made available to Utah's public K-12 schools through a competitive grant application process for LEAs. Schools that were granted licenses through this process were required to use the licenses within a specified timeframe. Licenses that were not used during this time were reallocated to other schools.

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. Edivate is an online learning platform that teachers can use independently, as part of PLCs, or as a whole school. The Edivate library contains a range of educator resources, including videos, community forums and groups. As part of the grant, teachers are required to upload videos of themselves teaching in order to reflect on their teaching 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 platform 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 spend using the Edivate platform) and *quality* (e.g., to what extent did teachers perceive that Edivate provided useful content? To what extent did teachers feel they were provided with training that allowed them to effectively use the platform?). 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 platform on students' learning outcomes and interest in STEM. Student outcomes will be further assessed by analyzing student math performance by program use at the classroom level, as these data become available.

Data sources included program implementation and participation records, Edivate data on teacher usage, 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 a team of trained qualitative data analysts who used HyperResearch software to categorize each comment and synthesize the results into major themes.

Figure 17. 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 43. License Distribution STEM Professional Learning

	2014-15	2015-16	2016-17
Number Edivate licenses requested	18,612	17,880	15,212
Number of Edivate licenses awarded	18,612	17,880	10,074[4] (66% fulfillment)
Number of districts awarded Edivate licenses	27	24	32
Number of charter schools awarded Edivate licenses[5]	12	10	17

Source: STEM AC data and annual reports

[4] In 2016-17, the STEM AC paid for 7,900 licenses, and SINET donated 2,174 licenses.
[5] The Utah Schools for the Deaf and Blind are listed under charter schools.

Table 44. Teacher and Administrator Survey Response Numbers for the Professional Learning Project

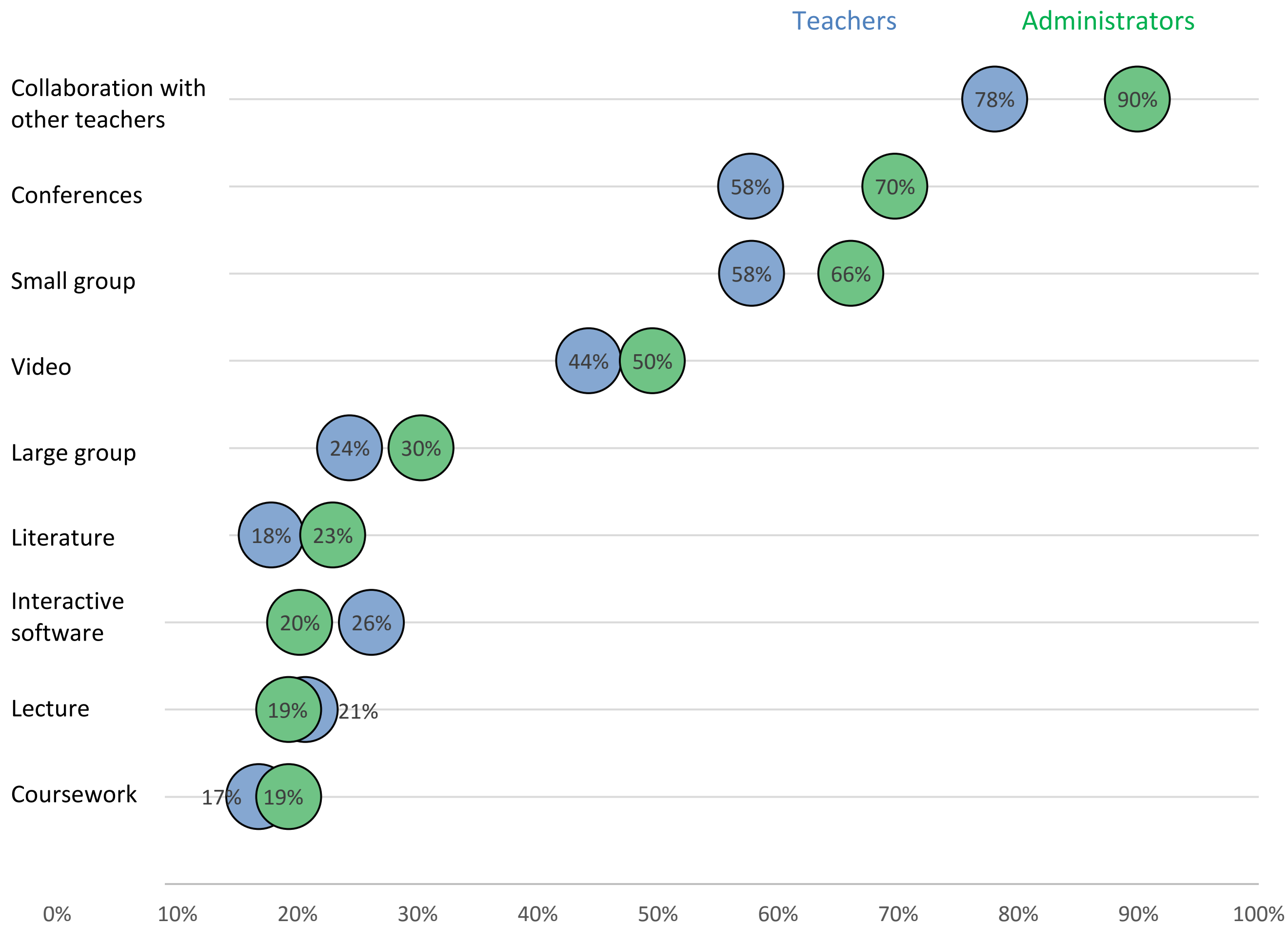
	N	%
Teachers Total	**1438**	**100%**
Teachers who have Used Edivate	818	57%
Teachers by Grade Level Distributions		
K - 2nd	200	14%
3rd - 6th	444	31%
7th - 8th	589	41%
9th - 12th	519	36%
Teachers by STEM Areas		
Science	822	57%
Technology	362	25%
Engineering	207	14%
Mathematics	796	55%
Does not teach STEM	324	23%
Administrators Total	**109**	**100%**
Administrators Using Edivate at their School	84	77%

- ✓ Teachers could choose more than one grade level and STEM area; therefore, the percentages add to more than 100%.
- ✓ Most teachers (77%) responding to the professional learning survey taught at least one STEM area.
- ✓ 57% of teachers who responded to the survey have used Edivate. Only teachers who indicated they used Edivate were asked to answer questions about Edivate.
- ✓ 77% of administrators who responded to the survey indicated their schools were using Edivate. Only administrators who indicated their schools used Edivate were asked to answer questions about Edivate.

Sources: Administrator and Teacher Surveys Spring 2017

Teacher Preferred Format and Motivation

Figure 18. Preferred Formats for Professional Learning[6]

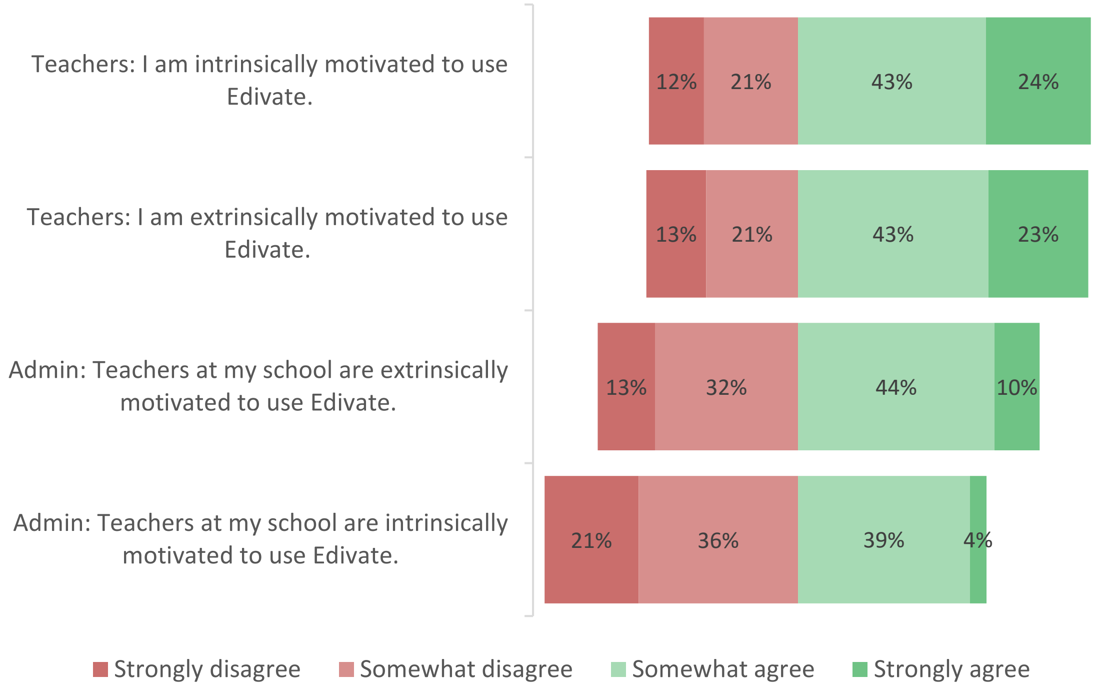


Sources: Administrator and Teacher Surveys Spring 2017

- ✓ Both administrators and teachers selected *collaboration with other teachers* most frequently as a preferred format.
- ✓ Approximately half of the administrators and teachers selected *video* and about one-quarter selected *interactive software*.

[6] Respondents could select all that applied.

Figure 19. Teacher Motivation to Use Edivate

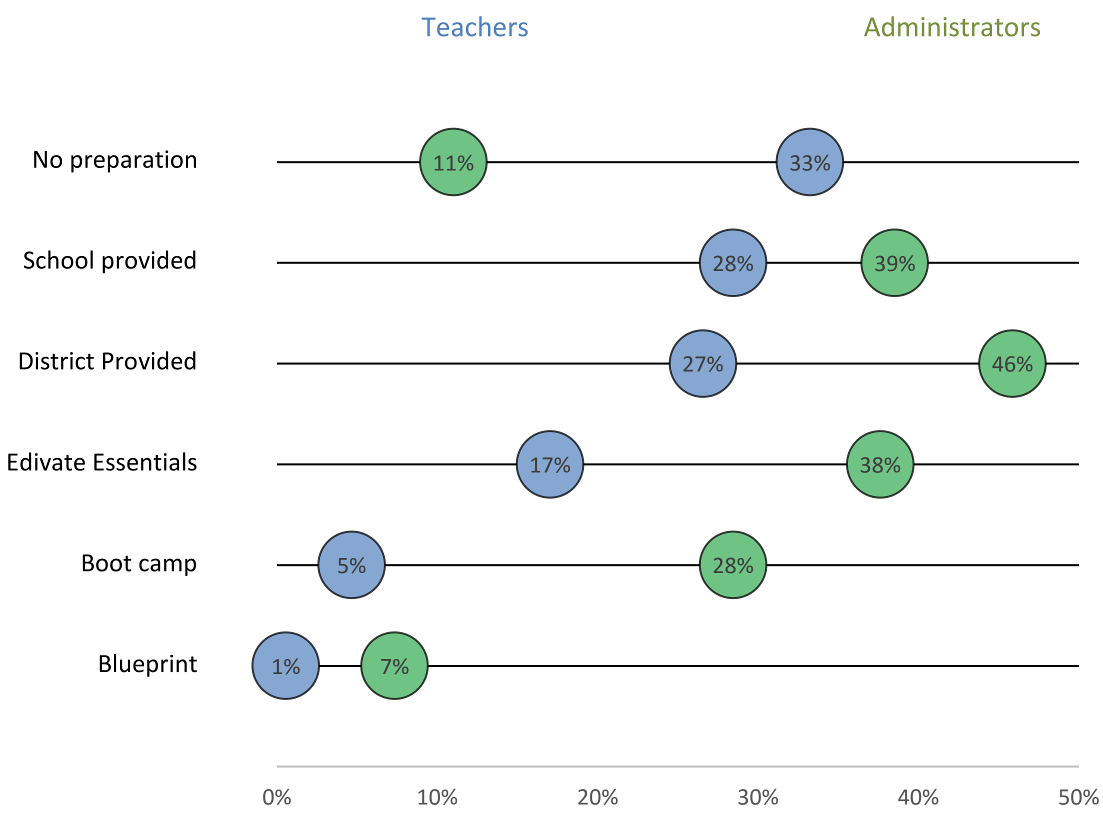


- ✓ Teachers indicated they were both extrinsically and intrinsically motivated to use Edivate.
- ✓ Administrators perceive teachers to be slightly more extrinsically motivated (54%) than intrinsically motivated (43%).

Sources: Administrator and Teacher Surveys Spring 2017

Preparation and Support

Figure 20. Teacher and Administrator Reports of Teacher Preparation for Using the Edivate Platform



- ✓ Respondents could select all that applied.
- ✓ 33% of teachers indicated they received no preparation to use Edivate. 11% of administrators indicated their teachers received no preparation.
- ✓ Preparation by the school or district was more common than Edivate Essentials or Boot camp.
- ✓ Administrators were more likely to indicate that teachers received each type of training than teachers.

Sources: Administrator and Teacher Surveys Spring 2017

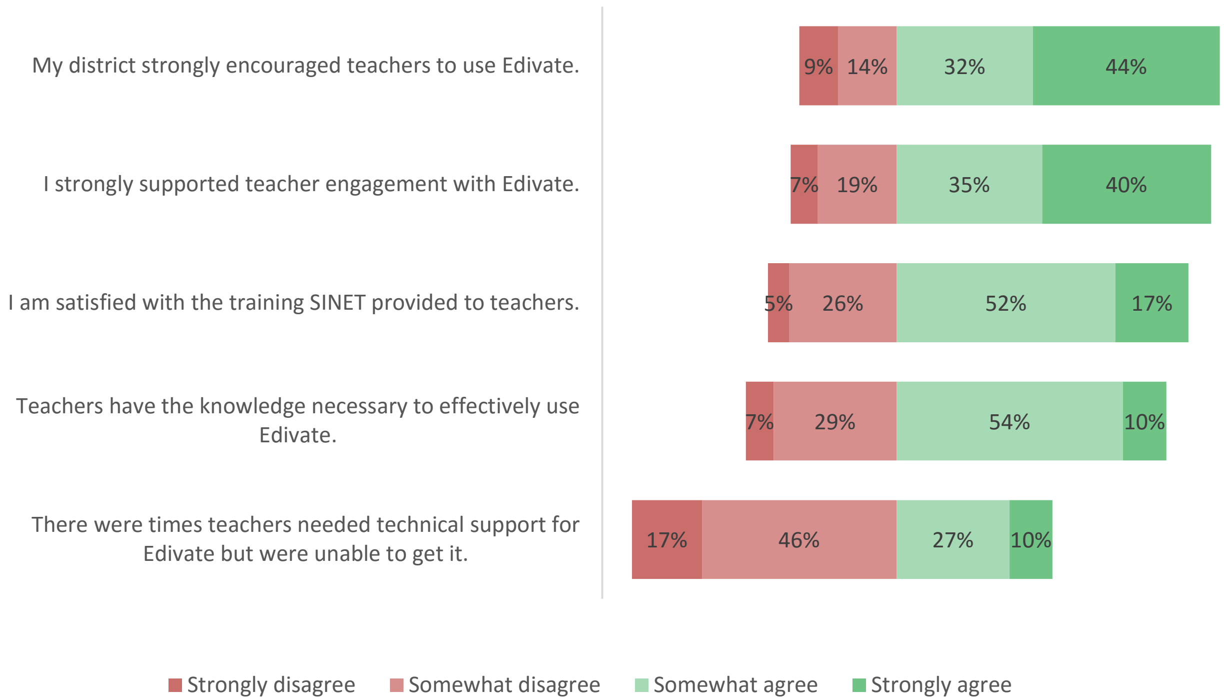
Table 45. Teacher Feedback on Training Received to Use Edivate

The comments should not be seen as representing all teachers; however, they provide insight into the opinions of some teachers.

Teacher Comments on Edivate Training	Example Quotes
The training was too superficial and did not answer their questions	"We have not learned how to do anything beyond searching for and watching the videos and responding to the associated questions." "The training was very basic each time and feedback we gave our instructors/questions about the programs were never answered to my expectations."
The training was not enough to counteract the problems with the platform	"The training was fine but the software is not user friendly and does not consistently work." "It was not so much an issue with the training as it was an issue with the way the site is set up. The categories and links don't follow a logical path. The website is not very user-friendly and if I ever forgot how to find something, it took a long time to figure out the correct menu and link to get there." "Did not like using Edivate, don't want to use Edivate. Not well designed, difficult use, uploading always failed, generally bad experience."
The software did not work the way the trainings indicated they would	"The Edivate training was great! But, when I tried to upload or save videos to Edivate, they would never work. Our group finally had to switch to a different technology because everyone was having trouble with this program." "I have had multiple problems uploading videos." "I had some videos that I was interested in uploading but was not able to. The steps were not readily apparent to me." "The training was fine, however we had A LOT of technical issues that never worked out. It was extremely difficult to work with Edivate."
There were technical issues during the training	"The program didn't work. The company sent trainers but the program couldn't work so we couldn't do anything with the trainer. Sometimes we could login and sometimes we couldn't. If Edivate is a requisite for this project, I would need to seriously consider my participation."

Source: Teacher Survey Spring 2017

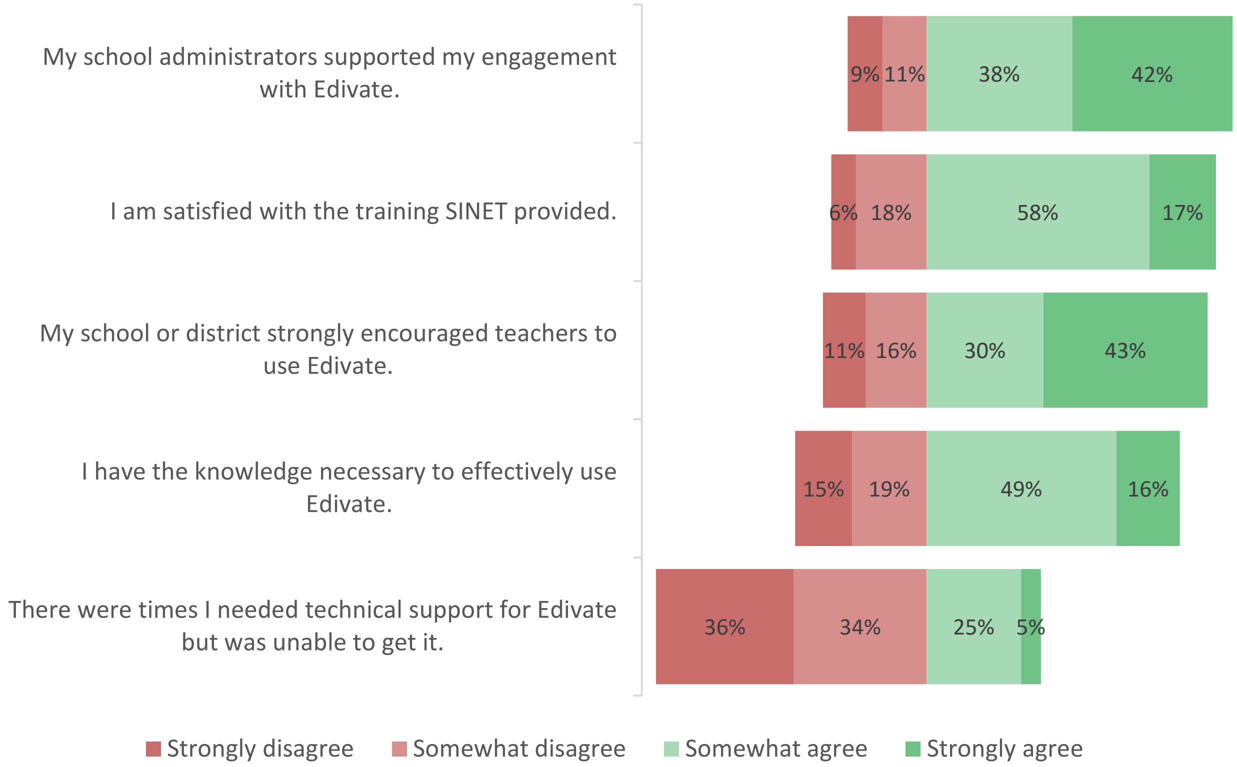
Figure 21. Administrator Perceptions of Support for Teachers to Use Edivate



- ✓ Three-quarters of administrators agreed they and the district strongly supported teacher engagement with Edivate.
- ✓ 64% of administrators agreed teachers had the knowledge to use Edivate, although only 10% strongly agreed.
- ✓ 69% agreed they were satisfied with the training SINET provided.
- ✓ Generally, administrators did not perceive that teachers were unable to get support for Edivate when they needed it.

Source: Administrator Surveys Spring 2017

Figure 22. Teacher Perceptions of Support for Edivate



- ✓ Teacher perceptions of support were very similar to administrator perceptions.
- ✓ The majority of teachers indicated they had the knowledge to effectively use Edivate (65%), but a sizable minority could use additional training.

Source: Teacher Survey Spring 2017

Program Use

Figure 23. Administrator Survey Reported School Use of Edivate

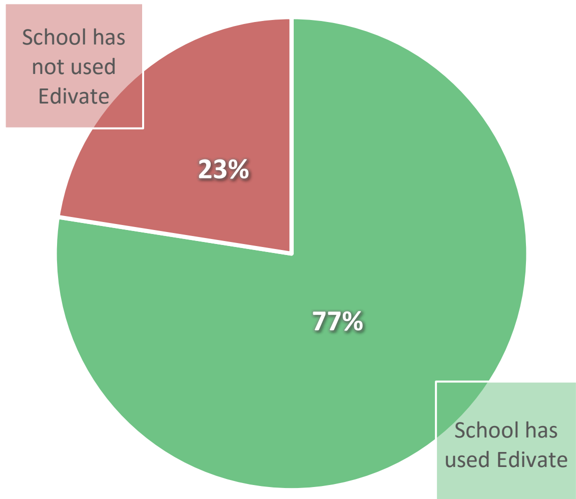
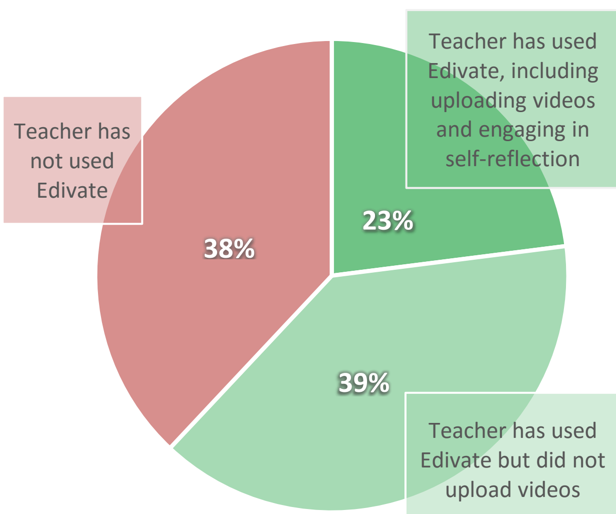


Figure 24. Teacher Survey Reported Use of Edivate



- ✓ 23% of administrators who received the professional learning survey indicated their school had not used Edivate.
- ✓ 38% of teachers who completed the professional learning survey indicated they had never used Edivate.

