NEWPORT NEWS PUBLIC SCHOOLS: SPARK EVALUATION STUDY

Phase II Evaluation Report

January 2019

Authors:
Kristi E. Wagner, Ed.D., Senior Research Associate, Shaffer Evaluation Group
Thomas Ward, Ph.D., Statistician, The College of William & Mary
Patricia Moore Shaffer, Ph.D., Principal, Shaffer Evaluation Group
Noël Williams, Research Associate, Shaffer Evaluation Group

Table of Contents

Executive Summary

Newport News Public Schools sought an evaluation study of its five-week long Summer Program for Arts, Recreation and Knowledge, also known as SPARK. SPARK is an extension of the year-long WE-LEAP program, which provides weekday, Saturday, and summer enrichment programs—including academic support, art, music, health and fitness, and STEM—reinforced with programming from community partners, providing cultural engagement and enrichment activities.

The intent of SPARK is to extend students' learning past the traditional school year and expose them to coursework from their upcoming grade, giving them a jump start on success. This program, which is offered free to kindergarten through eighth-grade students enrolled in NNPS and includes meals and transportation, offers a wide range of learning opportunities, including enrichment activities beyond the academic period. A National School Boards Association Magna Award winner for exemplary and innovative student learning, SPARK started with 2,000 students in 2015 and expanded to 6,000 in 2016. The 2018 session ran from July 9 through August 2, Mondays through Thursdays.

Results of the Phase II Evaluation

Program Quality

Findings about program quality are based on the evaluator's observations of the SPARK program across all participating schools using a research-based protocol to assess STEM learning programs:

- The most frequently observed indicators in SPARK classrooms were related to math and science content, including content accuracy and the appropriate use of math and science vocabulary.

- Teachers were frequently observed asking open-ended questions and providing assistance or scaffolding instruction for struggling students.

- Students were frequently engaged in activities with high cognitive demand and applying knowledge to novel situations.

- At the elementary level, examples of high-quality inquiry learning were more frequently observed, whereas "meaningful instruction" -- with its focus on conceptual development and cognitive engagement – was more visible at the middle school level.

Student Interest and Engagement in STEM

The results of a student survey conducted at the start of the summer program and once again in fall 2018 produced the following findings associated with SPARK participation:

- SPARK Elementary Students:

    - Students demonstrated increased attitudes towards science, which were statistically significant in Grade 5.

    - Statistically significant declines in student attitudes towards mathematics were observed.

    - Students demonstrated statistically significant increases in their confidence in communication, collaboration, and self-directed learning; increases were also statistically significant in Grade 5 and with female SPARK students.

    - Students' self-reported participation in STEM related activities did not increase in the fall semester following SPARK participation.

- SPARK Middle School Students:
  - Attitudes toward science declined, while mathematics attitudes among students remained stable, with slight variations by grade level and gender.
  - Middle school student attitudes towards engineering and technology increased overall, reaching statistical significance in Grade 8.
  - Eighth grade students were the only grade that demonstrated increased 21st century attitudes and skills, although the increase was not statistically significant.
  - Similar to the elementary level, students' self-reported participation in STEM related activities did not increase in the fall semester following SPARK participation.

Correlations Between Program Quality and SPARK Sites

- Program quality indicators had a positive relationship with the student attitudes and behavior outcomes. Higher scores on any dimension observed by the evaluator was related to more positive outcomes at the student level. Specifically, the analysis revealed that differences in observed program quality differences were related to students' math attitudes and 21st century attitudes and skills outcomes on the post-survey.
- There were small but statistically significant differences in students' math attitudes and 21st century attitudes and skills among the SPARK locations. Student attitudes at the three elementary locations were significantly higher that the two middle school locations.

Perceptions About Students' Readiness to Learn

- Teachers at both elementary and middle school levels described their SPARK students as demonstrating a stronger readiness to learn than their peers. Teachers frequently described SPARK students in the fall as engaged, enthusiastic, and confident.
- In general, elementary students indicated they felt more confident in science after participating in the SPARK program and described having a "heads up jump start" in science. Several elementary students also indicated they feel more confident in working with classmates and collaborating with students they do not know after participating in SPARK with students from other schools.
- Middle school students indicated that SPARK has helped them in math because of the extra practice. Specifically, sixth grade math students often described their work related to fractions.
- Elementary teachers felt the most valuable contribution of the SPARK program was "exposure" to learning and enrichment opportunities that they might not normally get to experience. Teachers at all school levels felt the afternoon enrichment activities were very important and provided students access to a range of opportunities.
- Middle School teachers felt the previous program design, which teamed teachers from the same school to serve students from that school, was more impactful.

Student Achievement in Mathematics and Science

The evaluator examined whether participation in the 2017 SPARK program made a difference in students' performance on the 2018 SOL assessments in mathematics and science compared to their non-participating peers.

- SPARK students demonstrated statistically significant increases in mathematics achievement in Grades 5 and 6. In Grade 6, SPARK participants also scored higher in the Probability, Statistics, Patterns, Functions and Algebra reporting category at statistically significant level.

- Fifth grade SPARK students demonstrated statistically significant increases in science achievement.

- Although the mean outcomes of SPARK participants were higher across multiple assessments and grade levels, those increases did not reach statistical significance.

Background

Summertime presents the challenge of summer learning loss for many students, but summer learning programs have the potential to reverse these losses by engaging students in exciting ways that look and feel very different from learning during the school year. In addition to academic enrichment, summer learning programs often provide opportunities for cultural, athletic, and other stimulating summer activities that are less frequently available to children from low-income homes.

STEM, or science, technology, engineering, and math, is a popular focus for summer learning programs. STEM summer programs offer a unique and multifaceted opportunity to maintain and build core skills in math and literacy during the high-risk summer months. They do so by engaging young people in hands-on, inquiry-based learning that motivates students by immersing them in activities with real-world application.

Many STEM summer and out-of-school time (OST) programs primarily focus on motivation and engagement outcomes rather than student learning. Common non-learning outcomes include attitudes toward STEM; engagement with or interest in STEM; confidence, self-esteem, or self-efficacy; and self-reported science or technology skills.[1] STEM programs have demonstrated significant increases in such outcomes. For example, participants in a middle school robotics and geographic information system (GIS) summer program showed a significant increase in self-efficacy and attitudes toward science.[2] Similarly, an elementary and middle school OST math instructional program, Got Math?, which provided students with the opportunity to apply math skills learned to a real life situation, was found to improve students' skills and attitudes toward math. Pre-post survey results showed a measurable increase in students' sense of self-efficacy regarding math.[3] A multiyear evaluation of a summer program for middle and high school girls demonstrated a slight improvement in attitude toward math and knowledge of STEM careers.[4]

In addition to improving STEM motivation and engagement, STEM activities have been demonstrated to improve academic outcomes. The Afterschool Alliance analyzed impacts associated with STEM learning after school. They found that STEM activities increased STEM knowledge and skills as evidenced by increased test scores as compared to non-participants, gains in knowledge about STEM careers, gains in computer and technology skills, increased general knowledge of science, and gains in 21st century skills, including communication, teamwork, and analytical thinking.[5] For example, in the SHINE 21st Century Afterschool Program, a five-week camp program in Carbon and Schuylkill County, PA, students in three school districts showed gains in academic performance (67%) and science grades (62%) from the third to the fourth marking period on their report cards.[6] National, statistically controlled studies indicate that children who engage with Engineering is Elementary, a curriculum that engages elementary students in the engineering process, perform better on assessment questions about related science topics than children who do not taught using this curriculum.[7] Similarly, the Wallace Foundation, in its multiyear study in five urban school districts to determine whether voluntary summer learning programs were effective, found students demonstrated a near-term benefit in mathematics after one summer's attendance.[8]

Through hands-on activities and projects, SPARK is designed to engage students actively with STEM content. As such SPARK has the potential to increase students' STEM interest and engagement and improve academic performance. Because of NNPS's interest in obtaining evaluation findings to support

---

[1] Ault, P. C. (2005). *Annual report: Salmon Camp Research Team*. Portland, OR: Oregon Museum of Science and Industry.
[2] Nugent, G., Barker, B.,Grandgenett, N., & Adamchuk, V. (2010). Impact of robotics and geospatial technology interventions on youth STEM learning and attitudes. *The Journal of Research on Technology in Education, 42*(4), 391-408.
[3] Ibid.
[4] Harvard Family Research Project. (n.d.). *A profile of the evaluation of Girls Incorporated—Thinking SMART Program.* Retrieved from http://hfrp.org/out-of-school-time/ost-database-bibliography/database/girls-incorporated-thinking-smart-program
[5] Afterschool Alliance. (2011). *STEM learning in afterschool: An analysis of impact and outcomes* [Research brief]. Retrieved from http://www.afterschoolalliance.org/STEM-Afterschool-Outcomes.pdf
[6] Ibid.
[7] http://successfulstemeducation.org/resources/engineering-elementary
[8] Augustine, C. H., McCombs, J. S., Pane, J. F., Schwartz, H. L., Schweig, J., McEachin, A., & Evans, K. S. (2016). *Learning from summer: Effects of voluntary summer learning programs on low-income urban youth*. Santa Monica, CA: RAND Corporation.

future applications seeking funding for SPARK, this evaluation study sought to assess attitudinal and academic outcomes associated with SPARK participation.

Approach

The district was interested in obtaining evaluation findings to support future applications seeking funding for SPARK, so a two-part evaluation study was implemented to assess outcomes associated with SPARK participation. The first phase used existing data and focused on the major academic outcomes associated with SPARK and also with WE-LEAP, which is the larger programmatic context for SPARK.[9] The Phase I evaluation report was submitted to NNPS in April 2018. The second phase offered a more comprehensive evaluation of the STEM-related outcomes of SPARK.

Research Questions

1. To what extent does SPARK, and specifically the Early Learning Lab, meet out-of-school time program quality expectations for STEM learning?

2. Are SPARK students' levels of STEM interest and engagement similar at the start of SPARK and in the fall semester of the following school year?

    a. Do students report participating in STEM—in-school, extracurricular, or out-of-school—more frequently since participating in SPARK than they did in the previous school year? Are there differences by subgroups (e.g., gender, race/ethnicity)?

    b. Did self-reported interest in STEM change significantly between the baseline and follow-up surveys? Are there differences by subgroups (e.g., gender, race/ethnicity)?

    c. To what degree do SPARK-only participants self-reported interest in STEM at follow-up differ from students also participating in WE-LEAP?[10]

3. Are there correlations between a site's assessed program quality and student attitudes and behaviors?

4. Are there perceived improvements in students' readiness to learn in the fall?

5. Do participants in Early Learning Lab exhibit stronger growth and/or achievement on identified strands within math and science standardized tests than their non-participating peers attending the same school?

The evaluation framework for this study and the detailed study plan are presented in Appendix A.

[9] It is necessary to identify the outcomes associated with WE-LEAP in order to distinguish SPARK's unique contribution to academic outcomes.

[10] This question could not be addressed due to insufficient numbers of WE-LEAP participants responding to the survey.

Results and Discussion

The findings for program outcomes are provided below, organized by research question.

1. To what extent does SPARK meet out of school time program quality expectations for STEM learning?

Observation data were collected at each SPARK site during the summer of 2018 using the SERVE Study of STEM Learning Observation Protocol to gather data on program quality. Due to the limitation that the observer visited a site on one day only and was not present for a series of unit lessons, findings should be interpreted with caution.