Not pictured: Teachers who had used the Edivate platform reported using it an average of 66 minutes per month. Edivate's recommendation for fidelity is a minimum of 20 minutes per month.

Not pictured: Usage data from SINET indicated that Utah teachers who used Edivate spent an average of 92 minutes on the platform over the past year. Based on a nine month academic year, teachers are using the platform an average of 10 minutes per month. A review of usage data by school district shows that district-level teacher use varies from an average of less than a minute to 500 minutes for the year. Figures showing usage rates by school district are available separately.

Sources: Administrator and Teacher Survey Spring 2017

Table 46. Teacher Reported Changes in Instruction Based on the Professional Learning

The comments should not be seen as representing all teachers; however, they provide insight into the actions of some teachers.

Teacher Reported Instructional Changes	Example Quotes
Teachers included classroom management strategies learned directly from Edivate, for example moving around the classroom and using objectives more often.	"I've added classroom management strategies that I observed in teachers on Edivate, and the videos have opened me up to presenting content in different ways as well."
Teachers made changes in the ways they engaged students, such as varying the ways they ask questions, their wait time, implementing more group work, and more student guided activities.	"I started using group work more effectively and I was able to help my students communicate better. / I used attention-getters to redirect the class back to study time."
Teachers were able to expand on lesson plans they used in the classroom as well as add to their current curriculums.	"I changed my Science lessons to be more 3 dimensional. I put more of the learning in my students' hands. I acquired more content knowledge to teach the standards accurately."
Teachers enjoyed the videos that helped them reflect on their own practices.	"It have taken time to reflect on my teaching and have used the Swivl to record myself teaching a social studies lesson. Love the ability to video effectively and sound came in great."

Source: Teacher Survey Spring 2017

Table 47. Teacher Intended Changes to Instruction Based on the Professional Learning

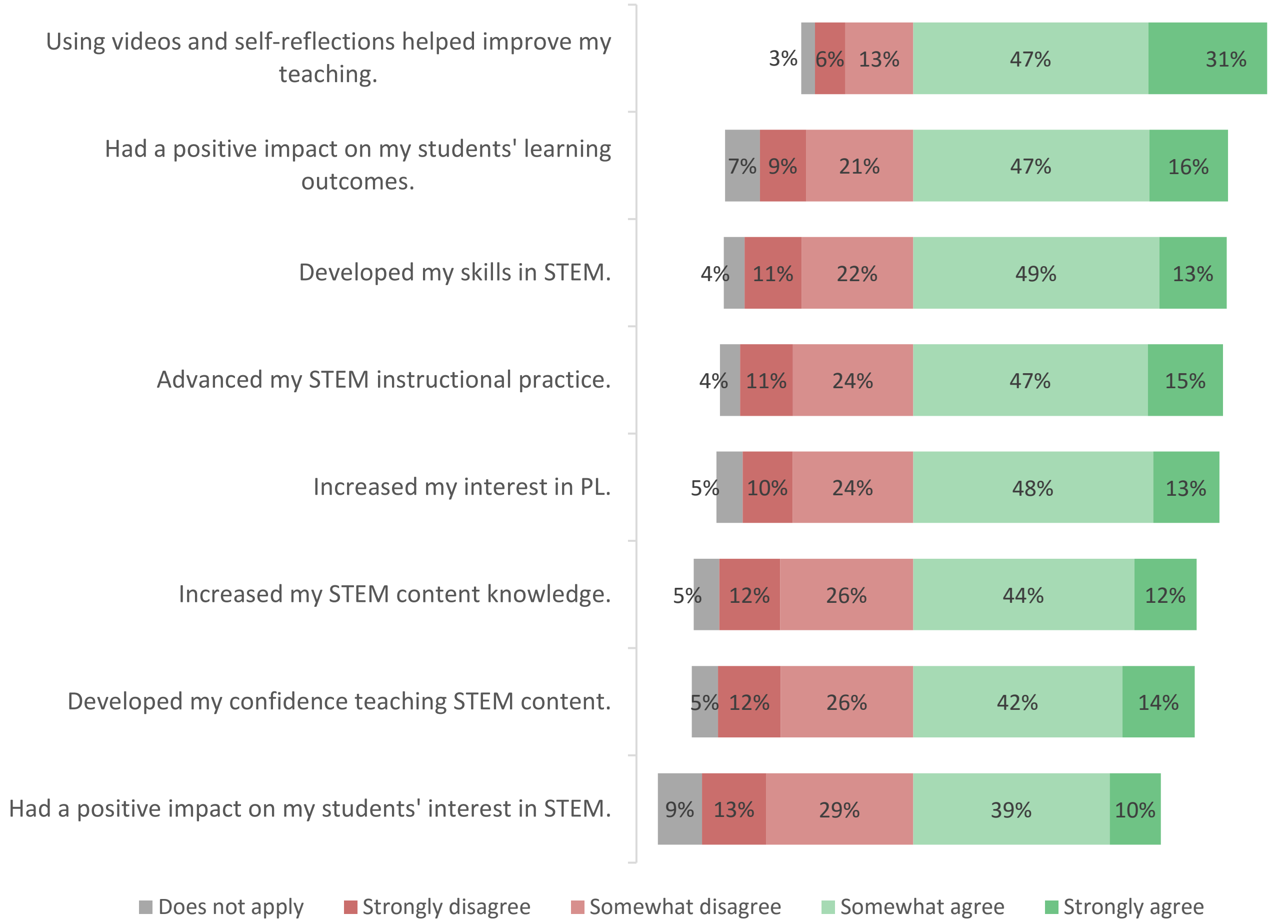
The comments should not be seen as representing all teachers; however, they provide insight into the intentions of some teachers.

Teacher Intended Instructional Changes	Example Quotes
Teachers plan to use Edivate more often.	"I plan to spend much more time on Edivate this summer and incorporate what I've learned in the areas I need to grow and develop most as a teacher, into my classroom." "Next I plan to be more effective about consistently seeking and watching Edivate videos."
Teachers plan to implement new curriculum or content.	"Next year I will have a chance to implement the content and curriculum planned using Edivate this year." "I have ideas for units that I will teach next year. I want to incorporate more collaborative learning between my students and make sure I scaffold learning even better than this year."
Teachers plan to record their teaching to reflect on individually and with colleagues.	"I want to use the upload videos more effectively and use the swivl tool to have more peer teachers review my lectures." "I would like to do more videos of myself with reflections."
Teachers intend to enhance their current lesson plans.	"I plan on incorporating more writing in my lessons." "I plan to extend each unit, adding activities and higher order thinking skills, to help students master the skills."
Teachers intend to increase the use of STEM-related lessons, activities, or content.	"Adding more hands on activities into my science and math lessons and more task related instruction." "I plan to use Edivate again next year and I am excited to find new STEM lessons to use with my class. I want to implement a force and motion Roller coaster lesson with my class next year that I saw on Edivate."
Teachers plan to increase hands-on and interactive learning.	"I will teach using Edivate more when teaching the different strands. I will teach with more hands- on exploration of the different phenomenon I want the students to learn." "I plan on increasing the variety of activities in class in order to better engage students with different learning styles."
Teachers intend to increase their use of cultural diversity as strengths.	"I am determined to use cultural differences as strengths."

Source: Teacher Survey Spring 2017

Perceived Outcomes

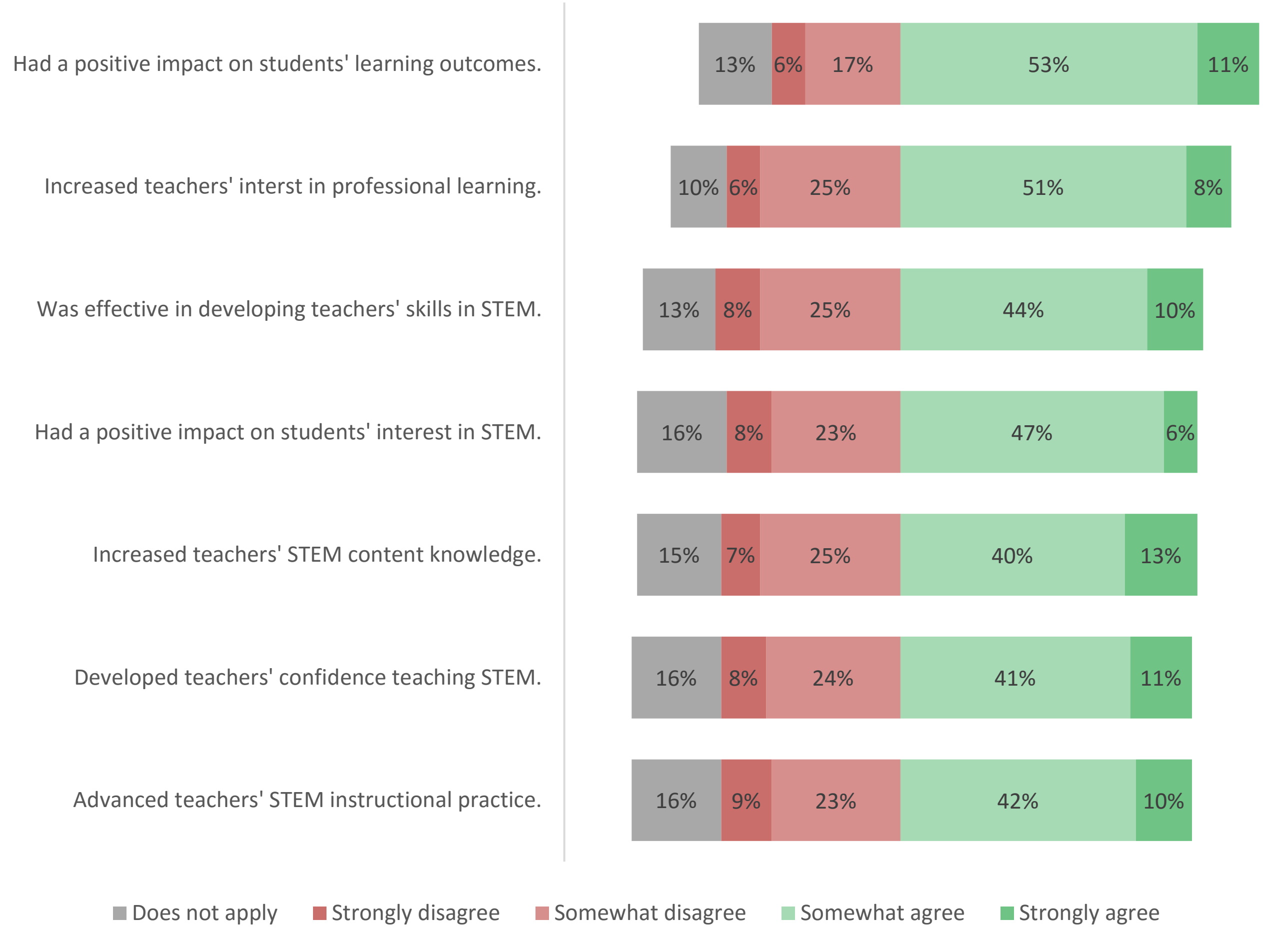
Figure 25. Teacher Perceptions of Effects of Edivate



- ✓ 78% of teachers who uploaded videos of themselves for self-reflection agreed that it helped their teaching.
- ✓ The majority of teachers indicated Edivate had a positive impact on their teaching and students' learning of STEM.

Source: Teacher Survey Spring 2017

Figure 26. Administrator Perceptions of Effects of Edivate



✓ The majority of administrators agreed that Edivate had positive effects on teachers and students, including improving student learning outcomes and interest in STEM.

SOURCE: ADMINISTRATOR SURVEY SPRING 2017

Teacher and Administrator Feedback about Edivate

Table 48. Teacher Positive Feedback about Edivate

The comments should not be seen as representing all teachers; however, they provide insight into the opinions of some teachers.

Teacher Positive Feedback about Edivate	Example Quotes
Teachers enjoyed the resources in Edivate.	"I like the variety of categories available and being able to select topics or areas of instruction of interest. I like the video and ways to watch different teaching as well as lesson planning." "It was a great place to find ideas for me to try out in the classroom. I loved the videos because they demonstrated exactly how to do certain techniques."
Teachers appreciated the collaboration in Edivate.	"I love Edivate and have really enjoyed seeing other teachers implement fresh ideas. It is so awesome to see students all around the U.S. learning." "The PD in general has helped me refine my teaching practice. Video reflection is a great tool and I want to continue using it in future PD's."
Teachers liked the ability to customize their use of Edivate.	"It is self-paced, easy to track, and something you can do whenever you have a minute or two."
Some teachers felt Edivate was easy to use.	"I liked the forum discussions. For a person that does not know technology very well, it was pretty easy to use.
Instruction improved as a result of using Edivate.	"I have learned a lot and I'm sure it has influenced my teaching in more ways than I can write about here. I feel like I am a better teacher after watching the videos and trying some new things with my class."
Teachers appreciated new ideas they got from Edivate.	"I really like to watch teachers teaching a specific concept because it gives me ideas on what I can use in my classroom. It is fun to watch others teaching styles and learn from other professionals."

Source: Teacher Survey Spring 2017

Table 49. Administrator Positive Feedback about Edivate

The comments should not be seen as representing all administrators; however, they provide insight into the opinions of some administrators.

Administrator Positive Feedback about Edivate	Example Quotes
Teachers could use Edivate on their own timeline and for topics of their own choosing	"I love the idea of self-directed professional development." "I love that it is something that can be done for professional development at any time and it is a useful tool for observations by administration." "It is easy to use and teachers can go at their own pace." "I recommend the use of Edivate because it provides a platform for teachers to use and meet online. This works with teacher's varied schedules. It provides tools for learning and feedback by peers." "I love the accessibility and utility of Edivate and would highly recommend it especially for small schools struggling to make professional development meaningful."
Some administrators expressed that Edivate is user friendly	"It is easy to do no matter where you are." "Edivate is easy to use, has an extensive library of teaching videos, and supports improvement of instructional practices."
The feedback provided through Edivate is helpful	"At first our teachers were reticent to upload videos of themselves. But the more they did this and viewed others they quickly found the feedback as very useful and even a confidence builder."
Some administrators expressed that Edivate is a high-quality program with good content	"The quality of the videos is excellent and most of the teachers were well prepared and interesting to watch."
Edivate provided motivation for teachers to improve their teaching	"It is a great tool for our teachers and it has had a big impact on their observation and motivation for change in their classroom." "Teachers were able to see what other teachers are doing and find motivation from learning from others on a teacher level."

Source: Administrator Survey Spring 2017

Table 50. Teacher Concerns about Edivate

The comments should not be seen as representing all teachers; however, they provide insight into the opinions of some teachers.

Teacher Concerns about Edivate	Example Quotes
Teachers expressed that it was difficult to find specific content, e.g., for a certain grade or subject.	"It is just not easy to find resources. Even with the different filters to try and find appropriate lessons for grade level and subject, I got a lot more useless videos/lesson plans than useful ones. It took too long to weed through them all so I stopped using Edivate." "There is very little information on science and especially the middle level sciences in Edivate." "There is not enough content for younger students."
Teachers were concerned that the website was difficult to navigate and not user friendly.	"The Edivate platform is not the most user friendly. We often had trouble as a team and had to work hard to understand how to use the features and video upload areas." "You really need to send out a finished product before having teachers use it. We don't have the time to spend hours trying to figure something out that takes away from our time in the classroom. It should enhance not distract. Easy to use and navigate should be on the forefront of the website." "Technical part is not easy - we had many problems in uploading videos into our page. We have many hi-tech teachers in our school but they even suffered a lot in the technical part - we had to call the help desk - I believe you can make a better user friendly system & manual." "It was extremely difficult to follow the platforms need to do the necessary work. I had many hours on the phone trying to get this program functioning for my personal use. When a whole team can't figure out how to work this program it is not user friendly. Some fixing and updating need to be addressed." "Again, the program itself isn't user-friendly. And even when I used it, there were issues! As a learning coach, I used it with observations for teachers and it would LOSE the work in its entirety, thus rendering the program quite nearly useless to us. We stopped using it nearly all together for the professional development aspect because we couldn't rely on it."
Teachers expressed that there were several technical issues, e.g., glitches, difficulties uploading, not pairing well with iPhones, etc.	"Uploading is clunky and doesn't work half the time." "There were times where you could not copy and paste an answer into the comments or conversation sections of Edivate. This is a huge problem because there were times I had typed it out and when I went to submit it the conversation box would wipe clean and say I had been booted from the program because I've been inactive. I would either find a way to make it so as long as someone is typing in those boxes it doesn't log you out of the program and/or enable the copy and paste feature." "There was difficulty with uploading video files as the Edivate site would crash if I tried to upload a large video file of myself." "There was a period of time when previously uploaded videos would not play." "There still seem to be some technical issues that arise with accessing some of the components of this program. Sometimes it works, and sometimes it doesn't."

Continued from previous page

Teacher Concerns about Edivate	Example Quotes
Teachers felt the videos were out of date and were looking for more relevant and up-to-date videos.	"The STEM videos aren't related to the new 3D and SEEd standards." "The content needs to be broadened and updated." "Some of the videos are old and do not take into account the change in the student population." "Some of the videos are extremely outdated." "I feel that many of the teaching strategies are not well informed by current engaged STEM strategies."
Some teachers prefer other sources and do not want to be tied down to one platform.	"While the potential is there in the system, it currently is difficult to use and inefficient. The 5 minute limit in video size makes it difficult to upload an actual lesson, which negates many of the benefits of being able to watch another teacher teach. It is also fairly difficult to navigate, has technical issues and often contains little useful information concerning what I'd like to learn about. As I noted earlier, I was able to find better information in a smaller time frame using YouTube." "There are other sources for my specialty that are more important and give me more information in my area - Computer Lab. I don't want to be locked in to using Edivate." "There are better, cheaper, faster tools for doing much of what Edivate is trying to do (e.g., Teachingchannel.org, Schoology, etc.) and the quality of the video library was inconsistent and often outdated." "I like to move rapidly through online training. Edivate limited my freedom to work at my own pace."
Some teachers would prefer more face-to-face or interactive PL.	"To me it's just one more thing that takes away personal contact and learning that goes hand in hand with face to face learning and the wealth of knowledge you get from interacting with other teachers and people. So yes, I have a concern when I'm sitting alone at my desk watching a video and I want to bounce ideas off another human being and I can't. I can't question the teacher in the video or ask them questions. The setup is always idyllic and that's a problem for me." "Takes the personal contact from evaluation of administrators."
Some teachers felt the videos were unrealistic and did not address behavior problems well.	"Most clips seem staged, especially on the behavioral management clips." "The videos need to be updated and include classrooms that have behavior issues instead of the stellar students."
Did not receive enough training	"Is there an Edivate 101 course that I can take to learn how to use it??????" "Just make sure to really train your teachers. One lesson on each part is not adequate enough learning." "My school left the training to ourselves and we never had good direction. I wish I could have met an Edivate rep."
Videos and assignments could be labeled better and have summaries available so that teachers can assess the content before investing time.	"Watching videos was a gamble on whether or not they would be a valuable use of my time." "Needs better summaries on assignments so I can get what I need without going through a lot of unneeded and unwanted information." "Most of the videos were very out of date or the video title didn't relate to the content in the video." "I just don't find the time because I have to search for grade level appropriate videos and have to watch the entire video in order to decide if the activity is something that I can use in my classroom or not."

Source: Teacher Survey Spring 2017

Table 51. Administrator Concerns about Edivate

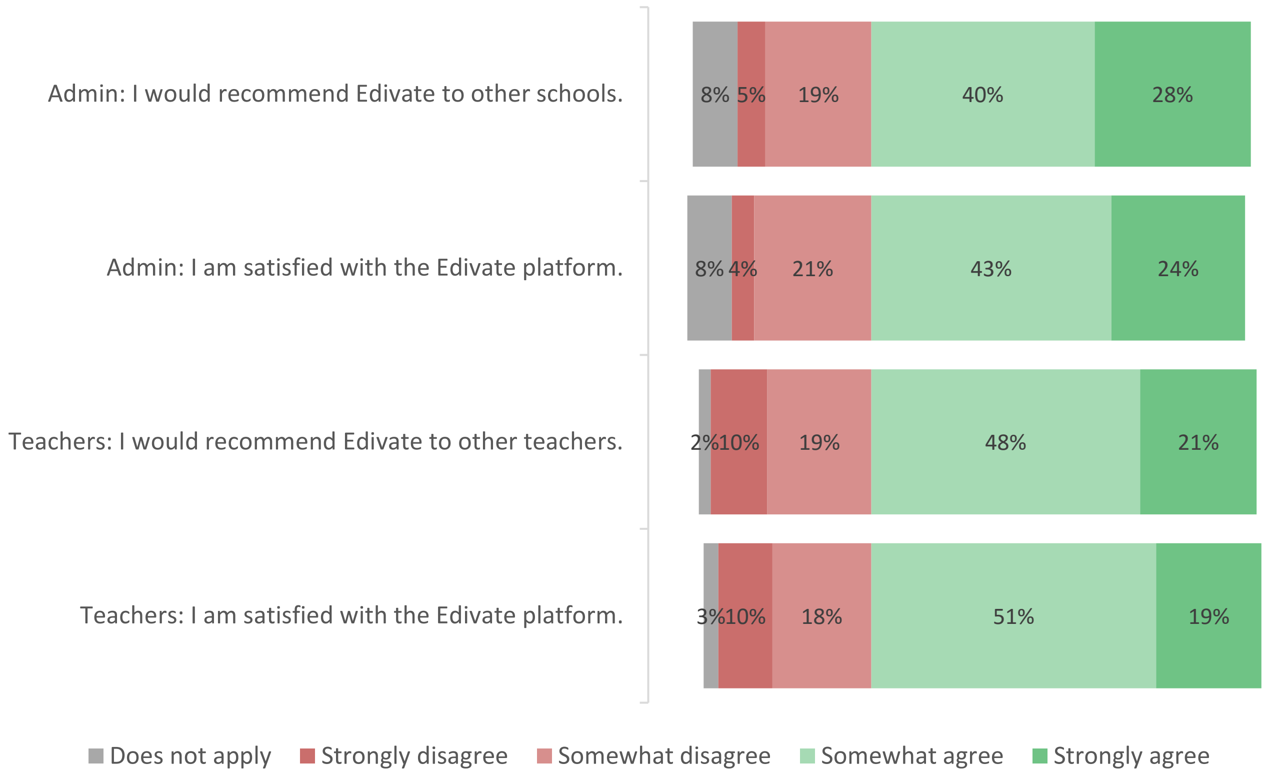
The comments should not be seen as representing all administrators; however, they provide insight into the opinions of some administrators.