Developed by the Regional Educational Laboratory Southeast, supported by the U.S. Department of Education, this observation protocol includes several scales illustrating different dimensions of STEM learning: Math and Science Content, Meaningful Instruction, STEM (Inquiry Learning), and Common Instructional Framework. Math and Science Content ratings gathered evidence related to content accuracy, teacher presentation and clarification, emphasis on meaningful relationships in the content, discussion of key concepts, connections to previous knowledge and or other content areas, and student misconceptions/mistakes. Indicators related to Meaningful Instruction focused on conceptual development and cognitive engagement. Evidence was focused on the cognitive demand of the activities, students explaining/justifying their thinking, opportunities to summarize learning, use of a variety of means to represent to concepts, applying knowledge to novel situations, and comparing/contrasting responses. STEM (Inquiry) Learning focused on student engagement in scientific practices and student vs. teacher driven activities by using indicators such as: students engaged in open-ended tasks, hands-on or real-life activities, developed their own questions/hypotheses to explore and determined which strategies they might use to complete a task. Lastly, the Common Instructional Framework focused on student collaboration and discussion, writing for communication, use of open-ended teacher questions, and instructional scaffolding. Each of the dimensions utilized a scale from 0 (not observed) to 3 (very descriptive of the observation). Frequency data represents the percentage of classrooms where the indicator was observed (ratings of 1 or greater). Observations were limited to morning hours during primary instructional time, approximately 30 minutes per observation, for a total of 3-4 classroom observations per site. Sites were in various stages of the curriculum during the observation period. Additional information, including the observation protocol, are located in the Appendices A and B.

Table 1 demonstrates the overall frequency of observed indicators for each dimension of the observation protocol, and by school level. Overall, the most frequently observed indicators were related to Math and Science Content, observed in 62% of classrooms. Indicators included “accurate and appropriate use of vocabulary” (87%) and “math or science content information was accurate” (83%). Indicators related to Common Instructional Framework were also frequently observed, with an overall frequency of 52%. Indicators such as “teachers were observed providing assistance/scaffolding when students struggled” reached 90% and “teachers asked open ended questions that require higher level thinking” reached 80%. Meaningful Instruction indicators had an overall observed frequency of 51%. Indicators such as “students experienced high cognitive demand” (80%) and “students were asked to apply knowledge to a novel situation (77%) were observed most frequently. Indicators in STEM (Inquiry) Learning and were less frequently observed with an overall frequency of 20%. Indicators included “students were engaged in open-ended tasks or questions” (40%) and “students engaged in scientific inquiry process (33%). The overall frequency by dimension is provided in Figure 1.

There were also differences observed differences across school levels (Figure 2). Differences in school levels were most apparent with indicators related to STEM (Inquiry) Learning and Meaningful Instruction. At the elementary level, all indicators of STEM (Inquiry) Learning were more frequently observed that at the middle school level; only one indicator was observed in middle school classrooms. Five of the six indicators of Meaningful Instruction were more frequently observed at the middle school level. The two different programmatic approaches likely influenced these indicators.

Program quality ratings were based on a limited sample of classroom observations across sites. Based on a review of a sample unit of study and participant feedback in both student and teacher focus groups, it is possible that the sampling strategy influenced the observation ratings, particularly in the STEM (Inquiry) Learning domain. At the elementary level, units are designed around a driving question and culminate with an open-ended performance task and student exhibition, which may not be as frequently observed during the shorter duration of an observation. The middle school program design did not include a focus science or STEM, which reduced the frequency of observed indicators in those areas.

Figure 1. Observed Frequency of STEM Learning Dimension

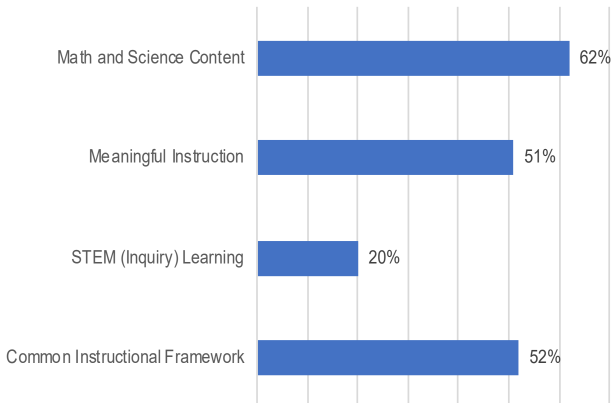


Figure 2. Observed Frequency of STEM Learning Dimension, by School Level

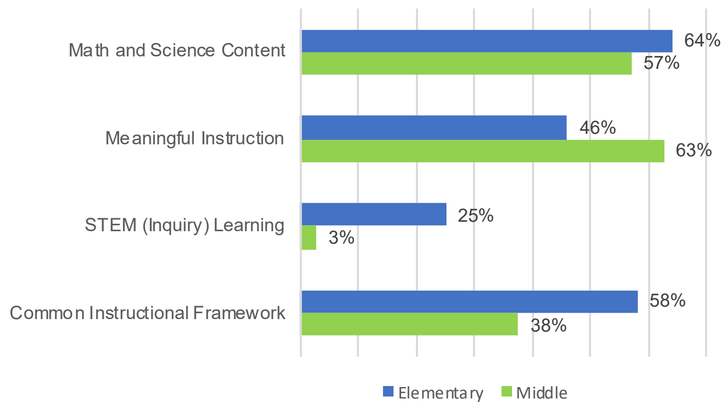


Table 1. Observed Frequency of Instructional Indicators

		Elementary N=22	Middle N=8	*Overall* *N=30*
Math and Science Content	1a. Math and science content information was accurate.	86%	75%	*83%*
	1b. Teacher's presentation or clarification of mathematics or science content knowledge was clear.	82%	75%	*80%*
	1c. Teacher used accurate and appropriate mathematics or science vocabulary.	91%	75%	*87%*
	1d. Teacher/students emphasized meaningful relationships among different facts, skills, and concepts.	14%	50%	*23%*
	1e. Student mistakes or misconceptions were clearly addressed (emphasis on correct content here).	68%	75%	*70%*
	1f. Teacher and students discussed key mathematical or science ideas and concepts in depth.	73%	63%	*70%*
	1g. Teacher connected information to previous knowledge.	68%	63%	*67%*
	1h. Appropriate connections were made to other areas of mathematics/science or to other disciplines.	18%	25%	*17%*
	1i. Appropriate connections were made to real-world contexts.	77%	13%	*60%*
Meaningful Instruction	2a. Students experienced high cognitive demand of activities because teacher did not reduce cognitive demand of activities by providing directive hints, explaining strategies or providing solutions to problems before students have a chance to explore them, etc.	73%	100%	*80%*
	2b. Students were asked to explain or justify their thinking.	45%	75%	*53%*
	2c. Students were given opportunities to summarize, synthesize, and generalize.	32%	50%	*37%*
	2d. Students used a variety of means (models, drawings, graphs, concrete materials, manipulatives, etc.) to represent phenomena.	36%	63%	*43%*
	2e. Students were asked to apply knowledge to a novel situation.	73%	88%	*77%*
	2f. Students were asked to compare/contrast different answers, different solutions, or different explanations/interpretations to a problem or phenomena.	18%	0%	*17%*
STEM (Inquiry) Learning	3a. Students were engaged in open-ended tasks or questions.	41%	25%	*40%*
	3b. Students engaged in hands-on or real-life problem-solving activities or a lab experiment.	32%	0%	*23%*
	3c. Students developed their own questions and/or hypotheses to explore or test.	18%	0%	*13%*
	3d. Students engaged in scientific inquiry process (tested hypotheses and made inferences)	45%	0%	*33%*
	3e. Students determined which problem-solving strategies to use.	18%	0%	*17%*
	3f. Students had to present or explain results of project.	9%	0%	*7%*
	3g. Students worked on a project requiring creativity.	27%	0%	*20%*
	3h. There was an explicit evidence of teacher modeling engineering (or reverse engineering) design process.	27%	0%	*20%*
	3i. There was an explicit evidence of students using engineering (or reverse engineering) design process.	5%	0%	*3%*
Common Instructional Framework	5a. Students worked collaboratively in teams or groups.	45%	0%	*33%*
	5b. Students used writing to communicate what they had learned.	55%	63%	*60%*
	5c. Teachers asked open-ended questions that required higher level thinking.	86%	63%	*80%*
	5d. Teachers provided assistance/scaffolding when students struggled.	95%	75%	*90%*
	5e. Students engaged in discussion with each other.	41%	25%	*37%*
	5f. Students participated in guided reading discussions.	27%	0%	*20%*

2. Are SPARK students' levels of STEM interest and engagement similar at the start of SPARK and in the fall semester of the following school year?

Utilizing data from a pre-post student survey, a series of analyses were conducted to determine if students' levels of STEM interest and engagement changed from the start of SPARK to the fall semester. The survey consisted of four dimensions that measure student attitudes toward STEM related areas. The survey dimensions included Math Attitudes, Science Attitudes, Engineering and Technology Attitudes, and 21st Century Skills and Attitudes. The first three dimensions each include items measuring student self-efficacy related to their respective content areas (math/science/technology and engineering) and expectations for future value gains from success in these content areas. 21st Century Attitudes and Skills include items measuring student confidence in communication, collaboration, and self-directed learning.

For each pre/post survey respondent, a mean score was generated for each dimension. A comparison of the pre/post means, by dimension, was generated to determine if the changes were statistically significant. Students also responded to questions related to their STEM in-school/extracurricular related activities and out of school related STEM activities. To be included in the analysis for a dimension, a respondent must have completed approximately 75% of the items within the scale.

A total of 1216 students responded to the pre-survey and 1423 students responded to the post-survey. For analysis, only students with matched pre-post survey responses were included in the analyses. Overall, 51% of SPARK students participated in both the pre and post surveys. Responses were analyzed by scale or topics. A summary of outcomes organized by sub question is provided below.

a. *Do students report participating in STEM—in-school, extracurricular, or out of school—more frequently since participating in SPARK than they did in the previous school year? Are there differences by subgroups?*

To answer this question, the pre/post survey asked students to report their participation in a variety of STEM related activities, both in school and out of school. On the pre-assessment administered on the first day of the SPARK program, students reported their participation on a series of STEM related activities during the previous school year. On the post-survey administered in October, students reported their participation on the same series of STEM related activities for the current school year. Student responses may be influenced by several factors. School-based club offerings are often controlled at the site (sponsors, grade level focus, student selection by lottery) and student participation in extracurricular activities, particularly at the elementary level, is highly dependent on transportation and parental availability.

At both school levels, students reported participation in STEM related in-school, extracurricular, or out of school activities, but the frequency of participation did not increase in the fall semester following SPARK. Across both school levels, the most frequently reported STEM activities included STEM Club and playing games or using kits to do experiments or build things at home. There were only slight variations between grade levels or by gender.

Elementary. Overall, 59% of elementary respondents indicated they participated in at least one school related STEM activity during the last school year, while 54% of students reported participating during the current school year. STEM Club was the most frequently reported activity in both the pre- and post-survey. Participation levels varied slightly among males and females and grade levels. Detailed participation data are provided in Table 2.

Out of school related STEM activities included reading science books or magazines, accessing website sites, visiting museums, playing science games or kits at home, or watching science related programs on TV. Overall, 98% of elementary respondents indicated they participated in at least one out of school related STEM activity during the last school year, while 97% of students reported participating during the current school year. On both the pre and post survey, the most frequently reported activity was playing games or using kits to do experiments or build things at home. The least reported activity was reading science books or magazines. Participation varied slightly among males and females and grade levels. Detailed participation data are provided in Table 2.

Table 2. Elementary Student Participation in STEM Related Activities

		Male		Female		Grade 4		Grade 5		*Total*	
		N=194		N=213		N=214		N=197		*N=411*	
		PRE	POST	PRE	POST	PRE	POST	PRE	POST	*PRE*	*POST*
Elementary Student Participation in school related STEM Activites	Science Club	17%	16%	16%	12%	21%	14%	12%	14%	*17%*	*14%*
	STEM Club	33%	26%	30%	24%	33%	26%	29%	24%	*31%*	*25%*
	Gardening Club	7%	8%	11%	14%	7%	13%	11%	9%	*9%*	*11%*
	Robotics Club or Team	18%	17%	7%	9%	11%	11%	13%	15%	*12%*	*13%*
	Coding Club	21%	19%	12%	10%	16%	14%	16%	14%	*16%*	*14%*
	Engineering Club	17%	15%	15%	10%	15%	10%	17%	15%	*16%*	*12%*
Elementary Student Participation in out of school STEM Activities	Read science books or magazines	69%	69%	69%	69%	72%	63%	67%	74%	*69%*	*68%*
	Access web sites for computer technology information	76%	74%	80%	74%	78%	70%	79%	77%	*78%*	*74%*
	Visit a science museum, planetarium, or environmental center	77%	74%	78%	73%	76%	71%	79%	75%	*77%*	*73%*
	Play games or use kits to do experiments or build things at home	81%	79%	85%	80%	82%	76%	86%	84%	*83%*	*80%*
	Watch programs on TV or the internet about nature or discoveries	70%	68%	75%	77%	71%	77%	73%	69%	*73%*	*73%*

Middle School. Overall, 45% of middle school respondents indicated they participated in at least one school related STEM activity during the last school year, while 43% of students reported participating during the current school year. STEM Club was the most frequently reported activity in both the pre- and post-survey. Participation varied slightly among males and females and grade levels. Detailed participation data are provided in Table 3.

Out of school related STEM activities included reading science books or magazines, accessing website sites, visiting museums, playing science games or kits at home, or watching science related programs on TV. Overall, 97% of middle school respondents indicated they participated in at least one out of school related STEM activity during the last school year, while 96% of students reported participating during the current school year. On both the pre- and post-survey, the most frequently reported activity was playing games or using kits to do experiments or build things at home and visiting a science museum, planetarium, or environmental center. Participation varied slightly among males and females and grade levels. Detailed participation data are provided in Table 3.

Table 3. Middle School Student Participation in STEM Related Activities

		Male		Female		Grade 6		Grade 7		Grade 8		*Total*	
		N=225		N=190		N=222		N=121		N=85		*N=428*	
		PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST	*PRE*	*POST*
Middle School Student Participation in school related STEM Activites	Science Club	11%	14%	13%	15%	15%	17%	8%	10%	6%	12%	*11%*	*14%*
	STEM Club	23%	15%	29%	17%	34%	18%	19%	12%	6%	14%	*24%*	*15%*
	Gardening Club	4%	6%	9%	16%	10%	15%	2%	8%	2%	1%	*6%*	*10%*
	Robotics Club or Team	16%	22%	5%	14%	15%	23%	7%	16%	6%	7%	*11%*	*18%*
	Coding Club	11%	11%	13%	10%	14%	11%	12%	12%	7%	8%	*12%*	*11%*
	Engineering Club	12%	17%	4%	11%	9%	18%	7%	9%	7%	11%	*8%*	*14%*
Middle School Student Participation in out of school STEM Activities	Read science books or magazines	72%	65%	67%	70%	73%	70%	66%	61%	69%	73%	*70%*	*68%*
	Access web sites for computer technology information	82%	82%	72%	73%	78%	79%	82%	79%	75%	80%	*78%*	*79%*
	Visit a science museum, planetarium, or environmental center	86%	77%	78%	77%	85%	80%	76%	73%	87%	76%	*83%*	*77%*
	Play games or use kits to do experiments or build things at home	83%	77%	83%	79%	84%	79%	86%	74%	78%	82%	*83%*	*78%*
	Watch programs on TV or the internet about nature or discoveries	82%	82%	75%	79%	79%	79%	78%	82%	75%	83%	*78%*	*81%*

b. *Did self-reported interest in STEM change significantly between the baseline and follow-up surveys? Are there differences by subgroups?*

To determine if student interest in STEM changed, paired-sample t-tests were conducted using the pre/post survey data, by dimension. Analyses were run for scales in Math Attitudes, Science Attitudes, Technology and Engineering Attitudes, and 21st Century Attitudes and Skills.

At the elementary level, students demonstrated statistically significant declines in attitudes towards math but increased attitudes towards science. At fifth grade, the increase in science attitudes reached statistical significance. Attitudes towards engineering and technology increased only in Grade 5 and with female SPARK students; these changes did not reach statistical significance. Overall, the elementary group also demonstrated statistically significant increases in 21st Century Attitudes and Skills; increases were also statistically significant in Grade 5 and with female SPARK students.

At the middle school level, the overall Math Attitudes remained stable. There were variations between groups, with Grades 6 and 8 demonstrating slight mean increases, while there were statistically significant declines demonstrated at Grade 7 and with female students. Middle school students demonstrated declines in attitudes towards science in the overall group, Grades 6 and 7, and by gender. Only Grade 8 Science Attitudes demonstrated an increase, which did not reach statistical significance. Since the middle school summer SPARK program focuses on math and English, the absence of a science component likely influenced the Science Attitudes findings. Attitudes towards engineering and technology increased overall and in all groups with the exception of Grade 6; increases were found to be statistically significant at Grade 8. Grade 8 participants were also the only group who demonstrated increased 21st Century Attitudes and Skills; changes were not statistically significant.

Mathematics Attitudes. Analyses indicated that there was a statistically significant decrease in elementary students' attitudes Math Attitudes in the overall group. Additional disaggregation by grade level and gender indicated that changes in Grade 4 were statistically significant. There were not statistically significant changes in fifth grade or by gender (Figure 3).

At the middle school level, the overall group did not demonstrate statistically significant changes Math Attitudes. There were differences between groups: students in Grade 7 and female students demonstrated statistically significant decreases in Math Attitudes, while male students and eighth grade students demonstrated mean increases in Math Attitudes (Figure 4).

Notably, Math Attitudes were significantly higher among lower grade students. Math Attitudes of 4th and 5th grade students were comparable; however, Math Attitude ratings were significantly lower at each grade through grade 8 (Figure 5)

.

Figure. 3. Elementary Student Attitudes Towards Math

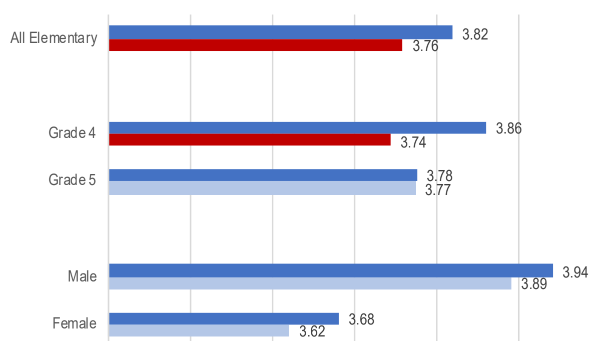
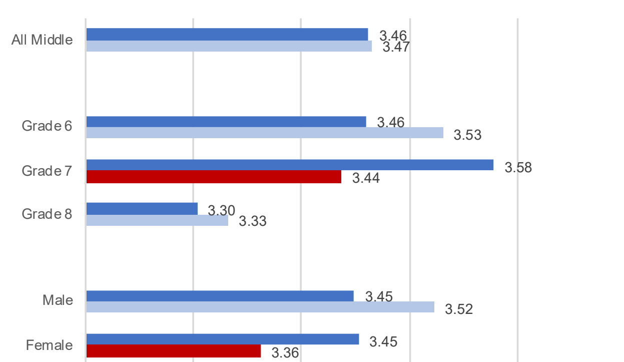


Figure. 4. Middle School Student Attitudes Towards Math



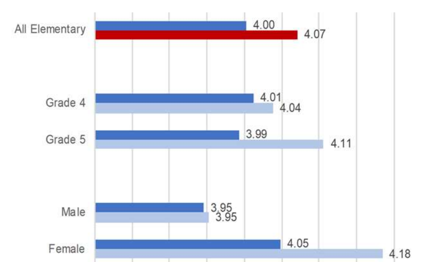
Understanding the Results

This analytical series is based on the student pre-post survey. Scores presented in the graphs are mean scores for the overall group, then disaggregated by grade level and gender.

A comparison of the pre/post means, by dimension, was used to determine if the changes in pre-post means were statistically significant. The first mean presented (first bar) is the mean from the pre-survey, followed by the mean from the post-survey (second bar).

A "statistically significant" change in mean, represented by a red post-survey bar. This indicates the identified group exhibited a change that reached statistically significant level. Statistical significance is demonstrated by a red bar in the graphs.

Figure X. Example



Line graphs are used to demonstrate changes in mean across grade levels. Line graphs are only included if the findings were significant.

Figure X. Example

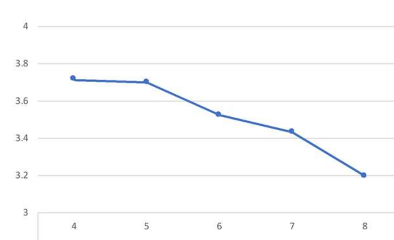
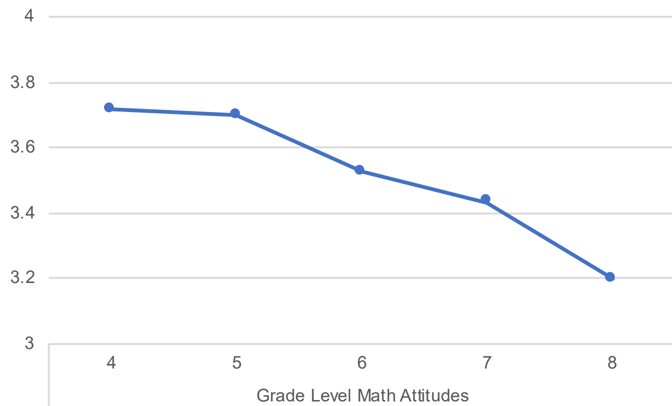


Figure 5. Student Attitudes Towards Math, by Grade Level



Science Attitudes. Elementary students and groups demonstrated overall increases in Science Attitudes, which were statistically significant at Grade 5 (Figure 6). At the middle school level, students demonstrated a decline in Science Attitudes, with the exception of Grade 8 where attitudes increased. The overall group, and specifically Grade 6 students, demonstrated statistically significant decreases in Science Attitudes (Figure 7). The middle school summer SPARK program focuses on math and English, and the absence of a science component likely influenced these findings. Across grade level, analysis confirmed that fifth grade students had statistically significant higher scores in Science Attitudes than other grades (Figure 8).