Administrator Concerns about Edivate	Example Quotes
Some administrators felt that Edivate required too much time.	"It is just hard to find the time." "Using Edivate requires a great deal of pre-work, not just using software. The culture of the school has to change, especially concerning sharing video feedback. We did not have the time to develop this capacity and openness."
Some administrators stated that Edivate content is irrelevant, outdated, and needs to be improved.	"Remove videos that are out of date and update them with current issues in education. Allow for schools to share their own examples with other schools." "More subject specific content would be of value." "It needs more fresh videos. It would be great if we could use some of our teachers who filmed themselves to upload." "Not all grade levels were equally represented." "There were limited STEM lessons per grade level." "Edivate lacks content for high school teachers, there is some of course but the majority seems to be geared to younger students."
Some administers cited technology issues and that the platform was not user friendly.	"It was not user friendly." "Technology issues were a challenge." "Sometimes difficult to keep track of where personal learning left off since the last log in." "Often, we experienced technical difficulties." "The program was fine, but the support was inadequate. Because of this my school was left with a bad first exposure to STEM."
Some administrators indicated that teachers need better training.	"We needed better training and more than one training." "The platform can be overwhelming at times, if teachers are not used to or if technical issues rise."
Administrators expressed that planning of using Edivate needs to be improved.	"When your own trainers and staff can't even explain how to use the system or what the terminology means then you have a major systemic problem." "I didn't really didn't understand that I was supposed to be using it with our faculty at all. I was given a login and told that I needed to view a certain number of videos. I assumed this was part of my coaching responsibilities and I didn't know it was something I could use/should use with teachers."
Some administrators indicated that teachers did not like the program.	"Our usage of Edivate decreased drastically this past year. We tried to find opportunities to use it, but found that, with all the PL regarding classroom instructional practices, the teachers had very little for the program." "The problem with using Edivate is getting teachers to believe in it as a tool to grow. I assumed all teachers would just love to share ideas through Edivate, but most of the teachers saw it as one more thing to do, rather than the possibility to collaborate and grow."

Source: Administrator Survey Spring 2017

Overall Assessments of Edivate

Figure 27. Administrator and Teacher Overall Satisfaction with Edivate



- ✓ 68% of administrators and 69% of teachers would recommend Edivate to others.
- ✓ 69% of administrators and 70% of teachers were satisfied with Edivate.

Sources: Administrator and Teacher Surveys Spring 2017

Table 52. Teacher Reasons They Would or Would Not Recommend Edivate to another Teacher

The comments should not be seen as representing all teachers; however, they provide insight into the opinions of some teachers.

Teacher Reasons They Would or Would not Recommend Edivate	**Example Quotes**
Some teachers enjoyed using it.	“It's a solid platform with great content.”
Some teachers appreciated the training videos.	“I liked watching the videos on specific lessons used in our state and seeing those lessons in action. I learned something from the videos.”
Some teachers felt Edivate provided a wide range of resources.	“I would recommend Edivate because it has such a wide variety of subjects that cover practically everything in the classroom.”
Some teachers liked Edivate because it facilitated collaboration.	“I would recommend Edivate because it helped me as a first-year teacher to get ideas from other teachers around the U.S. I got a lot of management ideas from this.”
Some teachers liked the ability to choose content.	“It is self-paced and self-serving. You can choose what videos and courses that apply to you. It doesn't require you to view unnecessary or unhelpful videos.”
Some teachers did not find the platform to be useful.	“It's much easier and just as effective to record yourself to evaluate yourself and others.”
Some teachers did not find the content to be useful.	“The quality of the videos and content was poor.” "It is just not easy to find resources. Even with the different filters to try and find appropriate lessons for grade level and subject, I got a lot more useless videos/lesson plans that useful ones. It took too long to weed through them all so I stopped using Edivate."
Some teachers expressed that it was difficult to find specific content that they were searching for, such as for a certain grade or subject.	“It was extremely difficult to find materials that related to kindergarten. STEM content for lower grades was extremely limited and while well thought out was not engaging. I also feel like most lessons for the younger grades were not interesting and provided too much guidance versus fostering true hands on exploration and discovering of learning outcomes.” It is just not easy to find resources. Even with the different filters to try and find appropriate lessons for grade level and subject, I got a lot more useless videos/lesson plans that useful ones. It took too long to weed through them all so I stopped using Edivate.
Some teachers were concerned that the website was difficult to navigate and not user friendly.	“I find the platform difficult to navigate.” "The Edivate platform is not the most user friendly. We often had trouble as a team and had to work hard to understand how to use the features and video upload areas."
Some teachers felt they needed more training on Edivate.	“I don't feel I was adequately trained in the use of this program. Just watching videos and getting ideas is great but I can't really put it into practice in my classroom. “
Some teachers felt they did not have time to invest in Edivate.	“I think it is a great platform. Unfortunately, we just don't have the time to use it unless we do it on our own time... and they already require a LOT of us on our own time.”

Source: Teacher Survey Spring 2017

Continued from previous page

Teacher Reasons They Would or Would not Recommend Edivate	Example Quotes
Some teachers described technical issues, such as glitches, difficulties with uploading videos, not pairing well with iPhones, etc.	“There were so many technical difficulties, which caused hours of wasted time. I tried using the videos that were in the Edivate library and found them extremely antiquated and not useful. It was difficult to collaborate with colleagues because it seemed no one was interested in collaborating.” "Technical part is not easy - we had many problems in uploading videos into our page. We have many hi-tech teachers in our school but they even suffered a lot in the technical part - we had to call the help desk - I believe you can make a better user friendly system & manual."

Considerations for Improvement for the STEM Professional Learning Project

Teachers and administrators rated the STEM professional learning project more ambivalently than the personalized math project or the STEM endorsement project. Use rates were low, with 38% of teacher survey respondents from schools with Edivate licenses indicating they had not used Edivate and 23% of administrator survey respondents from schools with Edivate licenses indicating their school had not used Edivate. Only 23% of teacher respondents had used Edivate including uploading videos and engaging in self-reflection. However, among those teachers who had used Edivate and uploaded videos, 78% agreed or strongly agreed that it had helped improve their teaching. The majority of teachers and administrators also agreed that Edivate had a positive impact on students' learning, developed teacher skills and instructional practice in STEM, increased teacher STEM content knowledge and confidence in teaching STEM, and increased teacher interest in additional professional learning. However, a substantial number of teachers and administrators disagreed that Edivate had these positive effects.

The following considerations are provided for the purpose of improving the STEM professional learning program.

Findings	Considerations for Improvement
33% of teachers and 11% of administrators indicated they received no preparation for using Edivate. Some teachers commented that the training was too superficial and did not answer their questions. 35% of teachers indicated they did not have the knowledge necessary to use Edivate effectively. 68% of administrators and 69% of teachers would recommend Edivate to others.	**To increase effective use of the online professional learning through improved teacher training:** • Require teachers and administrators to participate in training as a condition of receiving an Edivate license. • Distribute trainings over the year so that teachers can get their questions answered after using the platform. • Offer different levels of training (beginning, advanced, etc.) • Study usage rates and provide targeted training to schools or districts that are not fully utilizing the system.
Some teachers indicated the platform was not intuitive and often did not work. These results indicate that the majority of teachers are not using the program as intended and may not be getting the full benefit of the program features.	**To increase effective use of the online professional learning through improved professional learning platforms:** • Provide options beyond Edivate to address teachers' frustrations with Edivate. • Focus additional evaluation resources on understanding why teachers are not using the platform more. • Work with teachers and schools to resolve specific frustrations with the platform.

Addendum to the 2016-17 STEM Action Center Program Evaluation

Analysis A: 2016-17 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 the fall of 2017 for the 2016-17 school year. At that time, student outcomes data were not yet available to the UEPC. Therefore, this addendum provides analyses of student outcomes associated with student use of the mathematics personalized learning software that was not available at the time the annual report was submitted. This analysis (Analysis A) is inclusive of identified software users during the 2016-17 academic year.[1] The UEPC presented these analyses to the STEM Action Center Board of Directors on 01/10/2018 and the Public Education Appropriations Subcommittee on 01/23/2018. The STEM Action Center distributed highlights from this analysis to the Public Education Appropriations Subcommittee in the form of a one-page infographic.

In these analyses, non-users are defined as students who did not use any of the five math software programs funded by the STEM Action Center 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.

This addendum is separated into two parts. The first part focuses on findings and contains a minimum amount of technical information. The second part, 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 and mean growth percentiles (MGP) 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. Do any of the vendor programs appear to have a stronger association with student achievement even after controlling the known factors that are related to the SAGE math scores?
4. What should the recommended minimum amount of time (minutes of use) be for each vendor program at each grade level? How many minutes of use for each program is needed to have an increase of 1-point percentile on the MGP in math?

[1] Post analysis, ALEKS and the STEM Action Center notified the UEPC that some students in the 2016-17 school year had been classified as non-users although they had used the ALEKS software. ALEKS indicated that this was due to a software setting at the local site level. Due to this software setting error, the UEPC will conduct additional analyses once the data reporting issue has been resolved.

Data Sources

Software vendors provided 2016-17 student usage data to the UEPC on a monthly basis through a secure platform. Student education data were provided to the UEPC following a data request and data sharing agreement. Student outcome variables included 2017 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 2016 SAGE mathematics raw scores and proficiency, grade level, gender, race and ethnicity, low-income (based on qualification for free or reduced lunch), school Title I status, and school type (elementary vs. secondary.)

Sample

There were 154,228 students identified as STEM AC math software users (see Table 1).[2] These include students using licenses purchased by the STEM Action Center as well as 9,990 students using other licenses for these five programs. Some students used more than one software program, leading to a combined percentage larger than 100. Of those students, 122,651 (80%) could be matched with their student 2017 SAGE data and 121,353 (79%) could be matched with 2016 SAGE data.

There were 399,515 students in the education data with 2017 SAGE math scores who did not use the math software during 2016-17. Almost all of these students (99%) could also be matched with 2016 SAGE data. Students who did not use the software were used as a comparison group in the analyses.

Almost half of the sample used in the outcomes analyses used ALEKS software (46%), while relatively few used Ascend Math (4%).

Use Levels

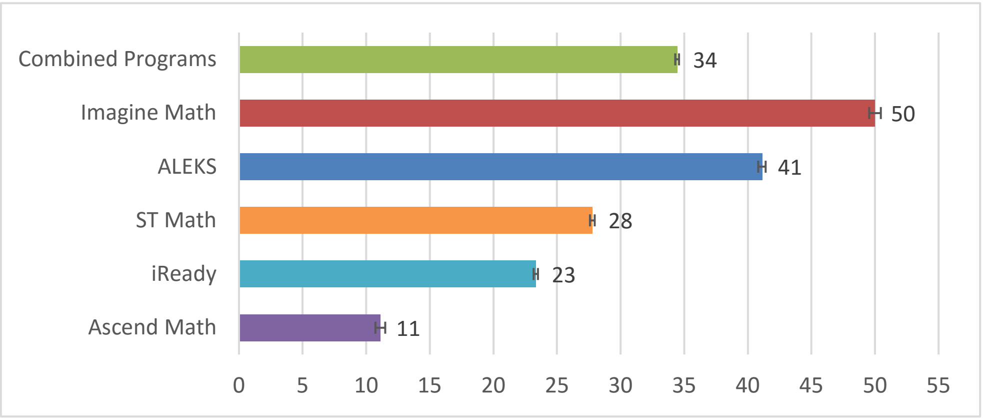
For all software programs combined, students used the software an average of 34 minutes per week (see Figure 1).

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

Software Vendor	N of Users	% of Users	N of Users with SAGE Scores	% of Users with SAGE Scores	Match Rate of Users with SAGE
ALEKS	58,331	38%	55,824	46%	82%
ST Math	35,670	23%	19,921	16%	92%
iReady	33,809	22%	22,095	18%	89%
Imagine Math	22,377	15%	22,025	18%	92%
Ascend Math	6,599	4%	4,829	4%	88%
Total Users (All Programs)	**154,228**	**100%**	**122,651**	**100%**	**87%**

Source: Vendor Usage Data and Student Education Data
See also appendix Tables 2 and 3 (pp. 13-14).
The match rate is calculated by subtracting K-2 students from the total users and dividing by the number of users with SAGE scores.

Figure 1. Average Minutes per Week Students Used Each Program



Source: Vendor Usage Data
See also appendix Table 2 (p. 13).
Error bars represent the 95% confidence intervals.
Minutes per week were calculated based on a 36-week school year.

[2] Students may be duplicated in this sample, as described in the appendix.

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.

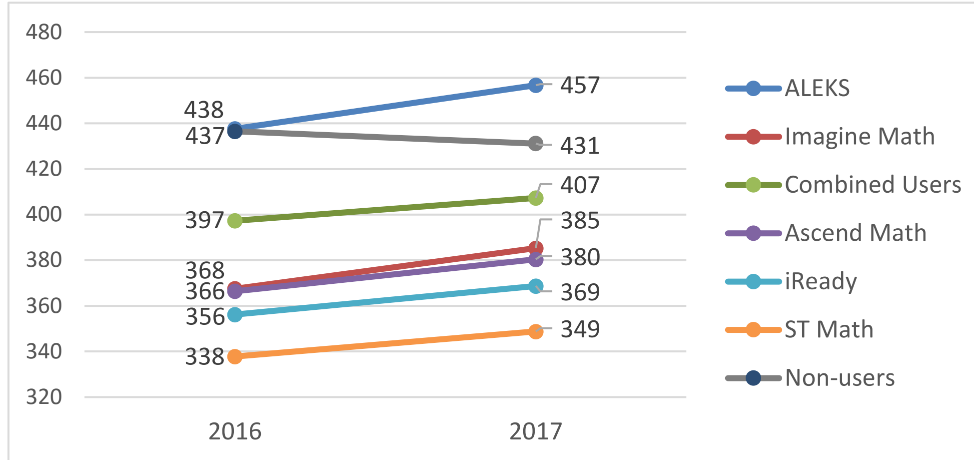
Raw SAGE Scores. SAGE raw scores were different between software users and non-users in both 2016 and 2017. Overall, students who used the software in 2016-17 had lower average SAGE scores in the previous year than students who did not use the software. (ALEKS users are the exception.) Student math scores were also different across the five software vendor categories (see Figure 2).

On average, users of all five programs had higher scores in 2017 than in 2016. Non-users had slightly lower SAGE scores in 2017. Because students who used the software started out lower than non-users at the beginning of 2016-17, a simple comparison of raw SAGE scores is not the best assessment of the relationship between program use and student math outcomes.

SAGE Mathematics Proficiency. The percentage of students who were proficient in 2016 and 2017 are provided in Table 9 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, 2017 proficiency rates are presented in two groups based on proficiency in 2016 (see Figure 3).

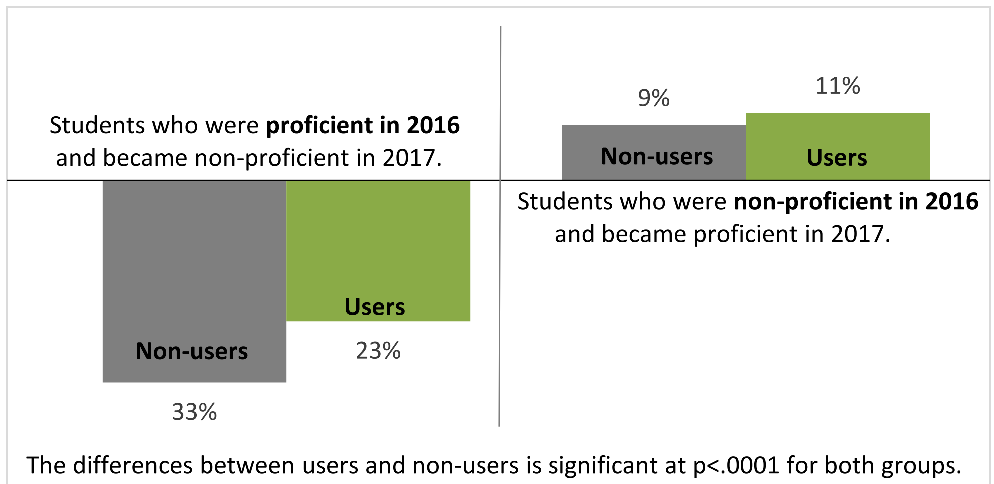
Fewer students who were proficient in math in 2016 became non-proficient in 2017 in the software user group than in the non-user group. Similarly, more students who were non-proficient in math in 2016 became proficient in 2017 in the software user group than in the non-user group (Figure 3).

Figure 2. Raw SAGE Math Scores in 2016 and 2017 for Students who used the Software in 2016-17



Source: Vendor Usage Data and Student Education Data
See also appendix Tables 3 and 4 (pp. 14-16), and Figures 9 and 10 (pp. 17-18).

Figure 3. Percentage of Students who Changed Math Proficiency From 2016 to 2017

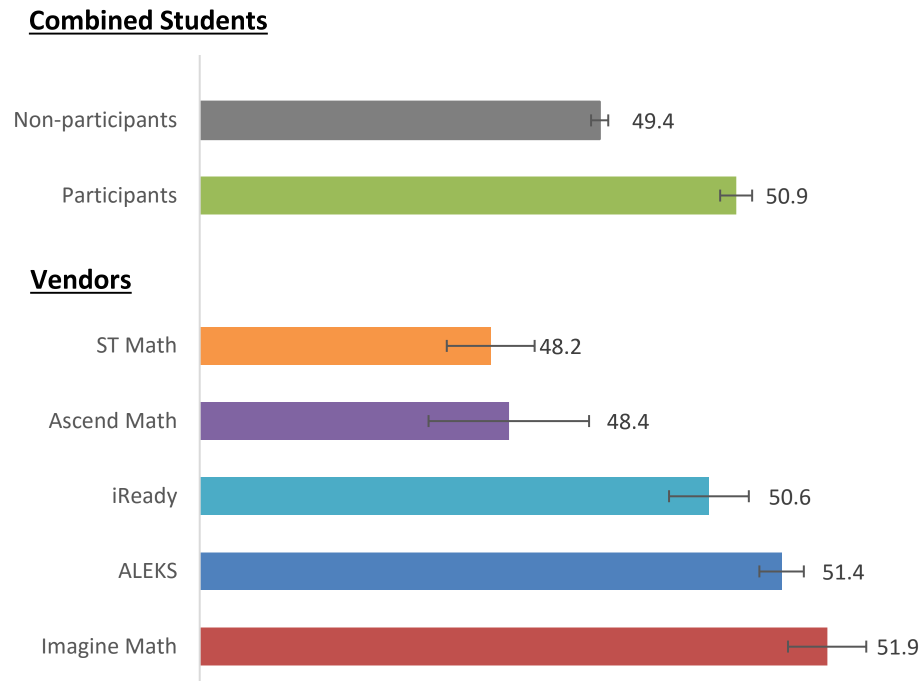


Source: Vendor Usage Data and Student Education Data
See also appendix Table 5 (p. 19).

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. 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.

Students who used any software program in the 2016-17 school year were 1.5 percentile points higher than students who did not use any software programs.

Figure 4. Mean Student Growth Percentiles for Users by Category



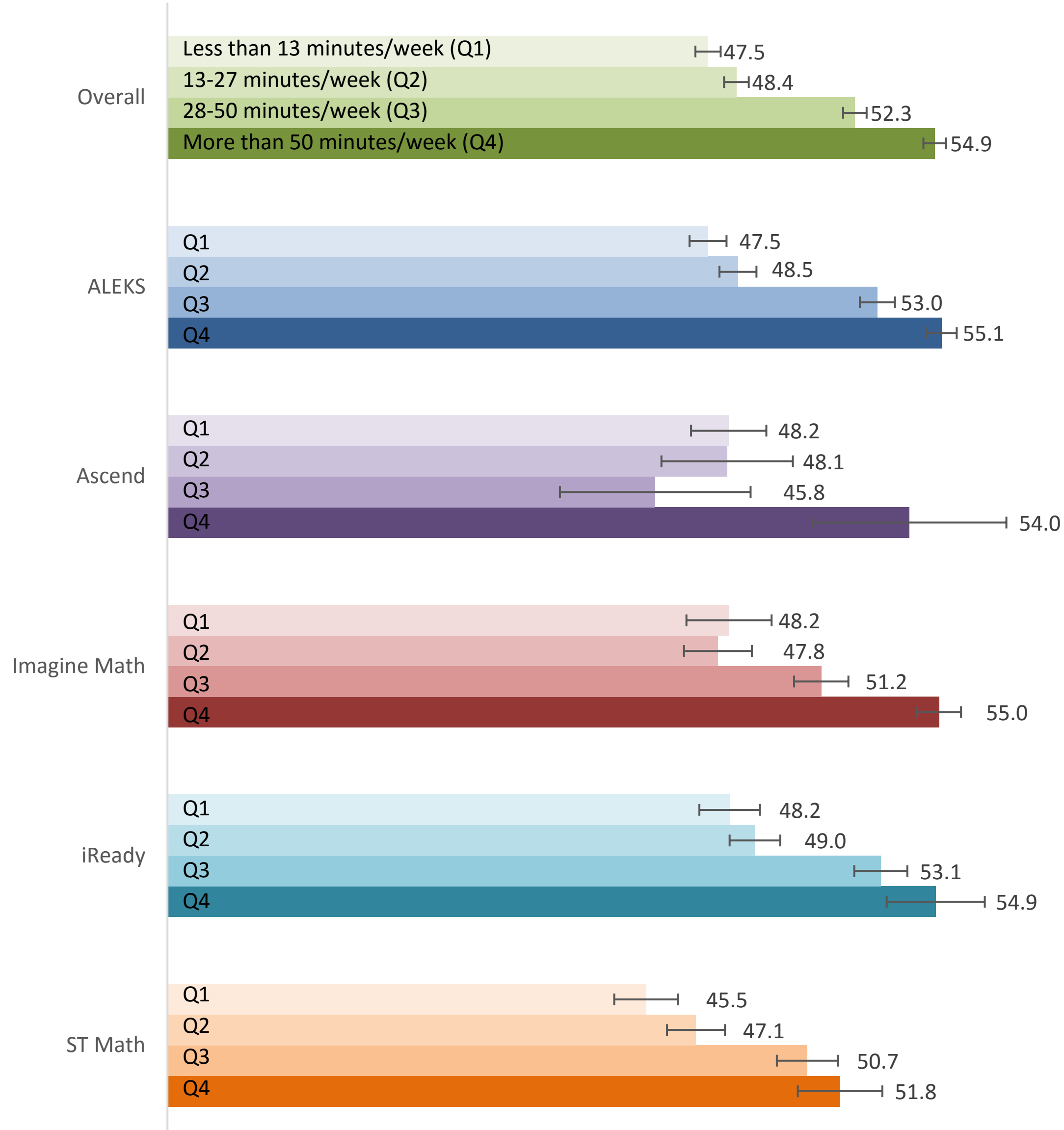
Source: Vendor Usage Data and Student Education Data
Error bars represent the 95% confidence intervals.
See also appendix Tables 6 through 9 (pp. 20-22, 25), and Figures 11 and 12 (pp. 23-24).