Figure 6. Elementary Student Attitudes Towards Science

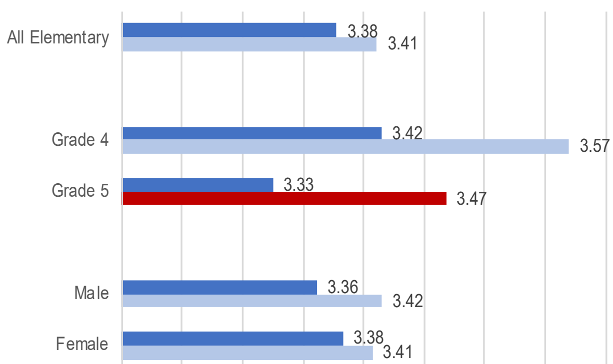


Figure 7. Middle School Student Attitudes Towards Science

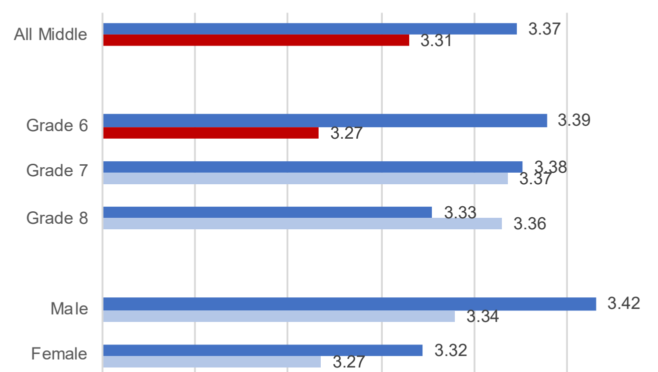
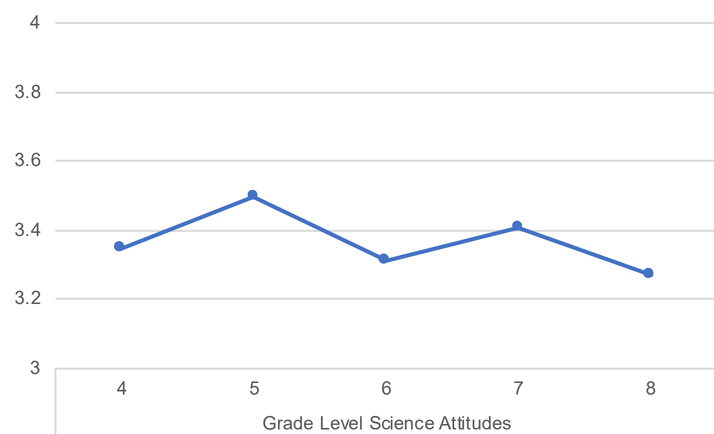


Figure 8. Student Attitudes Toward Science, by Grade Level



Engineering and Technology Attitudes. Overall, elementary students did not demonstrate improvement in Engineering and Technology Attitudes. However, students in Grade 5 and female SPARK students demonstrated increased attitudes, but the changes were not statistically significant (Figure 9). Overall middle school students reported increased Engineering and Technology Attitudes, which were statistically significant at Grade 8 (Figure 10). There were no statistically significant differences across grade levels.

Figure 9. Elementary Student Attitudes Towards Engineering and Technology

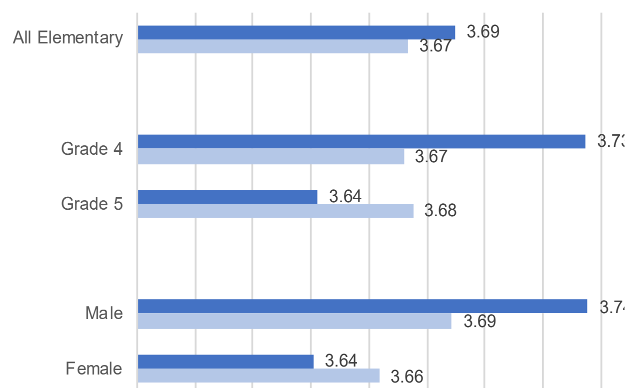
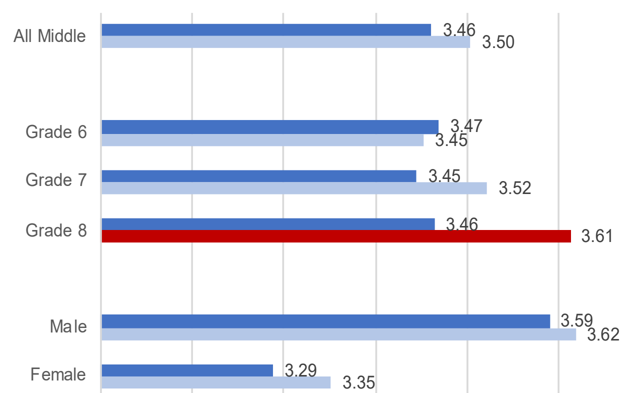


Figure 10. Middle School Student Attitudes Towards Engineering and Technology



21st Century Attitudes and Skills. Elementary students demonstrated statistically significant improvement in 21st Century Attitudes and Skills from the start of the SPARK program to the fall semester. At the elementary level, grade 5 and female students demonstrated moderate to large increases in mean scores for these attitudes and skills, but changes were not statistically significant (Figure 11). No significant changes were found at the middle school level, although increased mean scores were demonstrated at Grade 8 (Figure 12).

Across grade levels, the fourth and fifth grade means on 21st Century Attitudes and Skills were significantly higher than those for grades 6, 7, and 8. No other grade level comparisons were statistically significant (Figure 13).

Figure 11. Elementary Student 21st Century Attitudes and Skills

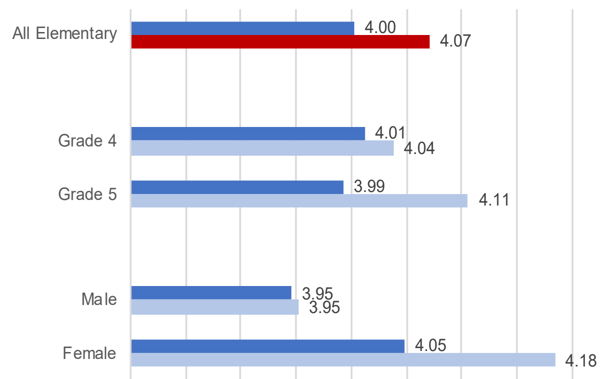


Figure 12. Middle School Student 21st Century Attitudes and Skills

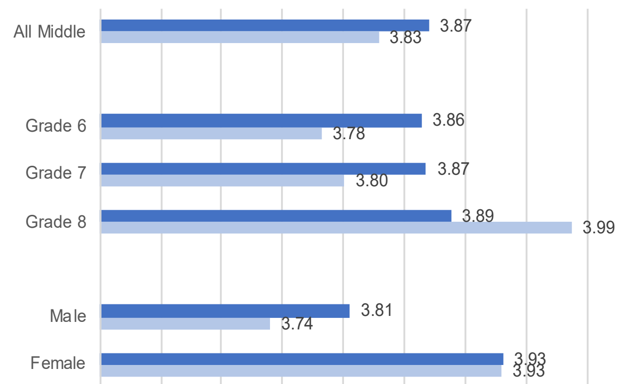
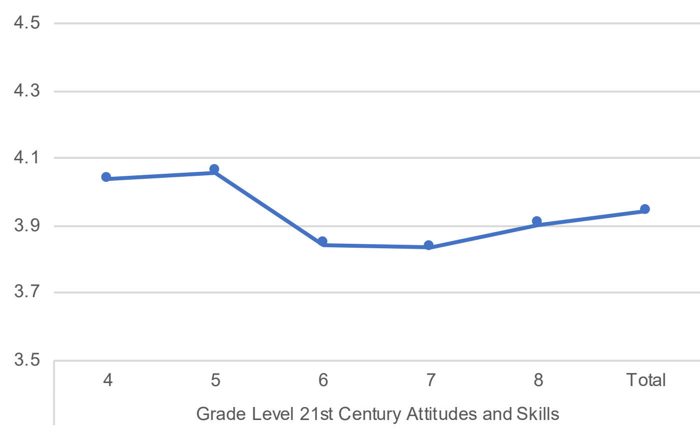


Figure13. Student 21st Century Skills and Attitudes, by Grade Level



c. *To what degree do SPARK-only participants self-reported interest in STEM at follow-up differ from students also participating in WE-LEAP?*

Unfortunately, there were very few WE-LEAP participant responses to the post-survey; therefore, there were insufficient data to address this research question.

3. Are there correlations between a site's assessed program quality and student attitudes and behaviors?

Program quality data, collected from the previously discussed classroom observations, was used to determine if there was a relationship between a site's assessed program quality and student attitudes as documented through the post-survey.

The initial analysis indicated that there were small but statistically significant differences in students' Math Attitudes and 21st Century Attitudes and Skills among the SPARK locations. The comparisons show attitudes at the three elementary locations were significantly higher that the two middle school locations. There are no significant differences among the elementary schools or the middle schools (Figures 14-15).

Based on the initial analysis, a second, multivariate analysis was used to determine if the observed program quality was related to student attitudes and behaviors.[11] The analysis revealed that each of the site quality indicators had a positive relationship with the student attitudes and behavior outcomes. In other words, higher scores on any observed dimension (i.e., Math and Science Content, Meaningful Instruction, STEM (Inquiry) Learning), Common Instructional Framework) was related to more positive outcomes in students' Math Attitudes and 21st Century Attitudes and Skills outcomes on the post-survey.

Figure 14. Student Attitudes Towards Math, by Site

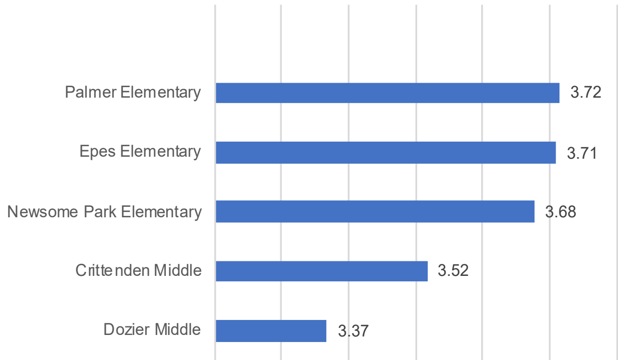
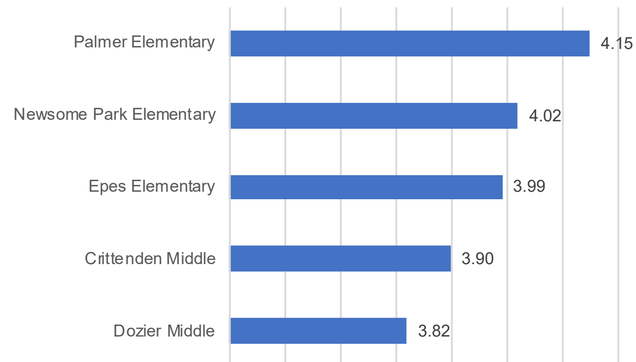


Figure 15. Student 21st Century Attitudes and Skills, by Site



4. Are there perceived improvements in students' readiness to learn in the fall?

To assess the program's impact on students' readiness to learn, a series of stakeholder focus groups were conducted. A total of five focus group discussions, 3 student and 2 teacher groups, were conducted between October 30 and November 13, 2018. Follow-up interviews with three additional teachers of SPARK students were conducted in January 2019. Findings are discussed below, organized by school level.

Elementary SPARK. A total of 13 fifth grade 2018 SPARK participants representing Newsome Park, Epps, and Palmer participated in the elementary student discussions. The teacher focus group discussion included 8 teachers who taught Grades 3-5 and ESL in the SPARK programs at Newsome Park or Palmer during the summer of 2018; one Sedgefield teacher participated in a follow-up interview.

Elementary teachers indicated their SPARK students demonstrate a stronger readiness to learn in the fall than their non-SPARK peers. Teachers described SPARK students as "excited and enthusiastic" in the classroom as they engage in learning activities. Teachers felt the SPARK students demonstrated increased confidence, particularly in science, due to their prior experiences in SPARK. One teacher indicated that her SPARK students often act as "teacher assistants" and help peers in class, which demonstrates their confidence with the learning activities.

Overall, teachers felt the most valuable contribution of the SPARK program was "exposure." Through SPARK, students are exposed to learning and enrichment opportunities that they might not normally get to experience. In the academic portion of SPARK, teachers felt the slower pace, hands-on activities, collaboration, and technology were impactful for students. Teachers also felt the afternoon enrichment activities were very important and provided students access to a range of opportunities, such as field trips, music, drums, dance, and science. Teachers felt the enrichment was particularly important for

[11] For this analysis, composite data are provided. The composite score, or the overall score, is the simple average of the dimensions.

students who “may not always receive the enrichment moment” because so much time is spent on remediation during the school year.