SAGE Student Growth Percentiles by Use Quartile and Vendor. In order to compare levels of use for student outcomes, we divided students into four equal groups (quartiles) based on average use per week. Quartile 1 included all students who used the programs less than 13 minutes per week. Quartile 2 included students who used the programs 13 to 27 minutes per week, Quartile 3 included students used the programs 28-50 minutes per week, and Quartile 4 included students who used the programs more than 50 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 50 minutes per week, were 5.5 percentile points higher than non-users on SAGE growth percentiles.[3]

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 10 through 17 (pp. 26-33).
Error bars represent the 95% confidence intervals.

[3] 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.

Predictive Analyses

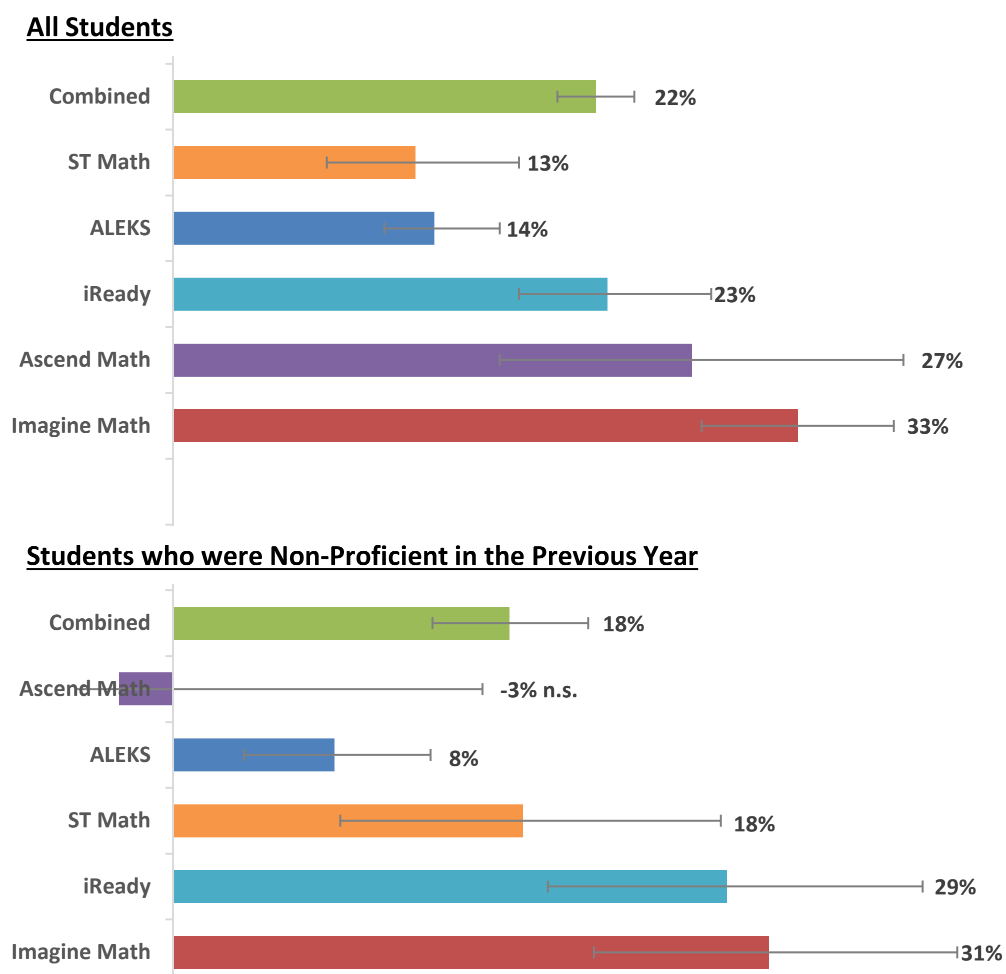
Increase in Likelihood of Proficiency. We used 2016 SAGE mathematics scores and demographic information to compare students to similar peers to determine whether there was a relationship between program use and SAGE outcomes. By comparing students to similar peers rather than looking at the simple comparisons 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 2016-17 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 22% 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 18% more likely to be proficient if they used one of the programs.

All five software programs were associated with increased likelihood of proficiency. All but Ascend Math were associated with increased likelihood of proficiency among students who were non-proficient in the previous year.

Figure 6. Increase in Likelihood of Math Proficiency by Category



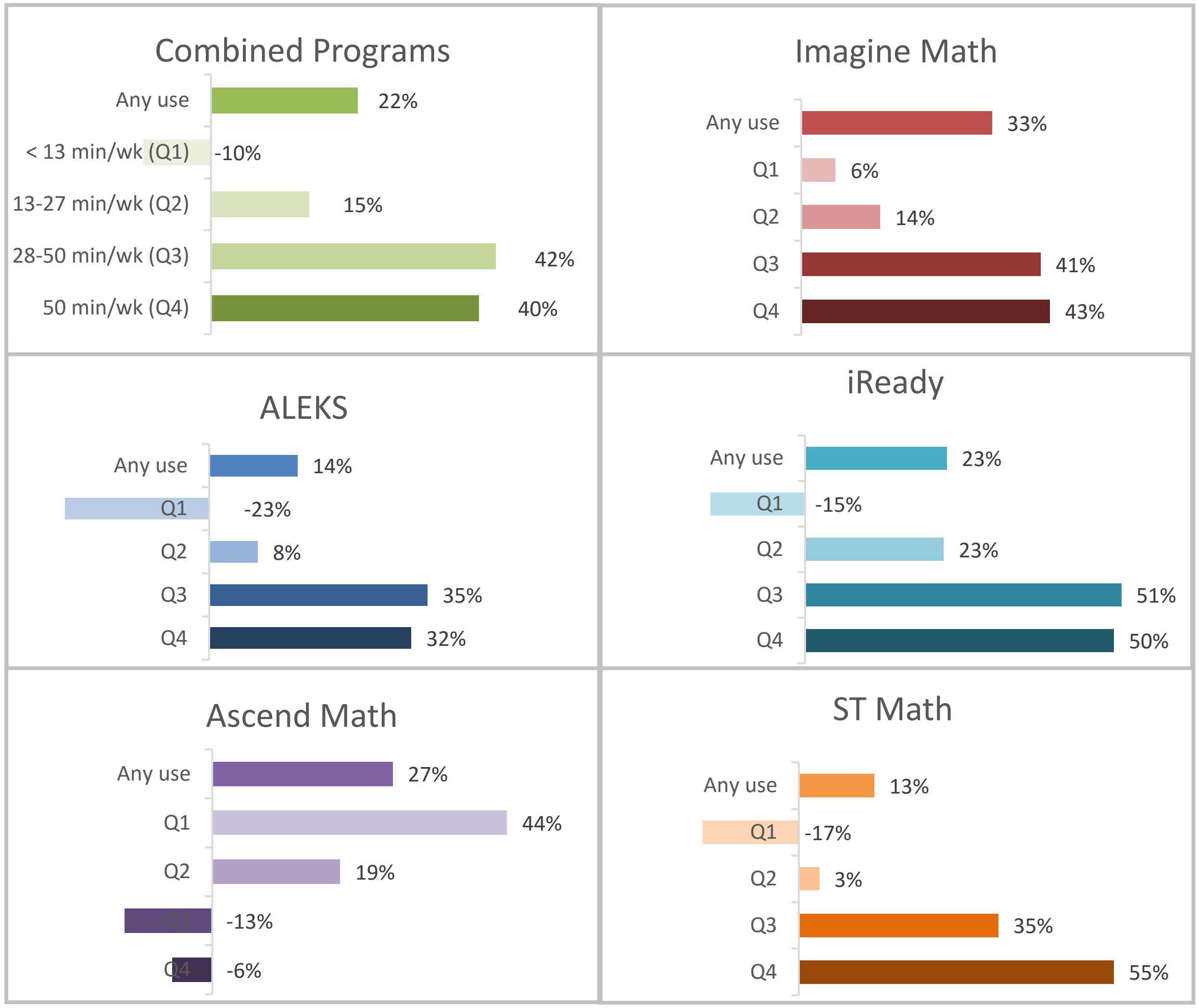
Source: Vendor Usage Data and Student Education Data
Error bars represent the 95% confidence intervals.
Variables held constant include school type (elementary or secondary), school Title I status, free or reduced lunch eligibility, race/ethnicity, gender, and 2016 SAGE math raw score.
See also appendix Tables 18 and 19 (pp. 34-35).

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 28 minutes or more per week were over 40% 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 SAGE scores and demographics. The exception is Ascend Math, which showed the opposite pattern. Because the sample size of Ascend Math users was small (less than 4% of the total users with SAGE scores) and the average weekly use rate was 11 minutes (with the mean falling within the first quartile), the Ascend Math results in this analysis should be interpreted with caution.

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), school Title I status, free or reduced lunch eligibility, race/ethnicity, gender, and 2016 SAGE math raw score.
See also appendix Tables 18 (p. 34) and 20-25 (pp. 36-41). Figure 13 on page 42 provides the same figures with error bars.

Ideal Amount of Time on Software

The quartile analyses shown in Figure 7 above indicate that, with the exception of Ascend, the software has the greatest relationship to achievement when students are using the programs a minimum of 28 minutes per week. We were also interested in looking at the maximal use levels for each software program at different grade levels.

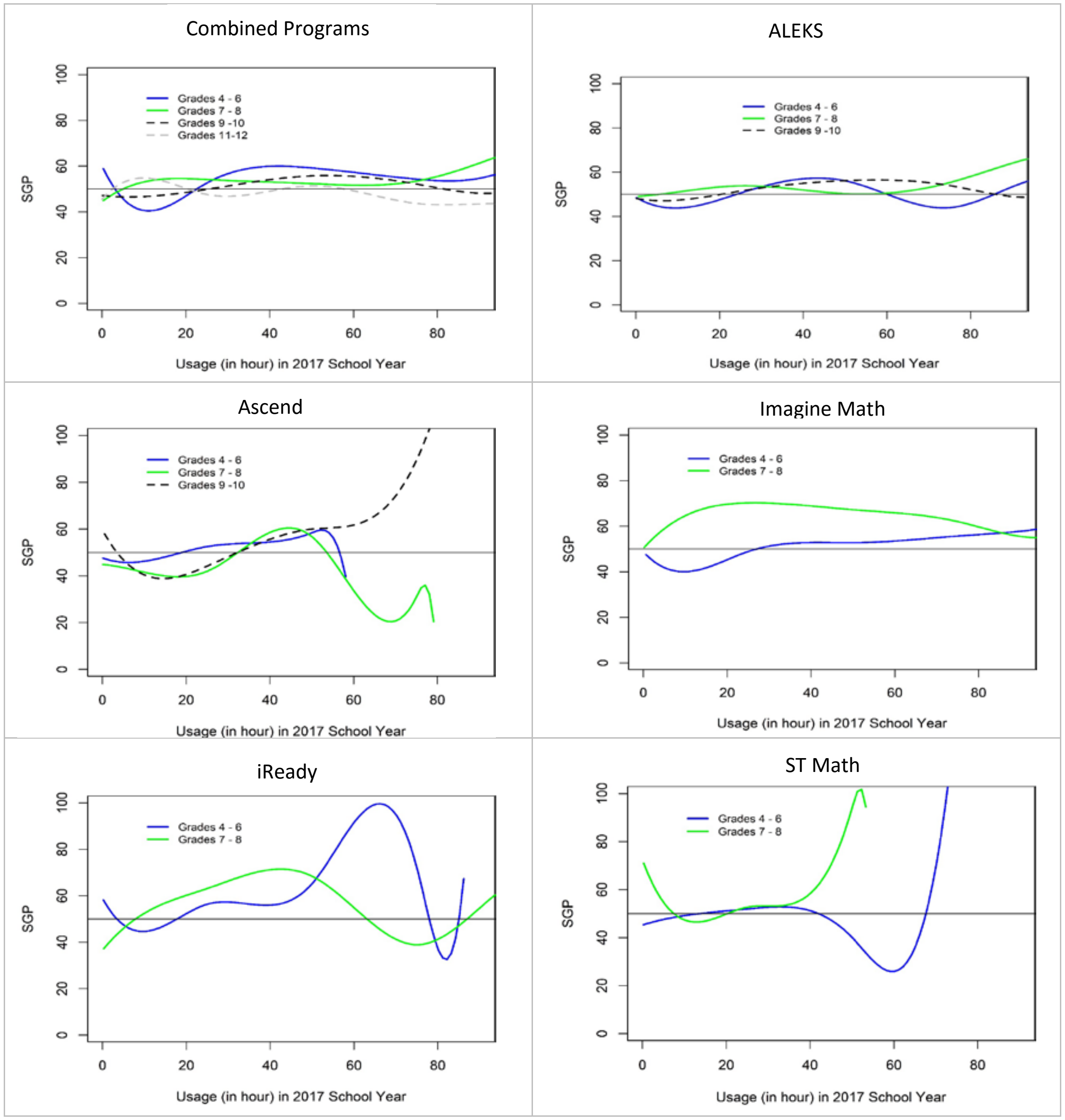
Figure 8 provides MGPs for each program and combined programs by four grade level ranges by amount of time spent on the program.[4] These six graph show that there is not necessarily an easy answer to the optimal amount of time for any grade to use a specific software product.

Additionally, because students are not randomly assigned to amount of use, we cannot assume that amount of use is driving math performance. Student amount of use may be attributed to many factors. For example, students who use the program very little may be disengaged with mathematics or school irrespective of the software program. Students who used the programs a lot may enjoy math and choose to spend more time on the program; alternatively, they may be struggling with math and need to spend additional time on the program to catch up with peers.

Instances where SGPs are very high or very low may not be reliable and may be a result of small sample sizes at that use level. Additional research is needed in this area.

Larger images of these figures are provided in the appendix.

Figure 8. Mean SAGE Growth Percentile Scores (MGPs) by Use in Hours per School Year, Grade Range, and Program



Source: Vendor Usage Data and Student Education Data
See also appendix Figures 14 through 19 (pp. 43-48).

[4] Hours per school year can be changed to minutes per week by multiplying hours by 1.67 (i.e., dividing by 36 weeks/year and multiplying by 60 minutes/hour).

Conclusions

Overall, our analyses indicated that for all three SAGE math outcome measures that were considered (raw score, 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. Additionally, while average raw scores for users of all five programs increased, the average for non-users decreased from 2016 to 2017. For proficiency, among students who were proficient in math in 2016, fewer users became non-proficient than non-users. Among students who were not proficient in 2016, more users became proficient in 2017 than non-users. Finally, on average, users' math SGPs were 1.5 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 28 minutes or more per week, and students who used the program more than 50 minutes per week had SGPs that were 5.5 percentile points higher than non-users.

Predictive analyses were also very positive. After controlling for previous year math SAGE scores and demographic variables (including school type, school Title I status, free or reduced lunch eligibility, race or ethnicity, and gender), software users were 22% 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 25 minutes or more per week were over 40% more likely to be proficient than non-users.

The interpretation of the analyses comparing the five vendors is complicated by differences between the programs. Programs had different sample sizes, different levels of use, and in some cases were used predominantly by different grade levels. The patterns of outcomes for the various software vendors are not straightforward. For example, Imagine Math users had the highest rate of overall increase in likelihood of math proficiency, with an increase of 33% over non-users. ST Math had the lowest increase, with an increase of 13% over non-users. However, the analysis of quartile use levels indicates that ST Math users in the 4^{th} use quartile had the highest increase in likelihood of proficiency, with a 55% increase over non-users.

Finally, ideal amount of time on software is also difficult to interpret due to differences between the programs. Based on these analyses, the ideal amount of time appears to be different for different grades and different software vendors. Further analyses are needed before strong conclusions can be drawn on this question.

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 Sources

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

Vendor Data

Five math learning platforms were included in the evaluation, including ALEKS, Ascend Math, Imagine Math, iReady, and ST Math. Student usage from vendors were collected every month for the current evaluation cycle starting in September 2016 and going through June 2017.

State Student IDs (SSIDs)

Schools who received STEM AC funding submitted SSIDs of student users to be used in the evaluation.

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

In these analyses, the outcomes of interest included software usage level, SAGE scaled (raw) scores, standardized growth percentiles (SGPs), and proficiency. Each analysis required different study populations, which had varying sample sizes. The largest sample size is for software usage, because it includes all students documented in the vendor data (grades K through 12). The analysis of SAGE raw scores included a subset of the full population because it only includes students in grades three or above who took the SAGE math test. The SGP analysis is smaller still because it only includes students in grade four or above who took the SAGE math test and had an SGP. Finally, in the analyses where 2016 SAGE math scores were held constant, only students who had both 2016 and 2017 SAGE math scores were included in the sample.

A small number of 12th grade students were represented in the data described above. Because the sample sizes were too small, the evaluation team excluded all 12th grade students from the analyses.

Data 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, school Title I math status, low income status, race/ethnicity, and gender where appropriate.
2. Due to cases of unrealistic minutes of use reported, we implemented a rule that any student who had greater than 99.95% of all users’ usage would be counted as missing. In addition, if a user had less that one minute, that user's data was counted as missing as well. Student program users whose minutes were missing were still counted as users, but they were not included in the usage analysis.
3. Student t-tests were used to test whether there were statistically significant differences 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 and SGPs. Student grade level, school type, school Title I math status, low income status, race/ethnicity, and gender were held constant in the multiple linear regression.

5. Logistic regression was used to analyze whether software use predicted student math proficiency. Different combinations of student grade level, school type, school Title I math status, low income status, race/ethnicity, and gender were controlled in different models.
6. Logistic regression was used to analyze the relationship between different usage quartiles and proficiency. Usage quartiles were defined as the ranges of minutes that divided the entire user population (all software programs combined) into four equal sized groups. Student grade level, school type, school Title I math status, low income status, race/ethnicity, and gender were controlled in the different models.
7. Linear regression was used to compare SGPs of students in different usage quartiles. Student grade level, school type, school Title I math status, low income status, race/ethnicity, and gender were controlled in the different models.
8. Smooth spline fit was used to identify the relationship between the minutes of use and SGP.

Limitations

1. Name spelling variations and typos in the data may have caused some incorrect matching. Name matching was conducted in two steps. First, we conducted an exact match. For the remaining unmatched students, we used a fuzzy matching technique. Students who were not matched in the exact or fuzzy match were classified as non-users. Match rates were very high, with 94.9% of unique software logins able to be matched to the SSIDs reported from schools and districts, and 92.3% of those matched SSIDs were able to be matched to USBE data. Therefore, after the two step process, 87.6% of the unique logins reported by software vendors were able to be matched to USBE data. This is high especially considering that the unique logins provided by vendors included instructor logins and logins used for training purposes.
2. Some students are duplicated in the analyses because they attended multiple schools or took multiple math tests. Approximately 10% of students in the analyses were duplicates. This issue will be addressed in the next evaluation cycle.
3. Data on student usage were reported for the entire school year, 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. This issue will be addressed in the next evaluation cycle.

Detailed Results Tables

Table 2. Sample Size (N), Average Minutes of Use per Week (M),[5] and Standard Deviation (SD) of Use by Demographics for Each Program (2016-17)

	Any Use			ALEKS			Ascend Math			iReady			ST Math			Imagine Math		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
Overall	154,228	35	34	58,331	41	40	6,599	11	18	33,809	23	18	35,670	28	20	22,377	50	39
Grade Level																		
K	6,101	20	18	57	31	28	214	2	4	2,480	15	14	3,356	24	18	41	52	42
1	10,526	25	19	66	47	42	641	1	2	4,008	21	15	5,881	28	18	54	37	34
2	11,643	26	21	134	28	31	705	3	5	4,664	22	16	6,254	31	21	63	40	28
3	17,314	33	29	2,245	33	31	1,020	7	10	4,856	24	17	5,526	30	21	4,009	52	39
4	18,304	33	29	2,952	35	31	1,166	10	16	4,941	25	18	5,187	28	21	4,447	52	37
5	17,688	35	32	3,649	36	33	1,021	10	12	4,396	26	19	4,778	25	19	4,252	56	41
6	17,729	37	36	4,821	39	38	781	21	23	4,330	23	19	3,581	23	19	4,727	58	44
7	14,856	37	33	10,032	39	35	176	25	26	1,720	25	17	345	24	17	2,746	40	31
8	13,661	43	40	10,171	49	43	243	28	27	1,533	22	17	258	21	18	1,572	27	26
9	12,117	52	48	11,538	53	48	185	35	29	100	27	24	168	19	18	174	35	30
10	7,004	35	37	6,704	35	37	117	26	22	114	25	18	32	24	11	67	20	21
11	3,978	30	34	3,712	30	34	120	19	19	105	30	24	46	30	16	31	44	23
12	3,307	33	35	2,250	32	35	210	9	15	562	35	31	258	29	22	194	42	33
Type of school																		
Elementary (K-6)	99,305	32	29	13,924	36	34	5,548	9	14	29,675	23	17	34,563	28	20	17,593	54	41
Secondary (7-12)	54,923	41	40	44,407	43	42	1,051	24	25	4,134	26	20	1,107	24	19	4,784	35	30
Title I Math																		
No	150,637	35	34	58,157	41	40	4,672	13	19	32,472	24	18	35,541	28	20	22,296	50	39
Yes	3,591	14	19	174	50	34	1,927	7	13	1,337	17	13	129	19	15	81	26	18
Low income																		
No	86,572	38	35	35,841	43	40	4,191	11	17	16,881	23	18	15,144	30	20	15,675	54	39
Yes	67,656	31	31	22,490	39	40	2,408	12	18	16,928	23	18	20,526	26	19	6,702	43	38
Race/Ethnicity																		
African American	3,206	36	34	783	44	42	64	20	21	603	24	21	1,488	30	22	343	55	48
Am. Indian/Alaskan	2,728	29	29	994	34	38	41	10	14	1,123	23	19	467	25	19	135	45	42
Asian	2,515	37	35	635	43	40	49	11	18	379	24	18	1,186	29	20	315	52	39
Hispanic/Latino	30,091	30	29	8,676	36	39	657	12	18	7,443	23	19	10,943	26	19	3,041	42	38
Multiple race	3,650	26	28	1,202	35	37	119	9	16	842	19	14	847	23	19	704	38	37
Pacific Islander	2,851	33	33	703	35	37	42	11	15	351	20	16	1,417	22	17	413	37	34
White	109,187	31	30	45,338	38	36	5,627	10	16	23,068	21	16	19,322	26	18	17,426	47	35
Gender																		
Female	74,837	36	34	28,374	39	37	3,255	10	15	16,303	21	16	17,330	25	18	10,765	46	35
Male	79,391	34	33	29,957	36	35	3,344	10	16	17,506	21	16	18,340	25	18	11,612	45	36

Source: Vendor Usage Data and Student Education Data

[5] Based on a 36-week year.