Students also shared they felt confident in science after participating in the SPARK program because they were “doing it now at school.” One student indicated he just took the “oceans test” and “what we did this summer helped me.” Overall, students described having a “heads-up jump start” in science. Several students also indicated they feel more confident in working with others and are “more open” to collaborating with other people after participating in SPARK with students from other schools.

Less than half of the students in the discussions described participating in school activities, such as the Robotics Club, 21st Century Club, or STEM Challenge. One student indicated he was interested in the Robotics Club but was “not picked” to participate. Outside of school, students reported participating in STEM activities included LEGO building, computers, and experiments at home.

Middle School SPARK. A total of 10 middle school students representing grades 6-8 at Dozier Middle School participated in the student discussion. Six teachers representing math and ESL at Dozier participated in the teacher discussion and two teachers participated in follow-up interviews.

When asked about the impact on students’ readiness to learn, teachers felt there was an impact on students who attended SPARK regularly. In follow-up interviews, teachers provided specific examples of students demonstrating readiness to learn by transitioning strongly into middle school classes, adapting to the pace and rigor of the curriculum, and generally being “more well prepared” than their peers.

Middle school students reported feeling more confident in math as they started the school year after SPARK and mentioned remembering things from summer program that helped. Students felt the summer program “helped” with both fractions and problem solving in math this year. Several students indicated that SPARK has helped them “get it” more quickly in math because of the extra practice.

When asked about their interest and participation in STEM, students in the group had limited participation and interest in STEM, math, or science. One student indicated he participates in coding and gaming outside of school. Others indicated they were already involved in other activities. One student indicated she participated in the STEM club last year but did not enjoy it. One student is enrolled in a STEM class at school.

5. Do participants in Early Learning Lab exhibit stronger growth and/or achievement on identified strands within math and science standardized tests than their non-participating peers attending the same school?

The analysis was designed to examine whether gains in standardized test scores differ between students who fully participate in WE-LEAP[12] and SPARK, partially participate (SPARK or WE-LEAP), or did not participate at all. The results may yield evidence of the relative effectiveness of varying levels of participation in the program. SOL data for the 2016-2017 and 2017-2018 academic years were available for grades 3, 4, 5, 6, and 8. SOL Math scores were available for each of the grades and SOL Science data were available for grades 5 and 8.

An analysis of the 2018 SOL mathematics and science data indicates there were statistically significant increases in the mathematics achievement of 2017 SPARK participants in Grades 5 and 6. In Grade 6, SPARK participants also scored higher in the Probability, Statistics, Patterns, Functions and Algebra reporting category at statistically significant level. Although the mean outcomes of SPARK participants were higher across multiple assessments and grade levels, those increases did not reach statistical significance.

[12] Participants in WE-LEAP and participants in SPARK may represent different student populations and learning profiles based on program selection and design.

Grade 3. The analysis found no significant effects on overall achievement in math or specifically in Number and Number Sense or Computation and Estimation reporting categories for 3rd grade students participating in 1) SPARK, 2) WE-LEAP, or 3) WE-LEAP and SPARK after controlling for the demographic variables (Figures 16 and 17). Note that the Grade 3 cohort analysis did not include a comparison to past academic achievement since third grade students would not have taken any SOL Mathematics tests in previous years, therefore the only statistical controls in the analysis are demographic variables.

Figure 16. Grade 3 Math: Overall Achievement

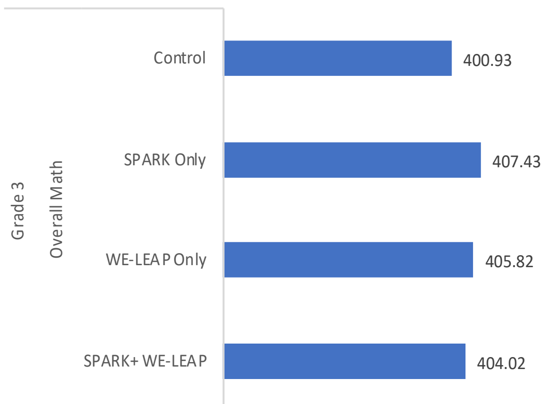
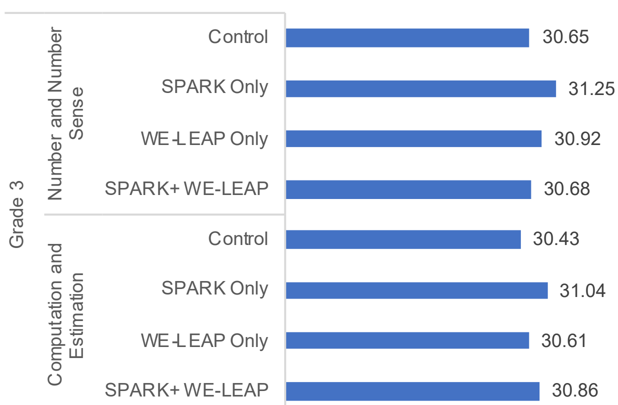


Figure 17. Grade 3 Math: Reporting Categories



Grade 4. The results of the analysis indicate that there were no significant effects on overall achievement in math or in the specific reporting categories of Computation and Estimation and Probability, Statistics, Patterns, Functions, and Algebra for fourth grade students participating in 1) SPARK, 2) WE-LEAP, or 3) WE-LEAP and SPARK after controlling for the demographic variables (Figures 18 and 19).

Understanding the Results

The analysis controlled for gender, disability status, ethnicity, and prior achievement in order to create equivalent groups (non-participants, participants) for analysis of program impact. Controlling for these variables increases the confidence that observed statistical changes are due to program participation, rather than demographic differences. Note that analyses did not include controls for prior achievement at the third-grade level since SOL testing begins at Grade 3.

All means reported are adjusted group means. Adjusted group means are generated by the previously described statistical analyses that control for demographic differences. Providing the adjusted means ensures group equivalence, including prior achievement when available, for appropriate comparisons in the research questions.

A "statistically significant" mean, represented by a red bar, indicates the participant group exhibited greater growth than the comparison group at a statistically significant level. Statistical significance is demonstrated by a red bar in the graphs.

Figure X. Example

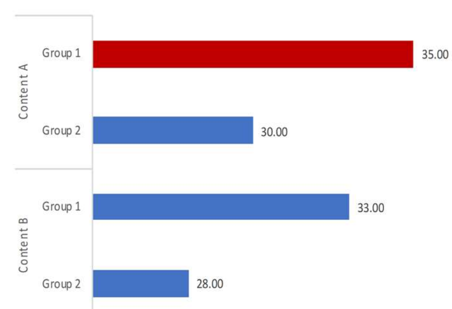


Figure 18. Grade 4 Math: Overall Achievement

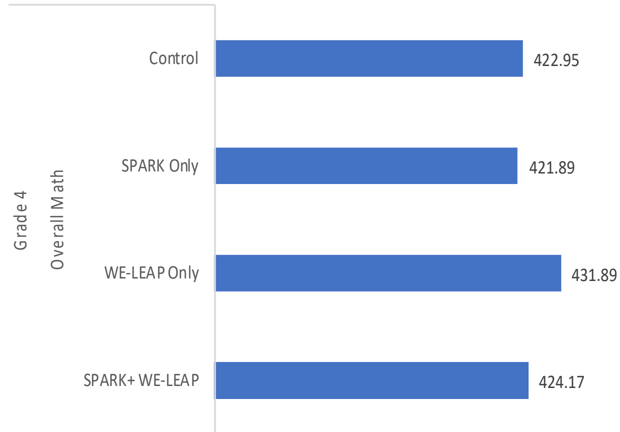
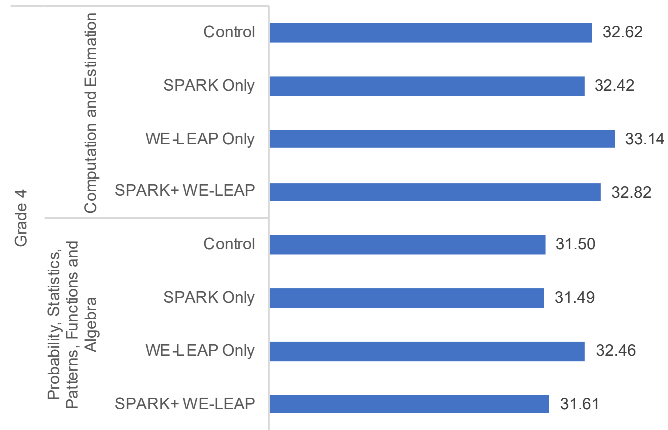


Figure 19. Grade 4 Math: Reporting Categories



Grade 5. The analysis found a statistically significant effect on the overall math achievement of SPARK only participants (Figure 20). Statistical comparisons for Math indicate that the SPARK Only group had a higher mean outcome than the other groups. There were no significant differences indicated for the math or science reporting categories. The mean Earth/Space reporting category scores were strong, but not statistically significant; of note, students frequently described engaging in activities during SPARK related to this strand of Grade 5 science. (Figures 21-23).

Figure 20. Grade 5 Math: Overall Achievement

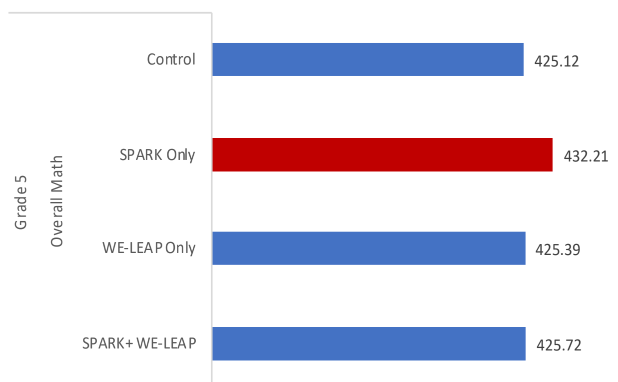


Figure 21. Grade 5 Math: Reporting Categories

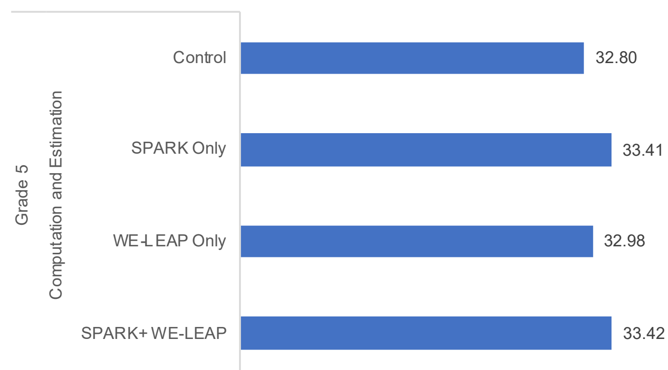


Figure 22. Grade 5 Science: Overall Achievement

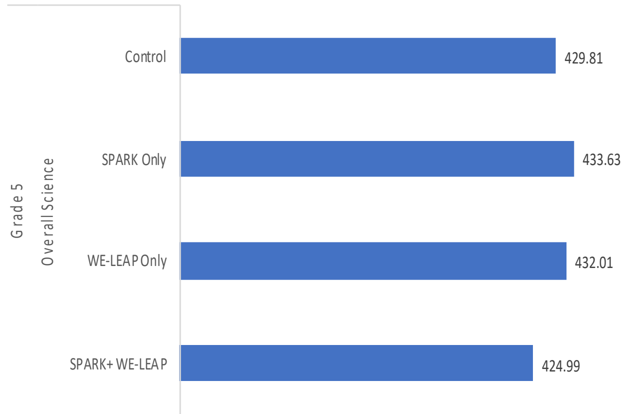
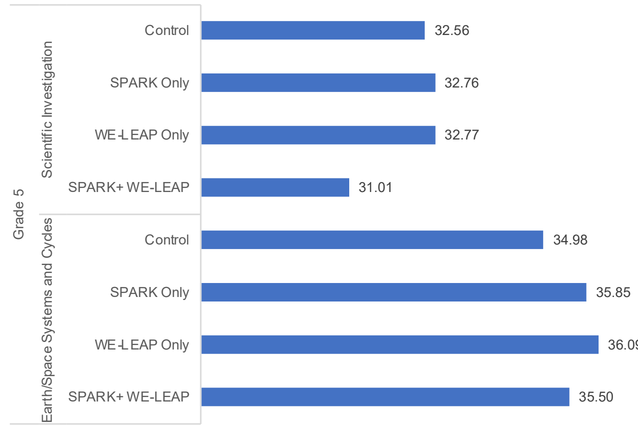


Figure 23. Grade 5 Science: Reporting Categories



Grade 6. The analysis found significant effects on overall achievement in math and specifically in the Probability, Statistics, Patterns, Functions, and Algebra reporting category for sixth grade math students participating in SPARK, after controlling for the demographic variables (Figures 24 and 25). The mathematics achievement for the control group – overall and in the aforementioned reporting category – was also found to meet statistical significance, which is an unexplained finding.

Figure 24. Grade 6 Mathematics

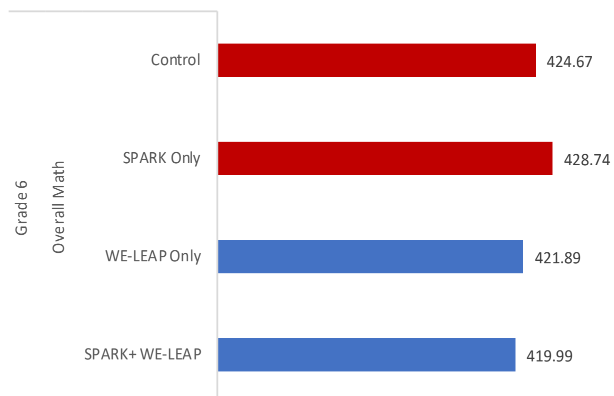
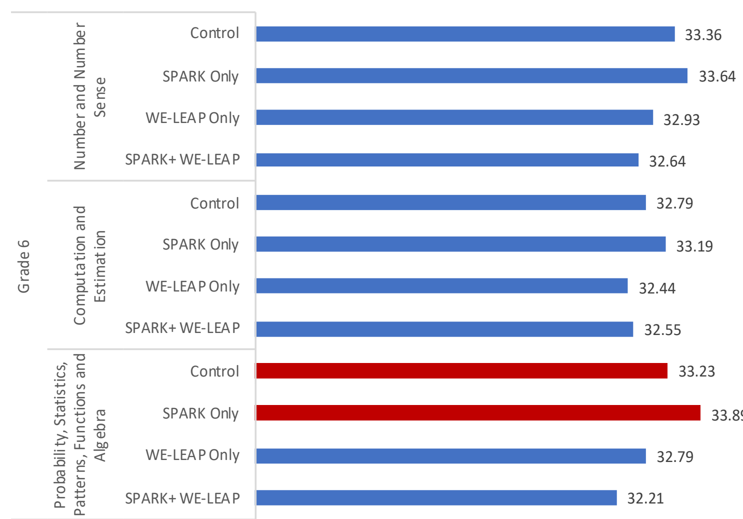


Figure 25. Grade 6 Mathematics Reporting Categories



Grade 8. The analysis found no significant effects on overall achievement in math or science or in their related reporting categories for eighth grade students participating in 1) SPARK, 2) WE-LEAP, or 3) WE-LEAP and SPARK after controlling for the demographic variables (Figures 26 and 27).

Figure 26. Grade 8 Math: Overall Achievement

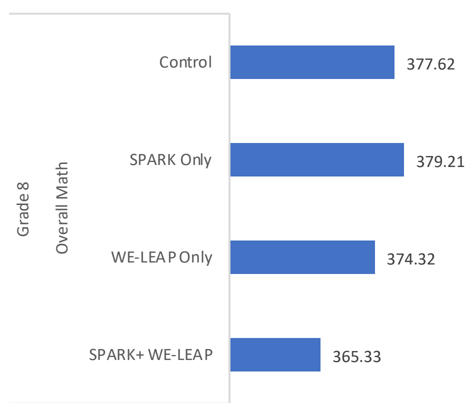


Figure 27. Grade 8 Math: Reporting Categories

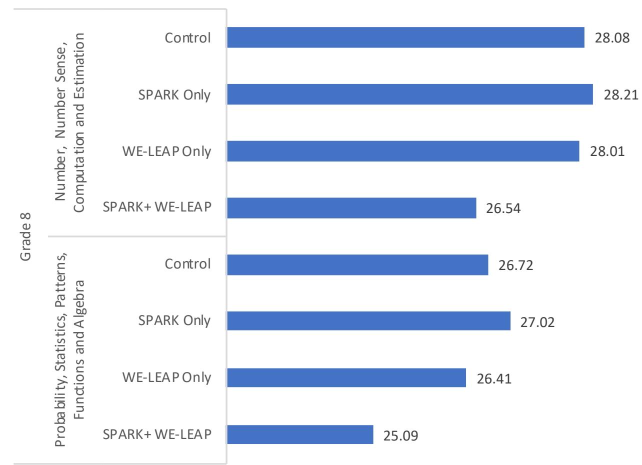


Figure 28. Grade 8 Science: Overall Achievement

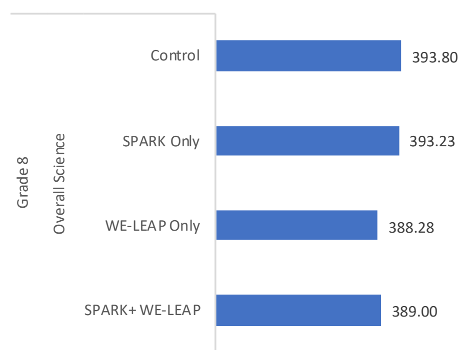
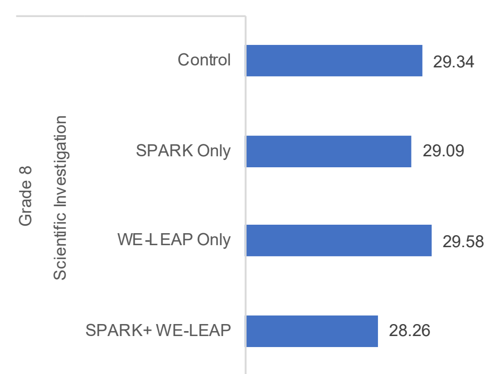


Figure 29. Grade 8 Science: Reporting Categories



6. Other Findings

Through focus group discussions and interviews with teachers and students, information was collected that contributed to other findings that do not specifically respond to a research question. In some cases, teachers in particular shared recommendations for improving the implementation of SPARK. These findings are shared below as formative feedback to program administrators.

Student Engagement. Teachers reported high levels of student engagement in SPARK activities. Elementary teachers described the program as “very hands-on” and “fun and engaging” for students. When asked about activities the student found most engaging, they highlighted a variety of activities, including: the creation of the surface of the moon, the Rover project, the activities with wedges, catapults, and race cars. Students, who were all fifth graders, recalled participating in multiple classroom activities, such as making layers of the Earth, exploring plate tectonics using cookies, building towers and/or volcanoes, and learning about earthquakes and tsunamis. Students indicated they preferred the "learning and doing" to the "sit and listen" components of lessons. Teachers also noted that students enjoyed the "tactile" activities and challenges that are not always feasible during the typical school year due to pacing, class size, and access to technology/materials. At the middle school, teachers felt middle school SPARK students were most engaged in activities that included technology or "anything involving games or competitions." Overall, teachers expressed an interest in more hands-on activities in the SPARK curriculum.

Curriculum/Instructional Issues. At the elementary level, teachers shared some concerns about the design of activities presented in the SPARK curriculum. When asked to share activities that students found challenging, the 4th grade teachers described the first activity in the curriculum related to *The Most Magnificent Thing*. In this activity, students had to build a free-standing tower that would hold a tennis ball within a certain timeline. However, no students were successful within the timeline and were described as "really frustrated" with the activity. Teachers also described several activities that they, as the teachers, found challenging. A commonly described challenge was the Archimedes activity; multiple teachers indicated they did not understand the directions in the lesson, were "confused," and were not successful with the lesson using the listed materials. Similar frustrations were expressed with the materials provided for the Rover project. In response to these challenges, several teachers indicated they began informally collaborating with their peers to problem-solve and share solutions to ensure the lessons were delivered successfully.

At the middle school level, teachers at one SPARK site – Dozier Middle School – commented on several technology-related issues that affected their ability to implement the summer curriculum. Teachers had limited access to working technology to implement components of the lesson plans. Slow or non-working technology was described as "frustrating for students" when the activities did not work. Teachers also described challenges with limited access to the designated computer labs and no access to calculators.

Program Design Issue. Middle school teachers spoke forcibly about a change in program design that affected their ability to work with students across the school year. Teachers participating in the focus group felt the previous program design, which teamed teachers from the same school to serve students from that school, was more impactful. Working with the incoming students allowed them to build relationships with struggling learners over the summer and provided opportunities for students to learn expectations and become familiar with "the faces" of teachers who will be in their building the next year. They encouraged the school division to reconsider this change for next year.

Value of Enrichment Activities. At the middle school level, teachers and students voiced strong support for the enrichment component of SPARK. Teachers felt the afternoon enrichment component of SPARK could be a "huge asset," with some teachers expressing the viewpoint that enrichment activities are a primary incentive for students to attend the program. Middle school students also expressed strong interest in the enrichment activities. Middle school students described engaging in numerous enrichment activities, including making model rockets and launching them, dancing, yoga, gaming, and robotics. One student attended the SPARK Character Camp and described it as very impactful. Overall, students described the SPARK program as a combination of academics and "fun stuff."

While there was strong support for enrichment, teachers suggested ways to improve this component. Some teachers recommended a more cohesive and rotating enrichment schedule to ensure that all students have access to off-site field trips, which did not happen at their site this year. They also suggested the program could expand enrichment activities by funding materials for teachers to design their own enrichment activities.

Conclusions

The Phase II study was designed to evaluate several components of the SPARK program, including program quality related to STEM learning, students' level of STEM interest and engagement, correlations between site quality and STEM related student attitudes and behaviors, perceived improvements in students' readiness to learn, and potential impact on academic achievement in science and math. Findings in several areas reveal promising results related to the SPARK program impacts on students, while other results may generate additional avenues for exploration and consideration.

Program quality data was positive across several dimensions. The data indicate that SPARK classrooms frequently demonstrated accurate math and science content, as well as appropriate use of content vocabulary, high level teacher questioning, and support of student learning through scaffolding instruction. Students were observed engaging in activities with high-cognitive demand and applying their learning in novel situations. One important study finding was that program quality matters: observation indicators were found to have a positive relationship with student attitudes and behaviors related to STEM, specifically on attitudes towards math and 21st century skills, such as communication, collaboration, and self-directed learning. Due to the relationship between site quality and student attitudes and behaviors related to STEM, program leaders should monitor program quality across sites to ensure consistency in student experiences and optimize student outcomes.