Table 3. Sample Size (N), [6] Average Math SAGE Scores (M), and SAGE Score Standard Deviation (SD) by Demographics for Users of Each Program and Non-users (2016-17)

	Any Use			ALEKS			Ascend Math			iReady			ST Math			Imagine 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 2015-16 based on 2016-17 software use.																					
2016-17	109,250	407	93	47,524	457	97	4,434	380	63	20,184	369	70	18,495	349	63	20,433	385	71	296,869	431	108
2015-16	93,840	397	85	47,491	438	87	3,395	366	57	15,281	356	61	12,842	338	55	16,275	368	60	298,966	437	106
Grade Level																					
3	16,378	314	37	2,116	318	34	991	326	30	4,601	312	37	5,208	307	38	3,785	320	36	37,435	313	35
4	17,236	345	45	2,781	346	43	1,129	359	39	4,630	342	45	4,846	335	47	4,205	352	44	36,378	345	43
5	16,565	375	52	3,409	375	50	978	387	46	4,077	373	52	4,473	364	53	4,002	383	50	34,961	377	51
6	16,402	409	61	4,474	411	60	752	426	53	3,975	411	59	3,319	393	65	4,362	413	60	33,233	412	58
7	13,477	444	65	9,274	448	64	143	423	57	1,441	430	73	292	434	55	2,452	439	66	36,155	443	67
8	12,327	481	77	9,269	487	75	207	449	70	1,294	449	83	216	462	77	1,444	478	79	35,717	481	79
9	10,381	502	92	9,967	504	92	149	457	89	60	412	106	109	455	109	133	476	66	36,405	508	98
10	5,631	521	110	5,419	524	109	80	442	84	80	414	123	25	504	99	48	392	103	37,680	538	114
11	853	510	132	815	514	131	N<10	--	--	26	363	97	N<10	--	--	N<10	--	--	8,905	547	117
Type of school																					
Elementary (K-6)	66,581	361	60	12,780	372	61	3,850	371	55	17,283	357	61	17,846	345	59	16,354	368	59	142,007	360	60
Secondary (7-12)	42,669	480	89	34,744	488	89	584	444	76	2,901	437	81	649	451	80	4,079	453	74	154,862	496	100
Title I Math																					
No	106,912	409	94	47,368	457	97	3,152	388	67	19,383	370	70	18,424	349	63	20,370	385	71	293,742	432	107
Yes	2,338	354	54	156	392	81	1,282	362	48	801	337	50	71	320	50	63	354	60	3,127	342	63
Low income																					
No	63,526	427	93	29,770	474	95	2,800	384	62	10,116	388	69	7,254	371	62	14,364	391	69	185,679	449	109
Yes	45,724	380	87	17,754	427	93	1,634	374	65	10,068	350	65	11,241	335	60	6,069	372	73	111,190	401	98
Race/Ethnicity																					
African American	1,978	348	79	546	402	92	40	359	63	362	332	58	786	315	58	299	352	69	4,242	387	97
Am. Indian/Alaskan	1,690	375	87	763	426	83	23	359	77	536	328	63	275	322	57	116	381	75	3,061	395	99
Asian	1,674	407	93	517	467	100	33	400	54	224	384	77	644	361	63	301	417	88	5,709	465	118
Hispanic/Latino	20,033	368	80	6,680	414	88	433	359	66	4,600	342	62	6,013	332	56	2,803	370	73	53,616	397	96
Multiple race	2,537	394	85	982	436	97	81	366	68	467	366	65	414	357	58	640	376	67	7,652	426	105
Pacific Islander	1,868	373	82	515	429	95	28	360	69	243	354	59	768	338	55	379	374	77	4,996	404	95
White	79,470	421	94	37,521	467	97	3,796	384	62	13,752	380	70	9,595	363	64	15,895	389	70	217,593	441	108
Gender																					
Female	53,175	409	92	23,063	460	94	2,181	382	62	9,836	369	69	9,083	349	62	9,881	386	70	144,001	433	105
Male	56,075	406	94	24,461	454	100	2,253	379	64	10,348	369	71	9,412	348	64	10,552	385	72	152,868	430	109

Source: Vendor Usage Data and Student Education Data

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

Table 4 displays the results of t-tests of comparisons of average raw math SAGE scores in each demographic category. For example, 3rd grade students who used the software had raw SAGE scores that were statistically significantly higher than 3rd grade students who did not use the software ($p<.006$). In the 4th grade, there was no difference between the user and non-user groups ($p=.4144$). Table 5 does not take into account pre-existing differences between students, and therefore is not a good measure of the relationship between program use and math performance. Table 4 is provided for reference only.

Table 4. Statistical Tests for Students by Demographic Categories on Average Math SAGE Scores

Variable	Use Status	N	Mean	STD Dev	STD Err	95% Confidence Limit		p-value
						Lower	Upper	
Overall	No	296,869	431.1	107.50	0.20	430.8	431.5	<0.0001
	Yes	109,250	407.3	93.28	0.28	406.8	407.9	
By grade level								
3	No	37,435	313.4	35.03	0.18	313.0	313.7	0.006
	Yes	16,378	314.3	36.48	0.29	313.7	314.8	
4	No	36,378	345.1	43.44	0.23	344.6	345.5	0.4144
	Yes	17,236	344.7	45.16	0.34	344.1	345.4	
5	No	34,961	376.6	50.58	0.27	376.0	377.1	<0.0001
	Yes	16,565	374.7	51.74	0.40	373.9	375.5	
6	No	33,233	411.8	57.72	0.32	411.2	412.4	<0.0001
	Yes	16,402	409.1	60.63	0.47	408.2	410.1	
7	No	36,155	443.0	67.43	0.35	442.3	443.7	0.11
	Yes	13,477	444.0	65.25	0.56	442.9	445.1	
8	No	35,717	481.0	78.64	0.42	480.2	481.9	0.9778
	Yes	12,327	481.1	77.43	0.70	479.7	482.4	
9	No	36,405	508.4	98.08	0.51	507.4	509.4	<0.0001
	Yes	10,381	501.9	92.02	0.90	500.2	503.7	
10	No	37,680	538.3	113.60	0.59	537.2	539.5	<0.0001
	Yes	5,631	520.8	110.00	1.47	517.9	523.7	
11	No	8,905	546.9	117.30	1.24	544.4	549.3	<0.0001
	Yes	853	510.3	132.50	4.54	501.4	519.3	
School Type								
Elementary (K-6)	No	142,007	360.1	59.51	0.16	359.8	360.4	0.087
	Yes	66,581	360.6	60.41	0.23	360.1	361.0	
Secondary (7-12)	No	154,862	496.3	100.00	0.25	495.8	496.8	<0.0001
	Yes	42,669	480.3	88.59	0.43	479.4	481.1	
Title I Math								
No	No	293,742	432.1	107.40	0.20	431.7	432.5	<0.0001
	Yes	106,912	408.5	93.62	0.29	407.9	409	
Yes	No	3,127	341.5	63.21	1.13	339.3	343.7	<0.0001
	Yes	2,338	354.3	54.19	1.12	352.1	356.5	

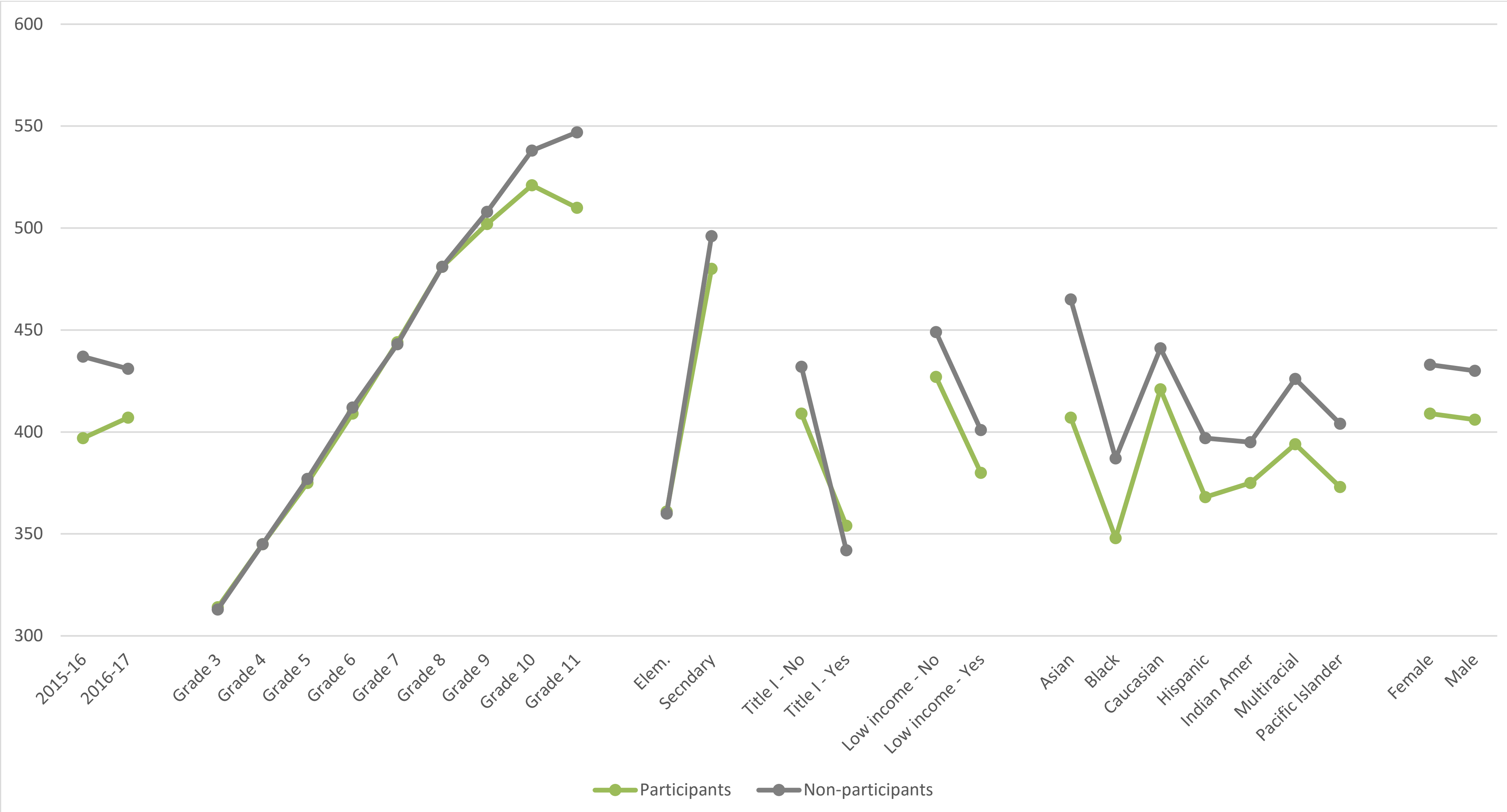
Table 4. Statistical Tests for Students by Demographic Categories on Average Math SAGE Scores (continued from previous page)

Variable	Use Status	N	Mean	STD Dev	STD Err	95% Confidence Limit		p-value
						Lower	Upper	
Low income								
No	No	185,679	449.4	108.70	0.25	448.9	449.9	<0.0001
	Yes	63,526	426.9	93.00	0.37	426.2	427.7	
Yes	No	111,190	400.7	98.01	0.29	400.1	401.3	<0.0001
	Yes	45,724	380.0	86.56	0.40	379.3	380.8	
Race/Ethnicity								
Asian	No	5,709	465.0	118.3	1.57	461.9	468.1	<0.0001
	Yes	1,674	406.5	93.19	2.28	402.0	411.0	
African American	No	4,242	386.8	96.58	1.48	383.9	389.7	<0.0001
	Yes	1,978	348.1	78.70	1.77	344.6	351.6	
White	No	217,593	440.9	108.20	0.23	440.4	441.3	<0.0001
	Yes	79,470	420.7	93.51	0.33	420.1	421.4	
Hispanic/Latino	No	53,616	396.9	96.00	0.41	396.1	397.7	<0.0001
	Yes	20,033	367.6	79.89	0.56	366.5	368.7	
Am. Indian/Alaskan	No	3,061	395.0	99.18	1.79	391.5	398.5	<0.0001
	Yes	1,690	374.9	87.27	2.12	370.7	379.1	
Multiple race	No	7,652	426.4	104.6	1.2	424	428.7	<0.0001
	Yes	2,537	394.4	85.26	1.69	391.1	397.7	
Pacific Islander	No	4,996	403.9	94.66	1.34	401.3	406.6	<0.0001
	Yes	1,868	372.8	81.52	1.89	369.1	376.5	
Gender								
Female	No	144,001	432.5	105.4	0.28	432	433	<0.0001
	Yes	53,175	408.8	92.32	0.4	408.1	409.6	
Male	No	152,868	429.9	109.3	0.28	429.3	430.4	<0.0001
	Yes	56,075	405.9	94.15	0.4	405.1	406.6	

Source: Vendor Usage Data and Student Education Data

Figure 9 provides a graphical representation of average raw SAGE scores provided in Tables 3 and 4. Figure 9 does not take into account pre-existing differences between students, and therefore is not a good measure of the relationship between program use and math performance. Figure 9 is provided for reference only.

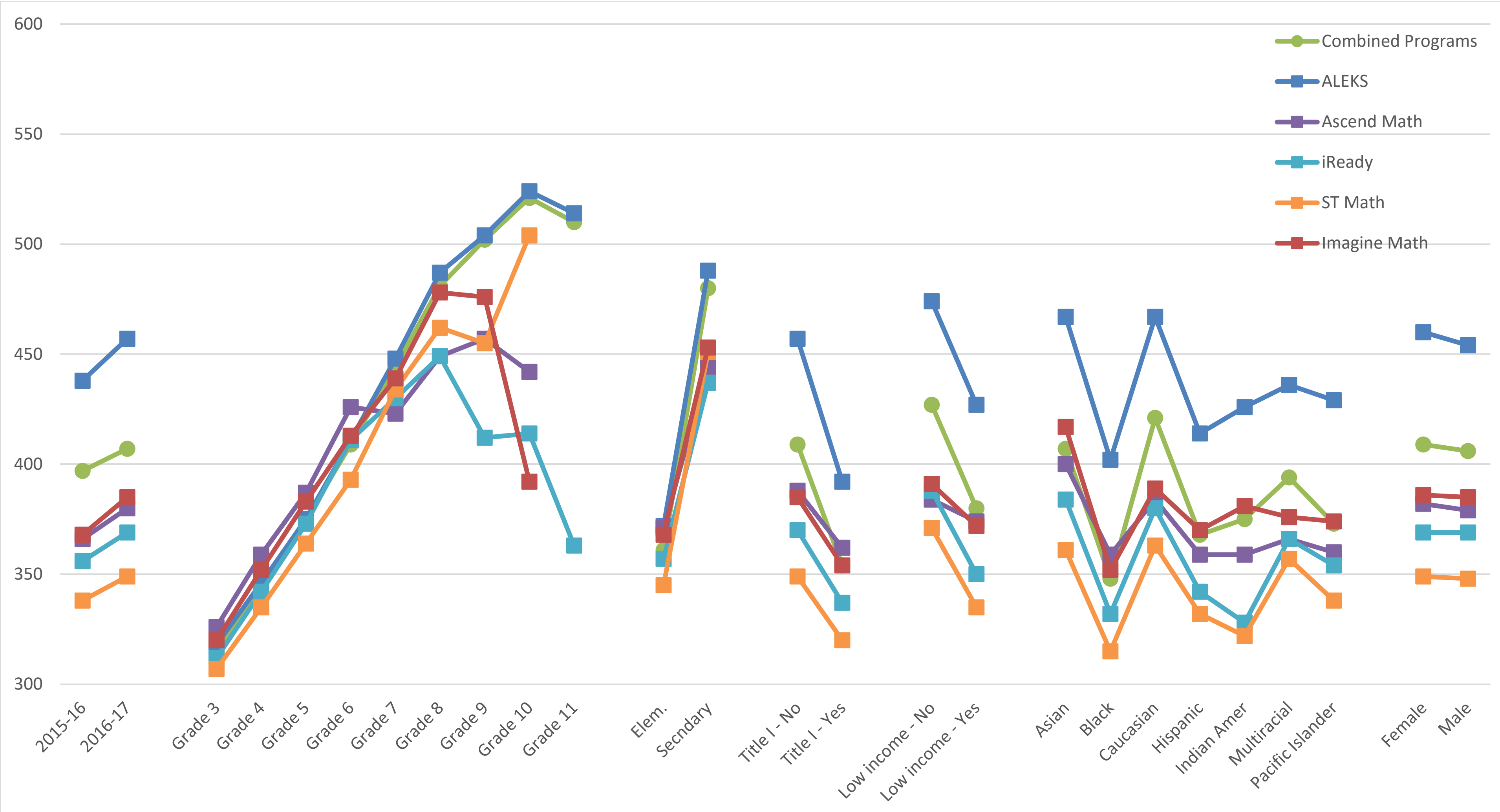
Figure 9. Comparison of Average Math SAGE Scores Between Users and Non-users by Demographic Category



Source: Vendor Usage Data and Student Education Data

Figure 10 provides a graphical representation of the mean data provided in Table 3. Figure 10 does not take into account pre-existing differences between students, and therefore is not a good measure of the relationship between program use and math performance. Figure 10 is provided for reference only.

Figure 10. Comparison of Average Math SAGE Scores by Demographic Category and Vendor



Source: Vendor Usage Data and Student Education Data

The top rows of Table 5 (Overall) provide the numbers of students in each proficiency category (proficient, not proficient, and missing) for users and non-users in the 2015-16 and 2016-17 school years. The bottom rows (2016-17 Proficiency by Status of Previous Year) provide 2016-17 proficiency by previous year proficiency category.

Table 5. Proficiency Comparison Between 2017 and 2016, and 2017 Proficiency by Proficiency Status in Previous Year

	Is Proficient	Non-users Frequency	Non-users Percent (%) Proficient	Users Frequency	Users Percent (%) Proficient
Overall					
Year 2017	No	162537	41.22	59433	48.98
	Yes	**132720**	**33.65**	**48956**	**40.34**
	Not reported	99101	25.13	12964	10.68
Year 2016	No	163321	41.41	51129	42.13
	Yes	**139578**	**35.39**	**43066**	**35.49**
	Not reported	91459	23.19	27158	22.38
2016-17 Proficiency by Status of Previous Year					
2016 - not proficient or missing proficiency	No	139496	54.75	51764	66.12
	Yes	**38605**	**15.15**	**15594**	**19.92**
	Not reported	76679	30.1	10929	13.96
2016 - proficient	No	23041	16.51	7669	17.81
	Yes	**94115**	**67.43**	**33362**	**77.47**
	Not reported	22422	16.06	2035	4.73
2016 - reported not proficient	No	149236	91.38	45643	89.27
	Yes	**14085**	**8.62**	**5486**	**10.73**
2016 - test not reported	No	31989	34.98	11996	44.17
	Yes	**24520**	**26.81**	**10108**	**37.22**
	Not reported	34950	38.21	5054	18.61

Source: Vendor Usage Data and Student Education Data

Table 6. Sample Size (N), Mean Growth Percentiles (M), and Mean Growth Percentile Standard Deviation (SD) by Demographics for Users of Each Program and Non-users (2016-17)

	Any Use			ALEKS			Ascend Math			iReady			ST Math			Imagine 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	85,702	50.9	29.1	41,435	51.4	28.8	3,232	48.4	27.8	14,454	50.6	29.4	12,393	48.2	29.6	15,548	51.9	29.5	233,271	49.4	29.0
Grade Level																					
4	16,159	48.7	29.1	2,600	50.9	28.7	1,080	53.6	28.1	4,311	47.8	28.7	4,545	46.7	29.5	3,937	49.0	29.2	34,024	49.9	29.0
5	15,690	50.1	29.4	3,249	47.9	29.4	939	43.6	27.6	3,848	52.8	29.4	4,200	48.3	29.6	3,797	52.3	29.2	32,787	49.4	28.8
6	15,419	50.1	29.2	4,211	49.4	29.1	719	48.0	26.3	3,716	51.2	29.6	3,086	49.3	29.3	4,140	50.0	29.5	30,958	49.3	28.9
7	12,374	53.4	28.7	8,520	52.7	28.5	126	50.8	27.4	1,328	57.0	28.5	241	52.2	30.7	2,271	54.2	29.2	31,560	48.1	29.0
8	11,195	52.2	29.1	8,479	52.0	28.4	178	42.4	27.3	1,155	44.6	30.7	197	62.1	29.9	1,277	60.0	30.0	31,602	49.0	29.0
9	9,480	52.3	29.0	9,131	52.3	29.0	122	47.6	28.5	43	51.4	30.2	98	48.6	33.4	116	61.9	29.2	32,322	49.8	29.0
10	4,845	51.1	28.3	4,727	51.1	28.4	64	48.0	27.0	40	45.3	25.8	21	44.0	28.6	N<10	--	--	32,506	49.8	29.1
11	540	48.7	28.7	518	48.5	28.6	N<10	--	--	13	41.3	29.9	N<10	--	--	N<10	--	--	7,512	50.4	29.1
Type of school																					
Elementary (K-6)	47,268	49.6	29.2	10,060	49.3	29.1	2,738	48.7	27.8	11,875	50.5	29.3	11,831	47.9	29.5	11,874	50.4	29.3	97,769	49.5	28.9
Secondary (7-12)	38,434	52.4	28.9	31,375	52.1	28.6	494	46.8	27.8	2,579	51.1	30.2	562	54.9	31.3	3,674	56.5	29.6	135,502	49.2	29.0
Title I Math																					
No	84,121	50.9	29.1	41,297	51.4	28.8	2,392	46.6	27.6	13,924	50.7	29.5	12,350	48.2	29.6	15,494	51.9	29.5	231,081	49.4	29.0
Yes	1,581	50.4	28.4	138	49.6	29.0	840	53.5	27.7	530	46.7	28.5	43	44.5	29.9	54	41.2	27.2	2,190	43.4	28.8
Low income																					
No	50,891	52.5	29.0	26,270	52.8	28.7	2,063	48.0	27.8	7,427	52.8	29.6	4,905	51.2	29.4	10,821	53.1	29.3	146,723	50.7	28.9
Yes	34,811	48.4	29.1	15,165	49.1	28.8	1,169	49.0	27.8	7,027	48.2	29.1	7,488	46.3	29.7	4,727	48.9	29.8	86,548	47.2	29.0
Race/Ethnicity																					
Asian	1,244	56.4	29	437	56.2	28.1	22	51.9	29.9	155	54.1	29.6	427	57	29.2	237	58.9	30.1	4,284	54	29
African American	1,340	45.5	28.6	436	46.3	27.8	29	44.6	29.5	220	43.4	29.1	482	43.3	29.1	220	48.8	28.9	3,115	45.4	28.9
White	63,486	51.8	29.1	32,956	52.3	28.8	2,790	48.7	27.9	10,079	51.4	29.5	6,467	49.7	29.7	12,020	52.4	29.4	171,653	50.1	29
Hispanic/Latino	15,143	47.1	29	5,748	46.7	28.2	305	46.2	27.1	3,149	47.7	29.2	4,080	45.6	29.6	2,224	49	29.8	42,132	46.4	28.7
Am. Indian/Alaskan	1,251	51.2	28.6	649	51.8	27.3	18	49.2	24.8	349	51.1	29.4	159	47.3	30.3	88	54.5	31.7	2,339	48.2	28.9
Multiple race	1,890	50.4	29.6	809	49.5	29.2	52	45.8	29.7	333	52.7	29.8	265	49.1	29.2	462	51	30	5,881	49.4	29.1
Pacific Islander	1,348	50.1	28.3	400	49.7	28.4	16	47.9	24.2	169	53.7	27.1	513	48.2	27.6	297	50.5	30	3,867	47	28.6
Gender																					
Female	41,823	51.8	28.6	20,222	52.9	28.1	1,610	48.8	27.4	7,057	51.8	28.9	6,041	48.4	29.5	7,534	52.2	29	113,651	50.1	28.3
Male	43,879	50.0	29.6	21,213	50.0	29.3	1,622	48.0	28.3	7,397	49.4	29.9	6,352	48.1	29.8	8,014	51.6	30	119,620	48.7	29.6

Source: Vendor Usage Data and Student Education Data

Table 7 displays the results of t-tests of comparisons of SAGE SGPs in each demographic category. For example, 10th grade students who used the software had math SGPs that were statistically significantly higher than 10th grade students who did not use the software (p=.0034). In the 11th grade, there was no difference between the user and non-user groups (p=.1889).

Table 7. 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	233,271	49.4	28.97	0.06	49.2	49.5	<0.0001
	Yes	85,702	50.9	29.11	0.10	50.7	51.1	
By grade level								
4	No	34,024	49.9	28.99	0.16	49.6	50.2	<0.0001
	Yes	16,159	48.7	29.10	0.23	48.3	49.2	
5	No	32,787	49.4	28.78	0.16	49.1	49.8	0.0289
	Yes	15,690	50.1	29.37	0.23	49.6	50.5	
6	No	30,958	49.3	28.88	0.16	49.0	49.6	0.0072
	Yes	15,419	50.1	29.23	0.24	49.6	50.5	
7	No	31,560	48.1	29.00	0.16	47.8	48.5	<0.0001
	Yes	12,374	53.4	28.72	0.26	52.9	53.9	
8	No	31,602	49.0	28.96	0.16	48.6	49.3	<0.0001
	Yes	11,195	52.2	29.10	0.28	51.7	52.7	
9	No	32,322	49.8	28.97	0.16	49.4	50.1	<0.0001
	Yes	9,480	52.3	29.05	0.30	51.7	52.9	
10	No	32,506	49.8	29.10	0.16	49.5	50.1	0.0034
	Yes	4,845	51.1	28.34	0.41	50.3	51.9	
11	No	7,512	50.4	29.12	0.34	49.8	51.1	0.1889
	Yes	540	48.7	28.75	1.24	46.3	51.2	
School Type								
Elementary	No	97,769	49.5	28.89	0.09	49.4	49.7	0.7104
	Yes	47,268	49.6	29.24	0.13	49.3	49.9	
Secondary	No	135,502	49.2	29.02	0.08	49.1	49.4	<0.0001
	Yes	38,434	52.4	28.88	0.15	52.1	52.7	
Title I Math								
No	No	231081	49.4	28.96	0.06	49.3	49.5	<0.0001
	Yes	84121	50.9	29.12	0.1	50.7	51.1	
Yes	No	2190	43.4	28.77	0.61	42.2	44.6	<0.0001
	Yes	1581	50.4	28.39	0.71	49	51.8	

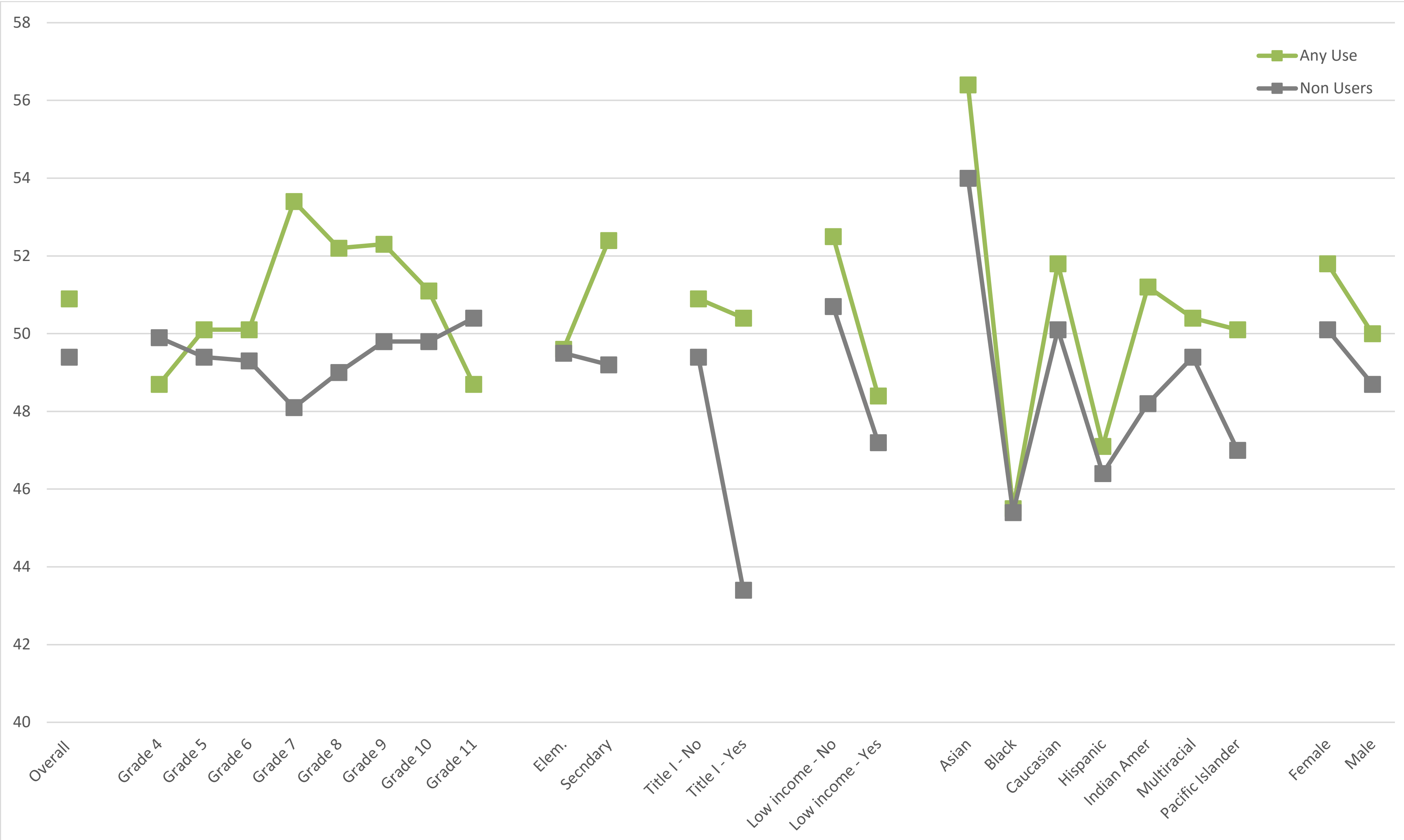
Table 7. Statistical Tests for Students with SAGE SGP Scores (continued from previous page)

Variable	Use Status	N	Mean	STD Dev	STD Err	95% Confidence Limit		p-value
						Lower	Upper	
Low income								
No	No	146723	50.7	28.89	0.08	50.5	50.8	<0.0001
	Yes	50891	52.5	28.98	0.13	52.3	52.8	
Yes	No	86548	47.2	28.96	0.1	47	47.3	<0.00010
	Yes	34811	48.4	29.13	0.16	48.1	48.7	
Race/Ethnicity								
Asian	No	4284	54	28.99	0.44	53.1	54.8	0.0087
	Yes	1244	56.4	29.06	0.82	54.8	58	
African American	No	3115	45.4	28.95	0.52	44.4	46.4	0.9158
	Yes	1340	45.5	28.63	0.78	44	47	
White	No	171653	50.1	28.98	0.07	50	50.3	<0.0001
	Yes	63486	51.8	29.07	0.12	51.6	52	
Hispanic/Latino	No	42132	46.4	28.66	0.14	46.2	46.7	0.0147
	Yes	15143	47.1	28.97	0.24	46.6	47.6	
Am. Indian/Alaskan	No	2339	48.2	28.86	0.6	47	49.4	0.0027
	Yes	1251	51.2	28.66	0.81	49.7	52.8	
Multiple race	No	5881	49.4	29.14	0.38	48.7	50.2	0.2222
	Yes	1890	50.4	29.61	0.68	49	51.7	
Pacific Islander	No	3867	47	28.6	0.46	46.1	47.9	0.0005
	Yes	1348	50.1	28.31	0.77	48.6	51.6	
Gender								
Female	No	113651	50.1	28.29	0.08	49.9	50.2	<0.0001
	Yes	41823	51.8	28.56	0.14	51.6	52.1	
Male	No	119620	48.7	29.58	0.09	48.5	48.9	<0.0001
	Yes	43879	50	29.59	0.14	49.7	50.2	

Source: Vendor Usage Data and Student Education Data

Figure 11 provides a graphical representation of the mean SGP data provided in Tables 5 and 6.

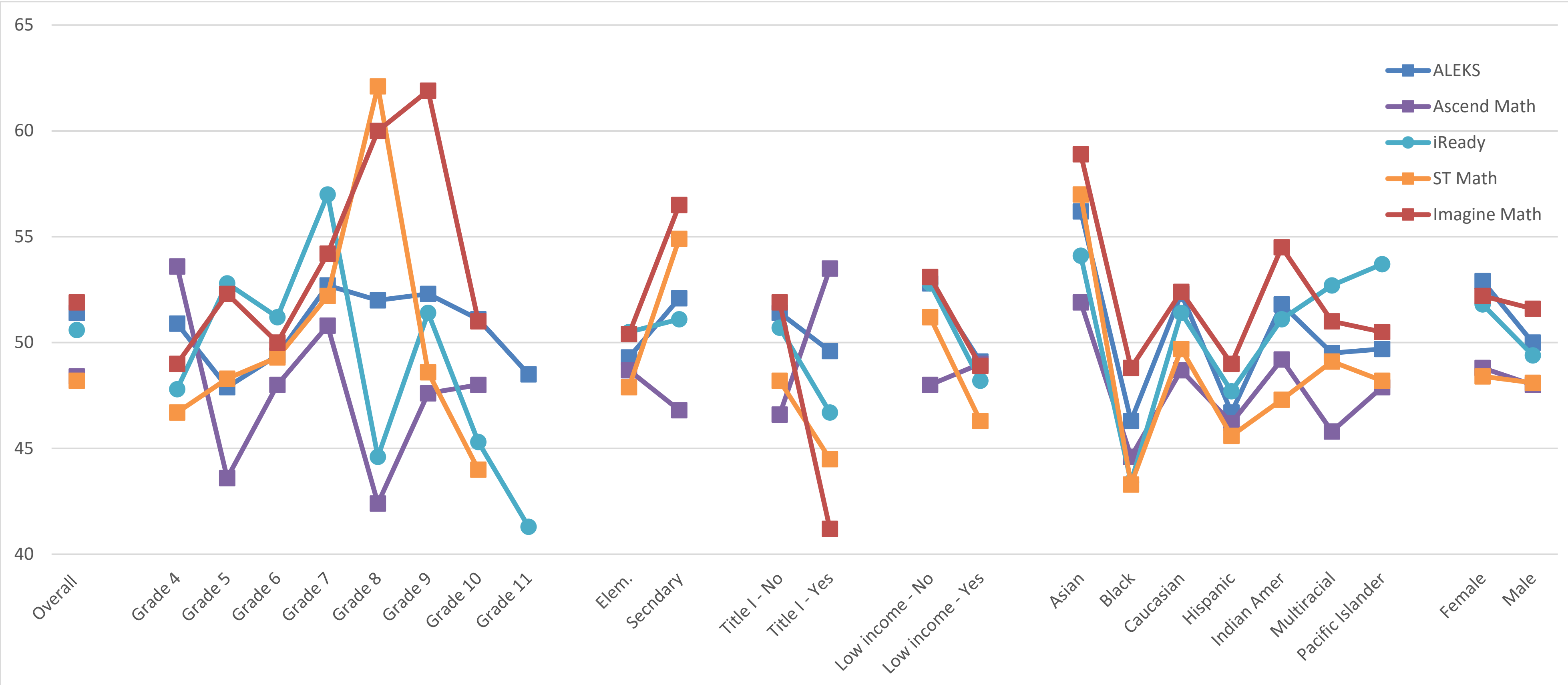
Figure 11. Comparison of Average SAGE SGP Between Users and Non-users by Demographic Category



Source: Vendor Usage Data and Student Education Data

Figure 12 provides a graphical representation of the mean SGP data provided in Table 5.

Figure 12. Comparison of Average SAGE SGP Between by Demographic Category and Vendor



Source: Vendor Usage Data and Student Education Data

Table 8 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 t-tests. For example, students who used ALEKS were on average 2.1 percentile points higher than students who did not use any programs, and this was statistically significant at the p<.0001 level. Students who used Ascend Math were not significantly different on their SGP scores than non-users (p=.0568).

Table 8. SAGE SGP Comparison Between Individual Vendors to Non-users

Vendor		95% Confidence Limit		P-value
	Estimated Difference	Lower	Upper	
ALEKS	2.1	1.8	2.4	<.0001
Ascend Math	-1.0	-2.0	0.0	0.0568
Imagine Math	2.5	2.0	3.0	<.0001
iReady	1.2	0.7	1.7	<.0001
ST Math	-1.1	-1.7	-0.6	<.0001

Source: Vendor Usage Data and Student Education Data

Table 9 provides the difference between the average math raw score for students who used each software program compared to students who did not use any of the programs, controlling for important demographic variables.

Table 9. Comparison of SAGE Raw Scores for Individual Vendors Compared to Non-users after Controlling for Grade Level, School Type, School Title I Math Status, Low Income, Race, and Gender

Vendor		95% Confidence Limit		P-value
	Estimated Difference	Lower	Upper	
ALEKS	2.0	1.7	2.3	<.0001
Ascend Math	-0.8	-1.8	0.2	0.1302
Imagine Math	2.3	1.8	2.8	<.0001
iReady	1.7	1.2	2.2	<.0001
ST Math	-0.3	-0.9	0.2	0.2622

Source: Vendor Usage Data and Student Education Data

Table 10 provides the regression coefficients and p-values for the regression equations predicting student growth percentiles in 2016-17 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. All the other models are listed for reference only.

Table 10. 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	-1.96	-2.38	-1.53	<.0001
	2nd Quartile	-1.04	-1.45	-0.63	<.0001
	3rd Quartile	2.8	2.4	3.2	<.0001
	4th Quartile	5.39	5	5.79	<.0001
m2 – Controls for 2016 SAGE math raw score	1st Quartile	-1.8	-2.22	-1.37	<.0001
	2nd Quartile	-0.87	-1.28	-0.45	<.0001
	3rd Quartile	2.95	2.54	3.35	<.0001
	4th Quartile	5.43	5.04	5.82	<.0001
m3 – Controls for grade level, school type, Title I math status, low income, race, gender	1st Quartile	-1.52	-1.95	-1.1	<.0001
	2nd Quartile	-0.67	-1.08	-0.26	0.0014
	3rd Quartile	2.96	2.56	3.36	<.0001
	4th Quartile	5.21	4.81	5.6	<.0001
m4 – Controls for school type, Title I math status, low income, race, gender, 2016 raw score	1st Quartile	-1.54	-1.97	-1.12	<.0001
	2nd Quartile	-0.74	-1.15	-0.33	0.0004
	3rd Quartile	2.88	2.48	3.28	<.0001
	4th Quartile	5.17	4.78	5.56	<.0001
m5 – Controls for school type, Title I status, low income, race, gender	1st Quartile	-1.47	-1.9	-1.04	<.0001
	2nd Quartile	-0.7	-1.11	-0.29	0.0009
	3rd Quartile	2.92	2.52	3.32	<.0001
	4th Quartile	5.17	4.78	5.57	<.0001

Source: Vendor Usage Data and Student Education Data

Tables 11 through 15 provides the regression coefficients and p-values for the regression equations predicting student growth percentiles in 2016-17 for each student usage quartile for each software vendor.

Table 11. 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	-1.96	-2.57	-1.35	<.0001
	2nd Quartile	-0.99	-1.6	-0.39	0.0014
	3rd Quartile	3.53	2.95	4.11	<.0001
	4th Quartile	5.62	5.12	6.12	<.0001
m2 – Controls for 2016 SAGE math raw score	1st Quartile	-1.99	-2.60	-1.38	<.0001
	2nd Quartile	-1.03	-1.64	-0.42	0.0009
	3rd Quartile	3.51	2.92	4.09	<.0001
	4th Quartile	5.51	5.00	6.02	<.0001
m3 – Controls for grade level, school type, Title I math status, low income, race, gender	1st Quartile	-1.92	-2.53	-1.32	<.0001
	2nd Quartile	-0.96	-1.57	-0.35	0.0021
	3rd Quartile	3.44	2.86	4.03	<.0001
	4th Quartile	5.37	4.86	5.88	<.0001
m4 – Controls for school type, Title I math status, low income, race, gender, 2016 raw score	1st Quartile	-1.94	-2.55	-1.34	<.0001
	2nd Quartile	-1.06	-1.67	-0.45	0.0007
	3rd Quartile	3.31	2.73	3.9	<.0001
	4th Quartile	5.34	4.83	5.85	<.0001
m5 – Controls for school type, Title I status, low income, race, gender	1st Quartile	-1.89	-2.5	-1.28	<.0001
	2nd Quartile	-1.01	-1.62	-0.41	0.0011
	3rd Quartile	3.32	2.74	3.91	<.0001
	4th Quartile	5.32	4.82	5.83	<.0001

Source: Vendor Usage Data and Student Education Data

Table 12. Student Growth Percentiles for Ascend 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	-1.28	-2.58	0.01	0.0523
	2nd Quartile	-1.34	-3.51	0.82	0.2233
	3rd Quartile	-3.67	-6.86	-0.49	0.0238
	4th Quartile	4.56	1.15	7.97	0.0087
m2 – Controls for 2016 SAGE math raw score	1st Quartile	-1.11	-2.41	0.19	0.0943
	2nd Quartile	-1.21	-3.38	0.95	0.2717
	3rd Quartile	-3.50	-6.69	-0.30	0.0319
	4th Quartile	4.80	1.37	8.22	0.006
m3 – Controls for grade level, school type, Title I math status, low income, race, gender	1st Quartile	-0.89	-2.24	0.46	0.1969
	2nd Quartile	-1.51	-3.67	0.65	0.1705
	3rd Quartile	-3.78	-6.97	-0.59	0.0202
	4th Quartile	4.97	1.56	8.39	0.0043
m4 – Controls for school type, Title I math status, low income, race, gender, 2016 raw score	1st Quartile	-0.88	-2.23	0.47	0.2016
	2nd Quartile	-1.57	-3.73	0.59	0.1552
	3rd Quartile	-3.76	-6.95	-0.57	0.0208
	4th Quartile	4.91	1.49	8.32	0.0049
m5 – Controls for school type, Title I status, low income, race, gender	1st Quartile	-0.84	-2.19	0.51	0.2242
	2nd Quartile	-1.56	-3.72	0.60	0.1572
	3rd Quartile	-3.81	-6.99	-0.63	0.0188
	4th Quartile	4.75	1.35	8.15	0.0061

Source: Vendor Usage Data and Student Education Data

Table 13. 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	-1.28	-2.62	0.06	0.0618
	2nd Quartile	-1.64	-2.73	-0.56	0.003
	3rd Quartile	1.71	0.83	2.60	0.0002
	4th Quartile	5.53	4.82	6.23	<.0001
m2 – Controls for 2016 SAGE math raw score	1st Quartile	-1.28	-2.63	0.07	0.0634
	2nd Quartile	-1.39	-2.48	-0.30	0.0123
	3rd Quartile	1.91	1.02	2.80	<.0001
	4th Quartile	5.75	5.04	6.45	<.0001
m3 – Controls for grade level, school type, Title I math status, low income, race, gender	1st Quartile	-0.93	-2.28	0.42	0.1771
	2nd Quartile	-1.42	-2.50	-0.33	0.0105
	3rd Quartile	1.51	0.62	2.41	0.0009
	4th Quartile	5.11	4.40	5.82	<.0001
m4 – Controls for school type, Title I math status, low income, race, gender, 2016 raw score	1st Quartile	-1.10	-2.45	0.24	0.1085
	2nd Quartile	-1.59	-2.68	-0.51	0.004
	3rd Quartile	1.33	0.45	2.22	0.0033
	4th Quartile	4.96	4.25	5.67	<.0001
m5 – Controls for school type, Title I status, low income, race, gender	1st Quartile	-0.83	-2.17	0.51	0.225
	2nd Quartile	-1.59	-2.67	-0.51	0.004
	3rd Quartile	1.40	0.51	2.29	0.002
	4th Quartile	4.98	4.27	5.69	<.0001

Source: Vendor Usage Data and Student Education Data

Table 14. Student Growth Percentiles for iReady 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	-1.26	-2.23	-0.29	0.0108
	2nd Quartile	-0.44	-1.25	0.37	0.2855
	3rd Quartile	3.64	2.78	4.50	<.0001
	4th Quartile	5.42	3.85	6.99	<.0001
m2 – Controls for 2016 SAGE math raw score	1st Quartile	-0.97	-1.94	0.00	0.0508
	2nd Quartile	-0.22	-1.04	0.59	0.5926
	3rd Quartile	3.84	2.97	4.71	<.0001
	4th Quartile	5.66	4.09	7.23	<.0001
m3 – Controls for grade level, school type, Title I math status, low income, race, gender	1st Quartile	-0.66	-1.64	0.31	0.1815
	2nd Quartile	0.09	-0.73	0.9	0.8377
	3rd Quartile	4.05	3.18	4.91	<.0001
	4th Quartile	5.79	4.23	7.36	<.0001
m4 – Controls for school type, Title I math status, low income, race, gender, 2016 raw score	1st Quartile	-0.74	-1.71	0.24	0.1394
	2nd Quartile	-0.06	-0.87	0.76	0.8947
	3rd Quartile	3.92	3.05	4.79	<.0001
	4th Quartile	5.72	4.15	7.28	<.0001
m5 – Controls for school type, Title I status, low income, race, gender	1st Quartile	-0.72	-1.70	0.25	0.1454
	2nd Quartile	-0.01	-0.82	0.81	0.9849
	3rd Quartile	3.97	3.10	4.83	<.0001
	4th Quartile	5.74	4.18	7.31	<.0001

Source: Vendor Usage Data and Student Education Data

Table 15. 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	-3.97	-4.97	-2.97	<.0001
	2nd Quartile	-2.35	-3.28	-1.41	<.0001
	3rd Quartile	1.26	0.28	2.24	0.0116
	4th Quartile	2.32	0.96	3.67	0.0008
m2 – Controls for 2016 SAGE math raw score	1st Quartile	-3.66	-4.67	-2.65	<.0001
	2nd Quartile	-2.01	-2.95	-1.06	<.0001
	3rd Quartile	1.52	0.54	2.51	0.0025
	4th Quartile	2.59	1.23	3.95	0.0002
m3 – Controls for grade level, school type, Title I math status, low income, race, gender	1st Quartile	-2.92	-3.93	-1.90	<.0001
	2nd Quartile	-1.36	-2.31	-0.42	0.0047
	3rd Quartile	1.91	0.92	2.90	0.0002
	4th Quartile	2.88	1.52	4.24	<.0001
m4 – Controls for school type, Title I math status, low income, race, gender, 2016 raw score	1st Quartile	-2.92	-3.93	-1.91	<.0001
	2nd Quartile	-1.39	-2.33	-0.44	0.0041
	3rd Quartile	1.87	0.88	2.86	0.0002
	4th Quartile	2.84	1.48	4.20	<.0001
m5 – Controls for school type, Title I status, low income, race, gender	1st Quartile	-2.90	-3.91	-1.89	<.0001
	2nd Quartile	-1.39	-2.33	-0.44	0.004
	3rd Quartile	1.92	0.93	2.90	0.0001
	4th Quartile	2.86	1.50	4.22	<.0001

Source: Vendor Usage Data and Student Education Data

In the first half, Table 16 provides SGPs by vendor and use quartile. In the second half, Table 16 provides the difference between the SGP in the 2nd, 3rd, and 4th quartiles compared to the first quartile.