Findings related to elementary students' interest and engagement in STEM varied. There were not demonstrated increases in elementary student participation in STEM activities, but students did demonstrate increases in their attitudes towards science, engineering and technology, and 21st century skills. The discrepancy between attitudes and behaviors may require further exploration to determine influencing factors. Site-based variations in school club availability or student selection procedures for clubs may impact student participation in STEM related activities at school.

At the elementary level, the findings demonstrate clearly that fifth grade students participating in SPARK experienced the strongest change in attitudes: positive increases in attitudes toward science, engineering and technology, and 21st century skills all reached statistical significance. Notably, SPARK student *achievement* in mathematics and science also demonstrated statistically significant increases in Grade 5, which is consistent with findings from the Phase I evaluation. The fifth grade appears to be SPARK's "sweet spot" for positively influencing student achievement and attitudes; the school division is advised to consider how it might take advantage of this insight.

One finding of concern at the elementary level was an overall decline in attitudes towards math that was found to be statistically significant. Unfortunately, there were few insights gained through discussions with teachers and students as to why this decline may have happened. Program staff are strongly advised to review the mathematics component of SPARK to ensure that the content and format engage students and build interest, in addition to building competencies, in mathematics.

At the middle school level, there was also variance in students' interest and engagement in STEM. There was a marginal decline in participation in STEM-related activities, both in and out of school, during the fall semester following SPARK. Generally, attitudes toward math remained stable, with Grades 6 and 8 demonstrating slight mean increases and statistically significant declines demonstrated at Grade 7 and with female students. Middle school students demonstrated declines in attitudes towards science and in 21st Century Attitudes and Skills, but neither change was statistically significant. Overall, student attitudes toward engineering and technology improved, with the increase at the 8th grade level reaching statistical significance; this finding may be related to curriculum offerings at the middle school level as students reported taking STEM or technology classes at school during focus group discussions.

Phase II findings also revealed statistically significant increases in SPARK student achievement in math at Grade 6. Students and teachers who participated in focus group discussions described specific units of study, such as fractions, that provided students with additional opportunities to learn and practice which bolstered their confidence and readiness to learn as they entered the fall semester. Findings related to math achievement may provide insight on the importance of SPARK participation at key grade levels to support student as they transition into a more challenging math curriculum.

Notably, there were differences in findings for female students that may warrant consideration in SPARK program design. At the elementary level, female students demonstrated a statistically significant increase in their confidence in communication, collaboration, and self-directed learning. They also improved their attitudes towards engineering and technology. At the middle school level, however there were statistically significant declines in female students' attitude towards mathematics, a trend that did not occur among the general student population. These findings point to areas of strength at the elementary level but also to a challenge for female students at the middle school level.

The SPARK program intends to provide additional learning opportunities for students who may need a "jump start" as they transition to the next grade level by overcoming possible summer learning loss. The SPARK program demonstrated promising findings with students demonstrating increased confidence in 21st century skills, as well as increased achievement in science and math, particularly in grade levels associated with transition. Teachers overwhelming described the SPARK participants as prepared and engaged learners in comparison to their classmates. The SPARK program was described by teachers as impactful because it provides much needed "opportunity" for students to gain academic skills as well as "exposure" to enrichment for students who may not always have access.

Appendix A. Study Design

Approach

The district was interested in obtaining evaluation findings to support future applications seeking funding for SPARK, so a two-part evaluation study was implemented to assess outcomes associated with SPARK participation. The first phase used existing data and focused on the major academic outcomes associated with SPARK and also with WE-LEAP, which is the larger programmatic context for SPARK.[13] The Phase I evaluation report was submitted to NNPS in April 2018. The second phase offers a more comprehensive evaluation of the STEM-related outcomes of SPARK.

Research Questions

1. To what extent does SPARK, and specifically the Early Learning Lab, meet out-of-school time program quality expectations for STEM learning? (classroom observations using program quality observation tool)

2. Are SPARK students' levels of STEM interest and engagement similar at the start of SPARK and in the fall semester of the following school year?

   a. Do students report participating in STEM—in-school, extracurricular, or out-of-school—more frequently since participating in SPARK than they did in the previous school year? Are there differences by subgroups (e.g., gender, race/ethnicity)?

   b. Did self-reported interest in STEM change significantly between the baseline and follow-up surveys? Are there differences by subgroups (e.g., gender, race/ethnicity)?

   c. To what degree do SPARK-only participants self-reported interest in STEM at follow-up differ from students also participating in WE-LEAP?

3. Are there correlations between a site's assessed program quality and student attitudes and behaviors?

4. Are there perceived improvements in students' readiness to learn in the fall?

5. Do participants in Early Learning Lab exhibit stronger growth and/or achievement on identified strands within math and science standardized tests than their non-participating peers attending the same school?

The evaluation framework for this study, which provides in tabular form the crosswalk between the evaluation questions, data sources, and analytical methods is provided in Table A.1.

[13] It is necessary to identify the outcomes associated with WE-LEAP in order to distinguish SPARK's unique contribution to academic outcomes.

Table A.1. Phase II Evaluation Framework

Research Question	Data Source	Analytical Approach
1. To what extent does SPARK, and specifically the Early Learning Lab, meet out-of-school time program quality expectations for STEM learning?[14]	On-site observations in all elementary and middle school SPARK sites using the SERVE Study of STEM Learning Observation Protocol[15] conducted by the evaluation team, July 16-August 2, 2018.	Cross-site data was analyzed using descriptive statistics, means and frequency counts, and disaggregated by site to determine a mean program quality score for each location.
2. Are SPARK students' levels of STEM interest and engagement similar at the start of SPARK and in the fall semester of the following school year? a. Do students report participating in STEM—in-school, extracurricular, or out-of-school—more frequently since participating in SPARK than they did in the previous school year? Are there differences by subgroups (e.g., gender, race/ethnicity)? b. Did self-reported interest in STEM change significantly between the baseline and follow-up surveys? Are there differences by subgroups (e.g., gender, race/ethnicity)? c. To what degree do SPARK-only participants self-reported interest in STEM at follow-up differ from students also participating in WE-LEAP?	PRE-POST student survey using dimensions from the Student Attitudes Toward STEM (S-STEM) Survey.[16] Students took the pre-survey July 8-11, 2018 and completed the post- survey between October 1-November 2, 2018.	The survey included a student identifier (ex: student lunch number), grade level, and school. Demographic data (gender, race/ethnicity) was matched by the NNPS. The demographic data allowed for data analysis across subgroups, as well as score matching across pre-post survey administrations. The matched pairs of scores were utilized for a comparison of means, paired-sample t-test, to determine if the attitudinal and behavioral changes are statistically significant. Including the WE-LEAP participants in the post-administration allows for a comparison of means across participation levels.
3. Are there correlations between a site's assessed program quality and student attitudes and behaviors?	Onsite observation data the and student post-survey results.	Program quality data (see Question 1 data source) was correlated with student survey data (see Question 2 data source) to assess whether program quality affects student attitudes and behaviors related to STEM.
4. Are there perceived improvements in students' readiness to learn in the fall?	Evaluator developed student and teacher focus group protocols . Focus group participants were identified by project staff. Student focus groups were	A standard qualitative analytical approach was applied to the data analysis. Themes were identified related to student readiness to learn.

[14] All students who attend SPARK are Early Learning Lab participants.
[15] Arshavsky, N., Edmunds, J., Charles, K., Rice, O., Argueta, R., Faber, M., Parker, B. (2012). STEM Classroom Observation Protocol. Greensboro, NC: The SERVE Center, University of North Carolina at Greensboro. Available at http://www.serve.org/STEM.aspx
[16] Unfried, A., Faber, M., Stanhope, D. & Wiebe, E. (2015). *The development and validation of a measure of student attitudes toward science, technology, mathematics, and engineering.* Journal of Psychoeducational Assessment. doi: 10.1177/0734282915571160 http://jpa.sagepub.com/cgi/reprint/0734282915571160v1.pdf?ijkey=4uXpGzzDfz3Pyuy&keytype=finite

	conducted at Newsome Park Elementary (October 30), Carver Elementary (November 5) and Gildersleeve Middle (November 13). Teacher focus groups were conducted at Newsome Park Elementary (November 1) and Gildersleeve Middle (November 8). To gather additional data, follow up phone interviews were conducted with four teachers who have a significant number of SPARK students in their classrooms, Jan 14-Jan 17, 2019.	
5. Do participants in Early Learning Lab[17] exhibit stronger growth and/or achievement on identified strands within math and science standardized tests than their non-participating peers attending the same school?	Student Virginia Standards of Learning (SoL) scaled scores and reporting category scores, 2016-17 and 2017-18.	Analysis of Covariance (ANCOVA) was utilized to examine whether SY2018 standardized test scores differed between program participants and non-participants. The analysis was designed to determine if there is evidence of effectiveness of varying levels of participation and standardized test score outcomes. The analyses controlled for: gender, disability status, ethnicity, and prior achievement, in order to create equivalent groups (control, participation level) for analysis of the program impact. By controlling for demographics, these factors were eliminated as influences on the outcome (i.e., the outcome is based on program participation). Analyses did *not* include controls for prior achievement at the third-grade level, since SOL testing begins at Grade 3. The primary analyses were conducted by grade level on the provided SOL outcome measures. A multivariate analysis of covariance (MANCOVA) was utilized when more than one SOL outcome measure was available at a grade level. The degree of correlation among the SOL outcome measures at each grade level was evaluated, and MANOVA used if the correlations were significant and meaningful (r > .3). If the correlations were not significant and meaningful, each SOL outcome measure was examined with a univariate analysis of covariance. The covariates in the analysis were the SOL measures available from the prior year.

[17] Early Learning Lab participants include SPARK and WE-LEAP participants.

Participant Sample & Recruitment Protocol

This evaluation study involved program participants, including teachers and students. This section provides detail on the criteria for selecting and process for involving participants in the survey and/or focus group discussions.

Students. All students in Grades 4-8 participating in SPARK with passive parent consent were asked to complete the STEM interest survey during the first week of program participation. All SPARK and WE-LEAP participants with passive parent consent were asked to complete the post version of the survey in October. Informed consent language was included in the introductions on the form. Students were able to exercise an "opt-out" option.

A sample of participants in Grades 5-8 were invited to participate in a focus group with the evaluator. A sample of up to 10 students, Grades 5-8, for whom the district had passive parent consent, were invited to participate in each discussion. NNPS program staff was asked to recommend the students who have participated in the SPARK program. Students were invited to participate in the focus group discussion and were able to exercise the right to refuse participation.

Parent consent for participation in the evaluation study was sought through the administration of a passive parent informed consent notice[18]. The parent consent notice was administered by NNPS program staff to parents of all students enrolled as of the date of the notice administration. School staff were informed about the passive parent consent distribution in order to respond to questions from parents. The consent notice (see Appendix B) was designed according to professional research practice and includes the following information:

- Title of the study and identification of the researcher conducting the study
- The purpose(s) for collecting data
- Description of what participants will be asked to do (e.g., participate in a focus group discussion)
- Amount of time required of participants
- Notice that participants will be audio-taped (if applicable) with an explanation of how the recordings will be used and what happens to the tapes after the research is completed
- Description of any individually identifiable student data to which the researcher seeks access and how and when data will be destroyed. There must also be a separate yes/no check box referring to the release of student level data
- Notice that all information will remain confidential
- Notice that participation is entirely voluntary and participants may withdraw from the study at any time, without negative consequences
- Notice of any reasonably foreseeable risks or benefits to the participant
- A telephone number and email address of researcher(s), so that the parent or participant may call if there are questions or concerns or to opt out of the evaluation study

In addition, the Protection of Pupil Rights Amendment (PPRA) passed under the No Child Left Behind Legislation requires that parents/guardians have access to the materials that will be used in school with their children. Therefore, the consent form will include the following text:

Parents, please be aware that under the Protection of Pupil Rights Act, you have the right to review a copy of the questions asked of or materials that will be used with your students. If you would like to do so, you should contact [INSERT RESEARCHER NAME] at (XXX) XXX-XXXX to obtain a copy of the questions or materials.