Table 16. Student Growth Percentile (SGP) Differences by Use Level by Vendor

Vendor	1st Quartile Use (<7.5 Hours per year)	2nd Quartile Use (7.5-16.75 hours per year)	3rd Quartile use (16.75-32.22 hours per year)	4th Quartile Use (32.23 + hours per year)
Growth Percentile Comparison for Different Usage Dosage, by Vendor				
Vendor	Mean SGP	Mean SGP	Mean SGP	Mean SGP
ALEKS	47.52	48.49	53.01	55.10
Ascend Math	48.19	48.14	45.81	54.04
Imagine Math	48.20	47.84	51.19	55.01
iReady	48.22	49.04	53.12	54.90
ST Math	45.51	47.13	50.74	51.80
Overall	47.52	48.44	52.28	54.87
Growth Percentile Increase Compared to Their Corresponding 1st Quartile				
ALEKS	Reference	0.97	5.49	7.58
Ascend Math	Reference	-0.05	-2.38	5.85
Imagine Math	Reference	-0.36	2.99	6.81
iReady	Reference	0.82	4.90	6.68
ST Math	Reference	1.62	5.23	6.29
Overall	Reference	0.92	4.76	7.35

Source: Vendor Usage Data and Student Education Data

Table 17 provides the same growth percentile information as the first half of Table 16, with confidence intervals added.

Table 17. Student Growth Percentile (SGP) for Different Use Levels

	Hours during the school year	Mean Growth Percentile	95% Confidence Interval
Overall			
1st quartile use	<7.5	47.52	(47.11, 47.93)
2nd quartile use	7.5- 16.74	48.44	(48.04, 48.83)
3rd quartile use	16.75-32.22	52.28	(51.90, 52.66)
4th quartile use	>=32.23	54.87	(54.50, 55.24)
ALEKS			
1st quartile use	<7.5	47.52	(46.92, 48.11)
2nd quartile use	7.5- 16.74	48.49	(47.89, 49.08)
3rd quartile use	16.75-32.22	53.01	(52.44, 53.57)
4th quartile use	>=32.23	55.10	(54.62, 55.58)
Ascend			
1st quartile use	<7.5	48.19	(46.97, 49.42)
2nd quartile use	7.5- 16.74	48.14	(46.01, 50.27)
3rd quartile use	16.75-32.22	45.81	(42.72, 48.90)
4th quartile use	>=32.23	54.04	(50.89, 57.19)
Imagine			
1st quartile use	<7.5	48.20	(46.82, 49.58)
2nd quartile use	7.5- 16.74	47.84	(46.74, 48.93)
3rd quartile use	16.75-32.22	51.19	(50.31, 52.08)
4th quartile use	>=32.23	55.01	(54.30, 55.71)
iReady			
1st quartile use	<7.5	48.22	(47.24, 49.20)
2nd quartile use	7.5- 16.74	49.04	(48.22, 49.85)
3rd quartile use	16.75-32.22	53.12	(52.26, 53.97)
4th quartile use	>=32.23	54.90	(53.31, 56.49)
ST Math			
1st quartile use	<7.5	45.51	(44.48, 46.54)
2nd quartile use	7.5- 16.74	47.13	(46.19, 48.07)
3rd quartile use	16.75-32.22	50.74	(49.75, 51.73)
4th quartile use	>=32.23	51.8	(50.43, 53.17)

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 2016-17. The five models (m1 through m5) are described in the table. Model 4 was used in the main body of the addendum changes in likelihood of attaining proficiency associated with software use are presented.

Table 18. 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	1.009	0.995	1.023	0.2208
	m2 – Controls for 2016 SAGE math raw score	use_yes	1.28	1.259	1.302	<.0001
	m3 – Controls for grade level, school type, Title I math status, low income, race, gender	use_yes	1.094	1.068	1.12	<.0001
	m4 – Controls for school type, Title I math status, low income, race, gender, 2016 raw score	**use_yes**	**1.218**	**1.195**	**1.241**	**<.0001**
	m5 – Controls for school type, Title I status, low income, race, gender	use_yes	1.029	1.014	1.045	0.0001
ALEKS	m1 – Simple comparison of users to non-users	use_yes 1 vs 0	0.961	0.942	0.98	<.0001
	m2 – Controls for 2016 SAGE math raw score	use_yes	0.845	0.826	0.864	<.0001
	m3 – Controls for grade level, school type, Title I math status, low income, race, gender	use_yes	1.108	1.073	1.145	<.0001
	m4 – Controls for school type, Title I math status, low income, race, gender, 2016 raw score	**use_yes**	**1.136**	**1.107**	**1.165**	**<.0001**
	m5 – Controls for school type, Title I status, low income, race, gender	use_yes	0.966	0.946	0.986	0.0011
Ascend Math	m1 – Simple comparison of users to non-users	use_yes 1 vs 0	1.485	1.399	1.577	<.0001
	m2 – Controls for 2016 SAGE math raw score	use_yes	2.328	2.167	2.502	<.0001
	m3 – Controls for grade level, school type, Title I math status, low income, race, gender	use_yes	1.055	0.953	1.168	0.3037
	m4 – Controls for school type, Title I math status, low income, race, gender, 2016 raw score	**use_yes**	**1.27**	**1.168**	**1.381**	**<.0001**
	m5 – Controls for school type, Title I status, low income, race, gender	use_yes	1.358	1.272	1.45	<.0001
Imagine Math	m1 – Simple comparison of users to non-users	use_yes 1 vs 0	1.267	1.231	1.304	<.0001
	m2 – Controls for 2016 SAGE math raw score	use_yes	1.998	1.931	2.067	<.0001
	m3 – Controls for grade level, school type, Title I math status, low income, race, gender	use_yes	1.113	1.061	1.168	<.0001
	m4 – Controls for school type, Title I math status, low income, race, gender, 2016 raw score	**use_yes**	**1.325**	**1.275**	**1.377**	**<.0001**
	m5 – Controls for school type, Title I status, low income, race, gender	use_yes	1.078	1.046	1.111	<.0001
iReady	m1 – Simple comparison of users to non-users	use_yes 1 vs 0	0.971	0.943	0.999	0.0426
	m2 – Controls for 2016 SAGE math raw score	use_yes	1.721	1.661	1.784	<.0001
	m3 – Controls for grade level, school type, Title I math status, low income, race, gender	use_yes	1.062	1.01	1.116	0.0183
	m4 – Controls for school type, Title I math status, low income, race, gender, 2016 raw score	**use_yes**	**1.226**	**1.177**	**1.278**	**<.0001**
	m5 – Controls for school type, Title I status, low income, race, gender	use_yes	1.055	1.023	1.088	0.0008
ST Math	m1 – Simple comparison of users to non-users	use_yes 1 vs 0	0.795	0.771	0.82	<.0001
	m2 – Controls for 2016 SAGE math raw score	use_yes	1.642	1.579	1.708	<.0001
	m3 – Controls for grade level, school type, Title I math status, low income, race, gender	use_yes	0.999	0.945	1.055	0.9612
	m4 – Controls for school type, Title I math status, low income, race, gender, 2016 raw score	**use_yes**	**1.126**	**1.077**	**1.178**	**<.0001**
	m5 – Controls for school type, Title I status, low income, race, gender	use_yes	1.016	0.982	1.051	0.3515

Source: Vendor Usage Data and Student Education Data

Table 19 provides the odds ratios and p-values for the logistic regressions predicting math proficiency in 2016-17 for students who were not proficient in the previous year (2015-16).

Table 19. Likelihood of Attaining Proficiency for Those who were not Proficient in the Previous Year (2016)

	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	1.053	1.019	1.089	0.0024
	m2 – Controls for 2016 SAGE math raw score	use_yes	1.2	1.16	1.241	<.0001
	m3 – Controls for grade level, school type, Title I math status, low income, race, gender	use_yes	1.098	1.058	1.139	<.0001
	m4 – Controls for school type, Title I math status, low income, race, gender, 2016 raw score	**use_yes**	**1.175**	**1.135**	**1.216**	**<.0001**
	m5 – Controls for school type, Title I status, low income, race, gender	use_yes	1.029	1.014	1.045	0.0001
ALEKS	m1 – Simple comparison of users to non-users	use_yes 1 vs 0	1.07	1.025	1.118	0.0021
	m2 – Controls for 2016 SAGE math raw score	use_yes	1.003	0.96	1.047	0.9055
	m3 – Controls for grade level, school type, Title I math status, low income, race, gender	use_yes	1.048	0.998	1.101	0.0622
	m4 – Controls for school type, Title I math status, low income, race, gender, 2016 raw score	**use_yes**	**1.084**	**1.037**	**1.134**	**0.0004**
	m5 – Controls for school type, Title I status, low income, race, gender	use_yes	0.966	0.946	0.986	0.0011
Ascend Math	m1 – Simple comparison of users to non-users	use_yes 1 vs 0	0.944	0.795	1.121	0.5116
	m2 – Controls for 2016 SAGE math raw score	use_yes	1.211	1.018	1.439	0.0302
	m3 – Controls for grade level, school type, Title I math status, low income, race, gender	use_yes	0.851	0.705	1.027	0.0926
	m4 – Controls for school type, Title I math status, low income, race, gender, 2016 raw score	**use_yes**	**0.972**	**0.813**	**1.161**	**0.7522**
	m5 – Controls for school type, Title I status, low income, race, gender	use_yes	0.926	0.777	1.105	0.3932
Imagine Math	m1 – Simple comparison of users to non-users	use_yes 1 vs 0	1.205	1.125	1.29	<.0001
	m2 – Controls for 2016 SAGE math raw score	use_yes	1.603	1.494	1.72	<.0001
	m3 – Controls for grade level, school type, Title I math status, low income, race, gender	use_yes	1.202	1.114	1.298	<.0001
	m4 – Controls for school type, Title I math status, low income, race, gender, 2016 raw score	**use_yes**	**1.31**	**1.219**	**1.408**	**<.0001**
	m5 – Controls for school type, Title I status, low income, race, gender	use_yes	1.153	1.075	1.237	<.0001
iReady	m1 – Simple comparison of users to non-users	use_yes 1 vs 0	1.013	0.943	1.089	0.7156
	m2 – Controls for 2016 SAGE math raw score	use_yes	1.442	1.339	1.553	<.0001
	m3 – Controls for grade level, school type, Title I math status, low income, race, gender	use_yes	1.16	1.071	1.257	0.0003
	m4 – Controls for school type, Title I math status, low income, race, gender, 2016 raw score	**use_yes**	**1.288**	**1.195**	**1.39**	**<.0001**
	m5 – Controls for school type, Title I status, low income, race, gender	use_yes	1.144	1.062	1.233	0.0004
ST Math	m1 – Simple comparison of users to non-users	use_yes 1 vs 0	0.867	0.801	0.938	0.0004
	m2 – Controls for 2016 SAGE math raw score	use_yes	1.334	1.23	1.448	<.0001
	m3 – Controls for grade level, school type, Title I math status, low income, race, gender	use_yes	1.145	1.048	1.25	0.0026
	m4 – Controls for school type, Title I math status, low income, race, gender, 2016 raw score	**use_yes**	**1.182**	**1.087**	**1.285**	**<.0001**
	m5 – Controls for school type, Title I status, low income, race, gender	use_yes	1.114	1.025	1.21	0.0111

Source: Vendor Usage Data and Student Education Data

Table 20 provides the odds ratios and p-values for the logistic regressions predicting math proficiency in 2016-17 for students based on their usage quartile.

Table 20. 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	0.727	0.708	0.746	<.0001
	Q2 vs No Use	0.843	0.822	0.864	<.0001
	Q3 vs No Use	1.148	1.120	1.177	<.0001
	Q4 vs No Use	1.404	1.370	1.439	<.0001
m2 – Controls for 2016 SAGE math raw score	Q1 vs No Use	0.974	0.944	1.006	0.1132
	Q2 vs No Use	1.145	1.111	1.181	<.0001
	Q3 vs No Use	1.531	1.487	1.577	<.0001
	Q4 vs No Use	1.484	1.442	1.527	<.0001
m3 – Controls for grade level, school type, Title I math status, low income, race, gender	Q1 vs No Use	0.901	0.861	0.943	<.0001
	Q2 vs No Use	0.936	0.897	0.977	0.0025
	Q3 vs No Use	1.180	1.133	1.230	<.0001
	Q4 vs No Use	1.354	1.300	1.410	<.0001
m4 – Controls for school type, Title I math status, low income, race, gender, 2016 raw score	Q1 vs No Use	0.900	0.868	0.933	<.0001
	Q2 vs No Use	1.146	1.108	1.186	<.0001
	Q3 vs No Use	1.423	1.377	1.471	<.0001
	Q4 vs No Use	1.398	1.354	1.443	<.0001
m5 – Controls for school type, Title I status, low income, race, gender	Q1 vs No Use	0.771	0.750	0.793	<.0001
	Q2 vs No Use	0.889	0.866	0.913	<.0001
	Q3 vs No Use	1.163	1.133	1.194	<.0001
	Q4 vs No Use	1.333	1.300	1.368	<.0001

Source: Vendor Usage Data and Student Education Data

Tables 21 through 25 provide the odds ratios and p-values for the logistic regressions predicting math proficiency in 2016-17 for students based on their usage quartile for each software vendor

Table 21. 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	0.649	0.623	0.675	<.0001
	Q2 vs No Use	0.813	0.781	0.846	<.0001
	Q3 vs No Use	1.106	1.065	1.149	<.0001
	Q4 vs No Use	1.264	1.223	1.306	<.0001
m2 – Controls for 2016 SAGE math raw score	Q1 vs No Use	0.606	0.578	0.634	<.0001
	Q2 vs No Use	0.735	0.703	0.769	<.0001
	Q3 vs No Use	1.048	1.004	1.094	0.0312
	Q4 vs No Use	0.977	0.942	1.014	0.2218
m3 – Controls for grade level, school type, Title I math status, low income, race, gender	Q1 vs No Use	0.850	0.795	0.91	<.0001
	Q2 vs No Use	0.903	0.845	0.964	0.0024
	Q3 vs No Use	1.205	1.134	1.281	<.0001
	Q4 vs No Use	1.401	1.327	1.478	<.0001
m4 – Controls for school type, Title I math status, low income, race, gender, 2016 raw score	Q1 vs No Use	0.771	0.732	0.813	<.0001
	Q2 vs No Use	1.077	1.023	1.134	0.005
	Q3 vs No Use	1.347	1.283	1.413	<.0001
	Q4 vs No Use	1.321	1.267	1.377	<.0001
m5 – Controls for school type, Title I status, low income, race, gender	Q1 vs No Use	0.672	0.644	0.701	<.0001
	Q2 vs No Use	0.836	0.802	0.872	<.0001
	Q3 vs No Use	1.082	1.040	1.125	<.0001
	Q4 vs No Use	1.250	1.208	1.294	<.0001

Source: Vendor Usage Data and Student Education Data

Table 22. Ascend 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	1.662	1.543	1.791	<.0001
	Q2 vs No Use	1.485	1.299	1.699	<.0001
	Q3 vs No Use	1.059	0.867	1.294	0.5746
	Q4 vs No Use	0.810	0.645	1.017	0.0697
m2 – Controls for 2016 SAGE math raw score	Q1 vs No Use	2.818	2.569	3.091	<.0001
	Q2 vs No Use	2.409	2.066	2.810	<.0001
	Q3 vs No Use	1.415	1.125	1.778	0.003
	Q4 vs No Use	0.966	0.753	1.239	0.7841
m3 – Controls for grade level, school type, Title I math status, low income, race, gender	Q1 vs No Use	1.037	0.912	1.179	0.5837
	Q2 vs No Use	1.098	0.890	1.355	0.3814
	Q3 vs No Use	0.856	0.620	1.184	0.3482
	Q4 vs No Use	1.421	0.981	2.059	0.0631
m4 – Controls for school type, Title I math status, low income, race, gender, 2016 raw score	Q1 vs No Use	1.441	1.295	1.603	<.0001
	Q2 vs No Use	1.191	1.002	1.415	0.0471
	Q3 vs No Use	0.869	0.668	1.131	0.2964
	Q4 vs No Use	0.940	0.707	1.252	0.6737
m5 – Controls for school type, Title I status, low income, race, gender	Q1 vs No Use	1.544	1.423	1.676	<.0001
	Q2 vs No Use	1.287	1.118	1.481	0.0004
	Q3 vs No Use	0.981	0.796	1.208	0.8548
	Q4 vs No Use	0.806	0.637	1.020	0.0727

Source: Vendor Usage Data and Student Education Data

Table 23. 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	0.694	0.638	0.755	<.0001
	Q2 vs No Use	0.956	0.896	1.020	0.171
	Q3 vs No Use	1.250	1.185	1.319	<.0001
	Q4 vs No Use	1.698	1.626	1.773	<.0001
m2 – Controls for 2016 SAGE math raw score	Q1 vs No Use	1.069	0.967	1.182	0.190
	Q2 vs No Use	1.434	1.325	1.551	<.0001
	Q3 vs No Use	1.988	1.865	2.118	<.0001
	Q4 vs No Use	2.702	2.568	2.843	<.0001
m3 – Controls for grade level, school type, Title I math status, low income, race, gender	Q1 vs No Use	0.945	0.818	1.093	0.4475
	Q2 vs No Use	0.892	0.799	0.995	0.0409
	Q3 vs No Use	1.064	0.975	1.161	0.1665
	Q4 vs No Use	1.296	1.209	1.390	<.0001
m4 – Controls for school type, Title I math status, low income, race, gender, 2016 raw score	Q1 vs No Use	1.059	0.944	1.188	0.3259
	Q2 vs No Use	1.136	1.041	1.241	0.0044
	Q3 vs No Use	1.414	1.317	1.518	<.0001
	Q4 vs No Use	1.430	1.351	1.513	<.0001
m5 – Controls for school type, Title I status, low income, race, gender	Q1 vs No Use	0.714	0.654	0.780	<.0001
	Q2 vs No Use	0.864	0.807	0.924	<.0001
	Q3 vs No Use	1.052	0.995	1.113	0.0749
	Q4 vs No Use	1.342	1.283	1.404	<.0001

Source: Vendor Usage Data and Student Education Data

Table 24. iReady 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	0.707	0.668	0.749	<.0001
	Q2 vs No Use	0.902	0.86	0.947	<.0001
	Q3 vs No Use	1.249	1.187	1.314	<.0001
	Q4 vs No Use	1.320	1.201	1.451	<.0001
m2 – Controls for 2016 SAGE math raw score	Q1 vs No Use	1.332	1.240	1.430	<.0001
	Q2 vs No Use	1.584	1.493	1.680	<.0001
	Q3 vs No Use	2.114	1.987	2.249	<.0001
	Q4 vs No Use	2.266	2.027	2.533	<.0001
m3 – Controls for grade level, school type, Title I math status, low income, race, gender	Q1 vs No Use	0.883	0.800	0.974	0.0127
	Q2 vs No Use	0.978	0.901	1.061	0.5862
	Q3 vs No Use	1.255	1.153	1.366	<.0001
	Q4 vs No Use	1.296	1.110	1.513	0.001
m4 – Controls for school type, Title I math status, low income, race, gender, 2016 raw score	Q1 vs No Use	0.846	0.780	0.919	<.0001
	Q2 vs No Use	1.225	1.146	1.310	<.0001
	Q3 vs No Use	1.514	1.412	1.623	<.0001
	Q4 vs No Use	1.502	1.324	1.704	<.0001
m5 – Controls for school type, Title I status, low income, race, gender	Q1 vs No Use	0.746	0.702	0.793	<.0001
	Q2 vs No Use	0.972	0.924	1.024	0.285
	Q3 vs No Use	1.394	1.321	1.472	<.0001
	Q4 vs No Use	1.463	1.323	1.618	<.0001

Source: Vendor Usage Data and Student Education Data

Table 25. 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	0.549	0.516	0.585	<.0001
	Q2 vs No Use	0.651	0.617	0.688	<.0001
	Q3 vs No Use	0.966	0.914	1.021	0.2211
	Q4 vs No Use	1.399	1.300	1.506	<.0001
m2 – Controls for 2016 SAGE math raw score	Q1 vs No Use	1.217	1.127	1.314	<.0001
	Q2 vs No Use	1.474	1.375	1.580	<.0001
	Q3 vs No Use	1.974	1.840	2.118	<.0001
	Q4 vs No Use	2.373	2.155	2.612	<.0001
m3 – Controls for grade level, school type, Title I math status, low income, race, gender	Q1 vs No Use	0.874	0.786	0.973	0.0135
	Q2 vs No Use	0.906	0.824	0.996	0.0407
	Q3 vs No Use	1.138	1.033	1.255	0.0092
	Q4 vs No Use	1.164	1.022	1.326	0.0226
m4 – Controls for school type, Title I math status, low income, race, gender, 2016 raw score	Q1 vs No Use	0.834	0.765	0.910	<.0001
	Q2 vs No Use	1.035	0.958	1.120	0.3827
	Q3 vs No Use	1.345	1.243	1.456	<.0001
	Q4 vs No Use	1.545	1.387	1.721	<.0001
m5 – Controls for school type, Title I status, low income, race, gender	Q1 vs No Use	0.726	0.678	0.777	<.0001
	Q2 vs No Use	0.846	0.798	0.898	<.0001
	Q3 vs No Use	1.213	1.142	1.288	<.0001
	Q4 vs No Use	1.705	1.575	1.846	<.0001

Source: Vendor Usage Data and Student Education Data

Figure 13 provides the increase in likelihood of proficiency for each use quartile for each program. The error bars represent the 95% confidence intervals.

Figure 13. Increase in Likelihood of Math Proficiency for Students in Each Use Quartile for Each Software Type with Error Bars

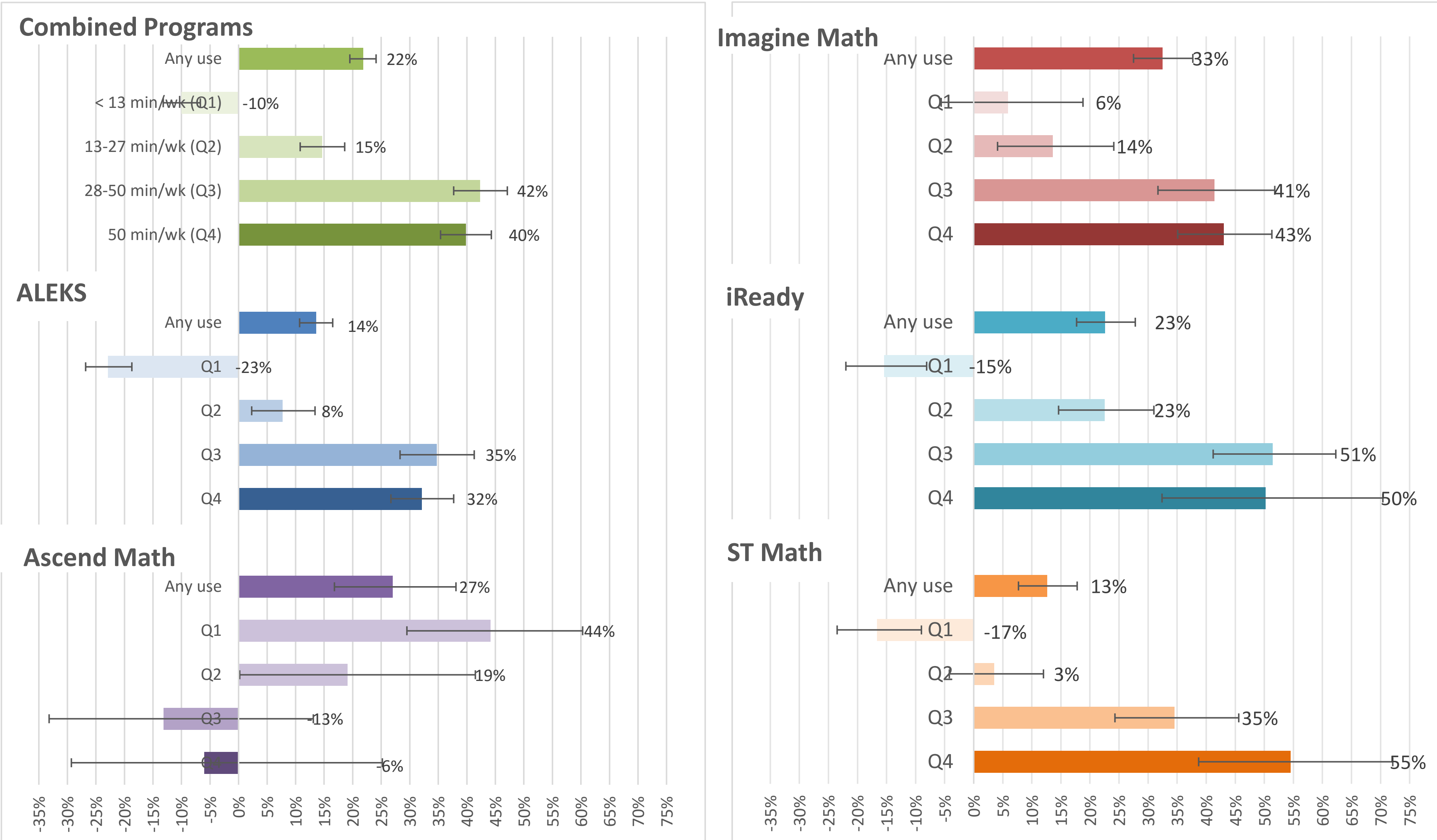
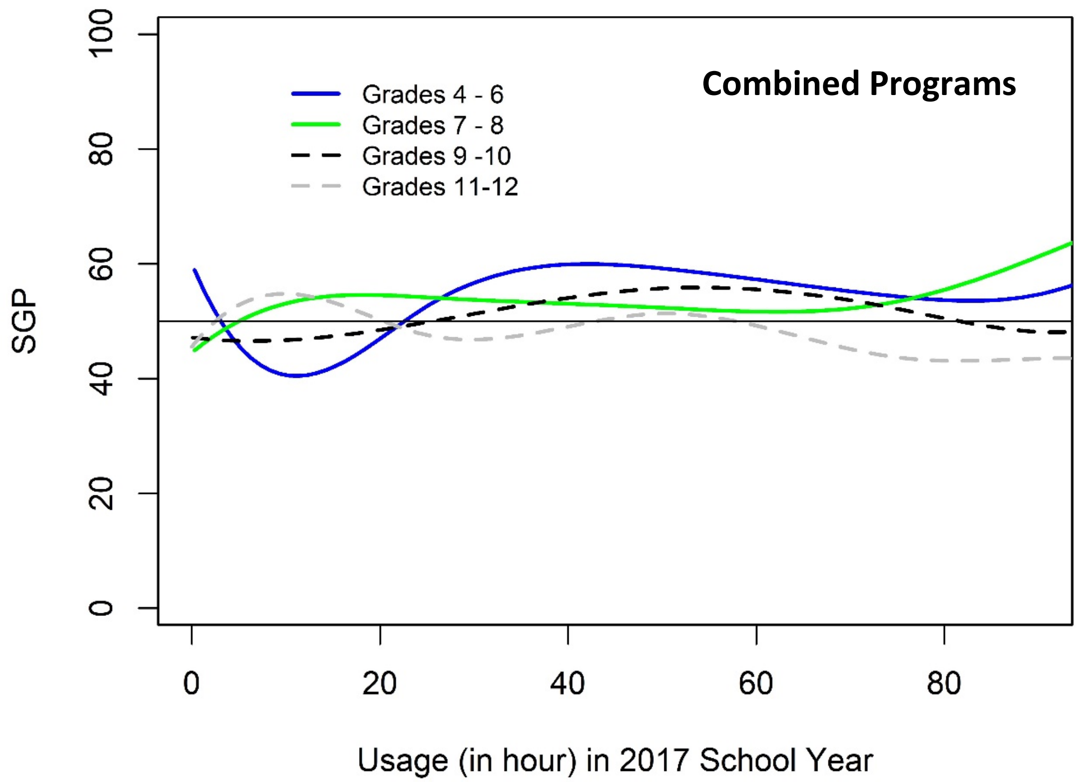


Figure 14 provides student SGPs for four grade level ranges for combined programs by average annual use in hours.

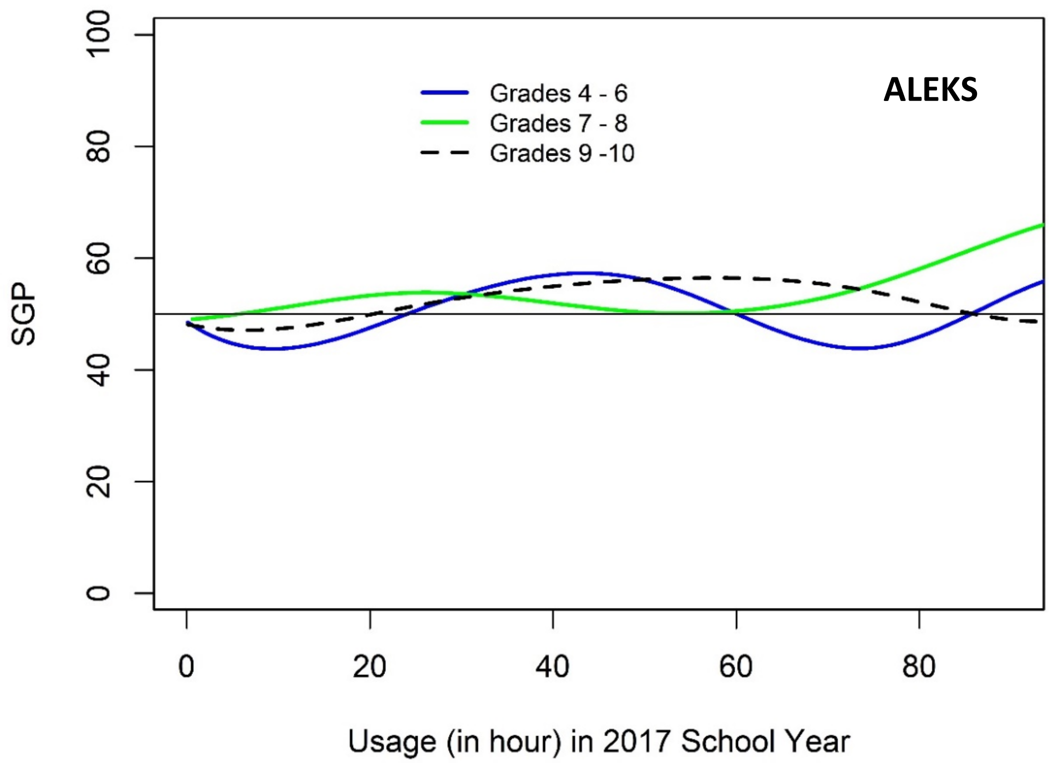
Figure 14. Overall (Combined Programs) Mean SAGE SGP by Student Usage in Hours per Year



Source: Vendor Usage Data and Student Education Data

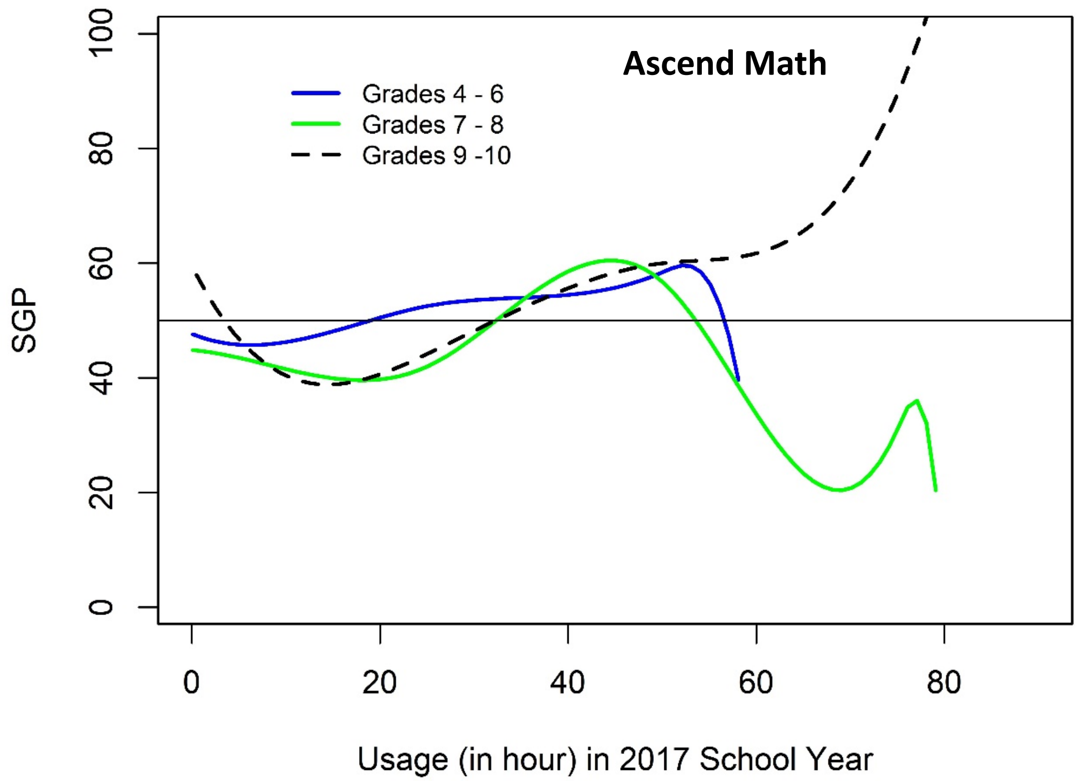
Figures 15 through 19 provides student SGPs for four grade level ranges for each program vendor by average annual use in hours.

Figure 15. ALEKS Mean SAGE SGP by Student Usage in Hours per Year



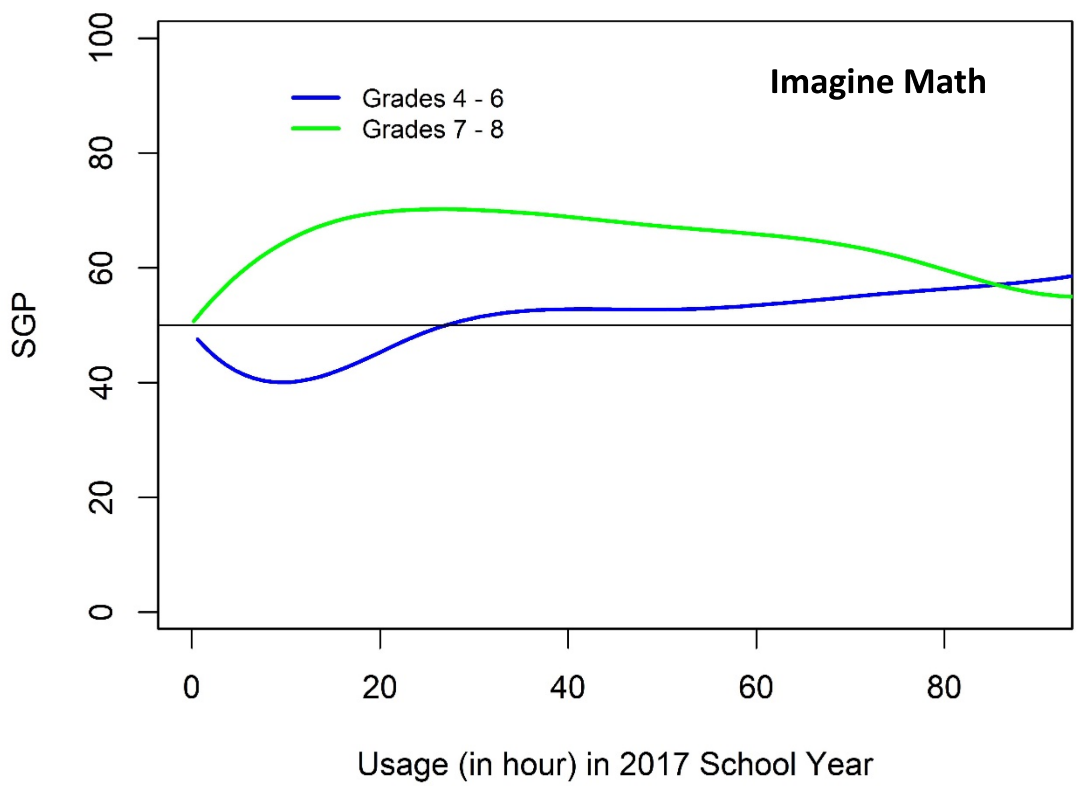
Source: Vendor Usage Data and Student Education Data

Figure 16. Ascend Math Mean SAGE SGP by Student Usage in Hours per Year



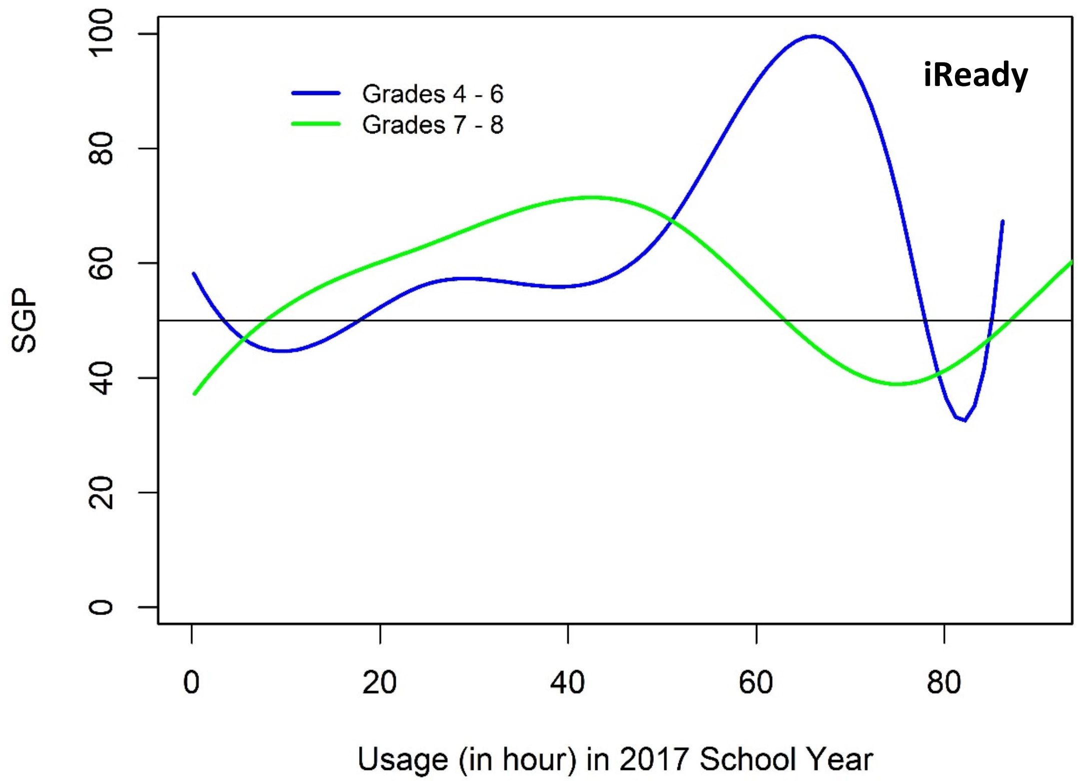
Source: Vendor Usage Data and Student Education Data

Figure 17. Imagine Math Mean SAGE SGP by Student Usage in Hours per Year



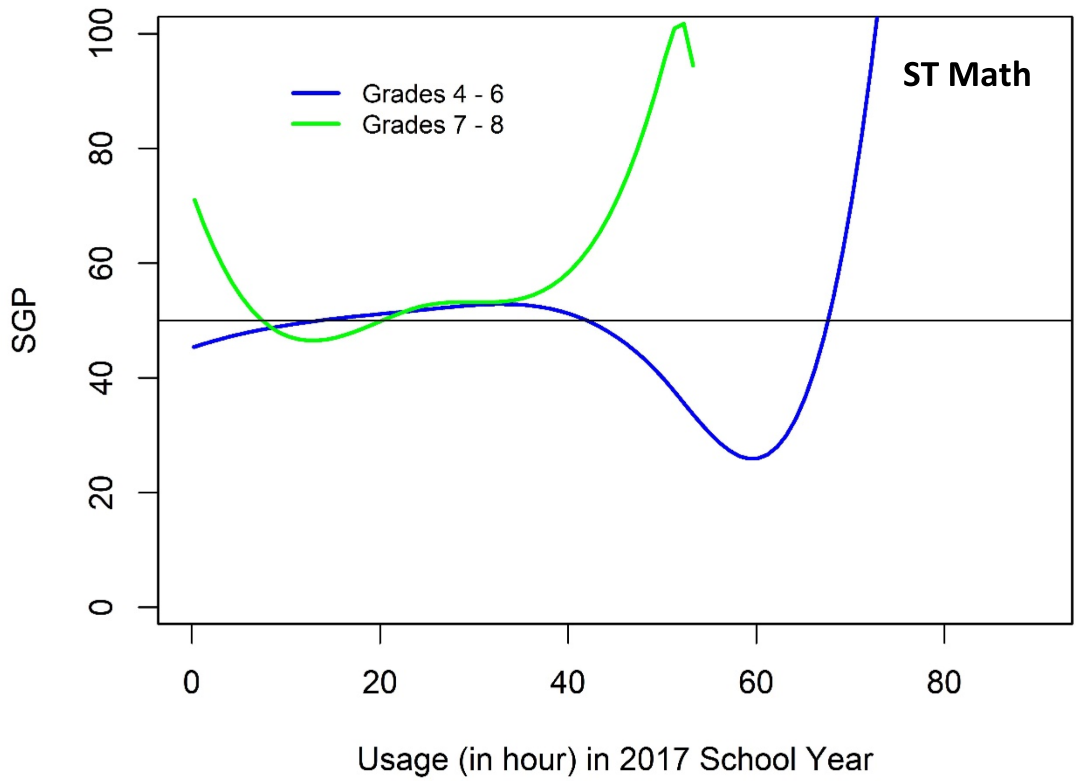
Source: Vendor Usage Data and Student Education Data

Figure 18. iReady Mean SAGE SGP by Student Usage in Hours per Year



Source: Vendor Usage Data and Student Education Data

Figure 19. ST Math Mean SAGE SGP by Student Usage in Hours per Year



Source: Vendor Usage Data and Student Education Data