Teachers. For each focus group, a sample of up to 10 teachers from each participating school level (elementary/middle) were invited to participate. Program staff were asked to recommend the teachers.

---

[18] While other student data will be utilized as part of the evaluation (e.g., enrollment data), personally identifiable information will not be shared with the evaluator, therefore parent consent for other data is not required.

Teachers selected for participation were formally invited using an informed consent letter to participate in the focus group discussion and were able to exercise the right to refuse participation (see Appendix B). Follow-up interviews were conducted with X elementary and X middle school teachers to gather additional data related to students' readiness to learn.

Data Collection

This section provides more detail on methods associated with data collection. If required, procedures or protocols are presented below in addition to a description of the collection method. Instruments are presented in Appendix B. Please note that protocols on participant recruitment were addressed in the Participant Sample section above. Analytical methods were previously described in Table A.1, by research question.

1. Student Pre-Post STEM Survey

Students enrolled in the SPARK program, rising Grades 4-8, were asked to complete the STEM survey during the first week of program participation, and again in October. WE-LEAP participants completed the survey in the fall semester. The evaluator created an online survey using identified dimensions of the Student Attitudes Toward STEM (S-STEM) Survey, a valid and reliable tool that measures student interest in math, science, engineering/technology, and 21st century learning. Additional questions related to student participation in STEM related activities assessed changes in student behaviors connected to STEM. The draft survey was reviewed by the project team, piloted with a small sample of age appropriate students, and final revisions made based on feedback. The electronic link was provided to NNPS program staff for distribution and use during the survey window. The survey is provided in Appendix B.

The survey consisted of four dimensions that measure student attitudes towards STEM related areas. The survey dimensions included Math Attitudes, Science Attitudes, Engineering and Technology Attitudes, and 21st Century Skills and Attitudes. The first three dimensions each include items measuring student self-efficacy related to their respective content areas (math/science/technology and engineering) and expectations for future value gains from success in their respective content areas (math/science/technology and engineering). 21st Century Attitudes and Skills include items measuring student confidence in communication, collaboration, and self-directed learning.

For each pre/post survey respondent, a mean score was generated for each dimension. A comparison of the pre/post means, by dimension, was generated to determine if the changes were statistically significant. Students also responded to questions related to their STEM in-school/extra-curricular related activities and out of school related STEM activities. To be included in the analysis for a dimension, a respondent must have completed approximately 75% of the items within the scale. Only students with matched pre-post survey responses were included in the analyses.

Pre-assessment was administered by NNPS program staff and/or teachers to all SPARK participants, rising Grades 4-8, during the first week of the program (July 9-11). The post-assessment was administered by NNPS program staff to all WE-LEAP and SPARK participants, Grades 4-8, during October-November 2018.

2. SERVE STEM Classroom Observation Form

Using a standardized observation protocol, the evaluation team collected data about classroom instruction indicators that are aligned with the objectives and curricula of the SPARK program. The evaluation team utilized the Study of STEM Learning Classroom Observation Protocol developed by the SERVE Center at the University of North Carolina-Greensboro supported by funding from a National Science Foundation grant (NSF #1135051) for a Race to the Top initiative. The draft protocol is provided in Appendix B.

The observation protocol included several scales: Math and Science Content, Meaningful Instruction, STEM (Inquiry Learning), and Common Instructional Framework. “Math and Science Content” ratings gathered evidence related content accuracy, teacher presentation and clarification, emphasis on meaningful relationships in the content, discussion of key concepts, connections to previous knowledge and or other content areas, and student misconceptions/mistakes. Indicators related to “Meaningful Instruction” focused on conceptual development and cognitive engagement. Evidence was focused on the cognitive demand of the activities, students explaining/justifying their thinking, opportunities to summarize learning, use of a variety of means to represent to concepts, applying knowledge to novel situations, and comparing/contrasting responses. “STEM (Inquiry) Learning” focused on student engagement in scientific practices and student vs. teacher driven activities by using indicators such as: students engaged in open-ended tasks, hands-on or real-life activities, or developed their own questions/hypotheses to explore, and determined which strategies they might use to complete a task. The “Common Instructional Framework” focused on student collaboration and discussion, writing for communication, use of open-ended teacher questions, and instructional scaffolding. Each of the dimensions utilized a scale from 0 (not observed) to 3 (very descriptive of the observation).

The evaluation team conducted observations of two to four classes at each program site, for a total site visit of 4 hours per school. Observations began the second week of the program and were limited morning hours during primary instructional time, approximately 30 minutes per observation, for a total of 3-4 classroom observations per site. Sites were in various stages of the curriculum during the observation period. The evaluation team scheduled the observations in collaboration with the school principal in collaboration with NNPS program staff. To prepare for each site visit, school staff provided a school map, classroom numbers, and tentative daily schedule to the evaluation team. To calibrate observation ratings, two researchers conducted observations at the first site and reached consensus ratings for each indicator.

3. *Interview and Focus Group Protocols for Use Teachers and Students*

The evaluator facilitated two focus group discussions with SPARK teachers and three focus group discussions with SPARK students to gather feedback on perceived improvements in students’ readiness to learn. A discussion of consent/recruitment was provided earlier. The evaluator facilitated discussions using a semi-structured protocol (see Appendix B for the consent protocol and discussion guide for each event). The discussions were audio-recorded with the permission of participants; a transcript was generated for analysis. A standard qualitative analytical approach, such as grounded theory, was applied to the data analysis.

Stakeholder focus groups and interviews were designed to obtain feedback related to students’ readiness to learn in the fall after attending SPARK. Teachers were asked to describe the SPARK program and engaging/challenging activities for students. They were also asked to describe SPARK students’ readiness to learn in the fall and what they perceive as the most valuable contribution the SPARK program makes to students. Students were asked to describe the SPARK program, activities they enjoyed or disliked, and how they feel about studying math/science this year. Students were also asked to describe how the SPARK program helped them to prepare for math/science this year and about their interest and participation in STEM related activities.

The participant recruitment and logistics for these events were coordinated with the program staff. The program staff was responsible for recruiting participants and scheduling the events in coordination with the evaluator. The program staff or designate also made the logistical arrangements for the discussion space.

4. *Student Assessment Data*

NNPS provided student-level assessment data from Science and Mathematics Standards of Learning assessments for all students in grades 3 through 8. De-identified individual student scaled score data and reporting category raw scores were presented in an Excel spreadsheet; the test date, academic subject of test, school, unique student identifier, grade level, gender, ethnicity, disability status, and participation level (SPARK, WE-LEAP, non-participant) were included in the provided data sheet. Data were cleaned to remove duplicates. A template was provided to facilitate data organization.

The analysis required school division student-level records of program enrollment and attendance (optional); a numeric student identifier was used to enable matching with student-level assessment data. The dataset was made available through secure data transfer and data were stored on a secure device with data encryption.

The sample for the study consisted of one control group (no intervention in 2017-18 or preceding year; district-wide) and three intervention groups with varying levels of treatment:

- 2017-2018 WE-LEAP participant and 2017 SPARK participant;
- 2017 SPARK participant only; and
- 2017-2018 WE-LEAP participant.

Table A.2 shows the SOL target variables in the dataset at each grade with the available SOL covariates. In addition to these covariates, there were additional demographic controls including Title 1 status (Yes/No), Gender, Race (Student of Color/Not of Color), and Disability status (Disabled/Not Disabled). These demographic controls were utilized in all SOL comparisons. Because it was anticipated that the SOL outcome scores would be correlated, SOL data for all outcomes at a grade level were analyzed in a multivariate analysis. The ultimate model was a multivariate analysis of covariance at each grade level where the covariates are the demographic variables and available prior SOL Math scores.

Table A.2. Target Variables and SOL Covariates by Grade

Target Variables	**Grade**	**SOL Covariates**
Overall Math; Number and Number Sense; Computation and Estimation	3	None
Overall Math; Computation and Estimation; Probability, Statistics, Patterns, Functions and Algebra	4	Grade 3 Math
Overall Math; Computation and Estimation	5	Grade 4 Math
Overall Math; Number and Number Sense; Computation and Estimation; Probability, Statistics, Patterns, Functions and Algebra	6	Grade 5 Math
Overall Math; Number and Number Sense, Computation and Estimation; Probability, Statistics, Patterns, Functions and Algebra	8	Grade 6 Math
Overall Science; Scientific Investigation; Earth/Space Systems and Cycles	5	Grade 4 Math

Timeline for Key Evaluation Activities

The final timeline for key study administration and data collection activities is presented in Table A.3.

Table A.3. Timeline for Major Evaluation Activities

Task	Timeline
Finalize the evaluation plan, including instrumentation.	By June 15
Data Collection & Analysis	

Administer the student pre-assessment to SPARK participants	July 9-11
Conduct onsite observations, ½ day per site	July 16-Aug 2
Submit student outcome data	By Nov 20
Administer the student post-assessment to SPARK and WE-LEAP participants	October 1-Nov 2
Conduct 3 student focus groups and 2 teacher focus groups	Oct 15- Nov 13
Reporting	
Draft Report. Submit draft report for NNPS review and feedback	By Jan 18
Final Report. Submission of final report.	By Feb 4

Appendix B. Consents and Instruments

Teacher Informed Consent Notice

My name is Dr. Kristi Wagner, and I am coordinating an evaluation study of the Extended Learning SPARK program at the request of Newport News Public Schools. The school division is collecting program related data to better understand the impact of the program on student learning.

As a teacher who taught within the program during the summer of 2018, I would like to invite you to participate in a focus group discussion this fall, when we will discuss perceptions of the SPARK program's impact on student readiness to learn

Although you probably won't benefit directly from participating in this study, we hope that NNPS students will benefit by your contributions to this study.

It is your choice to participate in this study. Participation, non-participation or withdrawal will not affect your employment with NNPS in any way. Even if you choose to participate, you may quit being in the study at any time or decide not to answer any question you are not comfortable answering. There is no apparent risk or benefit to your participation in the evaluation. NNPS students may benefit indirectly by your contributions to this study. All information you contribute will be held confidential.

Contact Dr. Kristi Wagner, external evaluator, kristi.wagner@shafferevaluation.com or 757-897-2754 no later than *[insert date]*, if you do not want to participate in this evaluation study. Thank you for your consideration.

Dr. Kristi Wagner
External Evaluator
Shaffer Evaluation Group
Alexandria, VA 22304

Student Consent Notice for Parents

Newport News Pubic Schools (NNPS) is collecting feedback and data on the Extended Learning SPARK program. By this notice, NNPS is informing you that your child will participate in an evaluation study of this initiative unless you opt out of the study. Your child can take part in activities supported by the project even if he/she does not participate in the study. Contact Dr. Kristi Wagner, external evaluator**,** at kristi.wagner@shafferevaluation.com or 757-897-2754 no later than [*insert date]*, if you do not want your child to participate in this activity.

What it Means for Students to Take Part in the Evaluation Study

- If your child is in grades 4-8, he/she may be asked to complete a survey related to their interest in STEM and STEM Careers. A survey will take approximately 10 minutes to complete and will be given to your child during their program participation.
- If your child is in grades 5-8, he/she may be asked to participate in a focus group discussion. The discussion would take place during the after-school program, not during instructional day. The discussion would last no more than 30 minutes.
- Your child does not have to answer any question he or she does not want to and can withdraw from the evaluation at any time without negative consequences.
- All information will be used only for evaluating the program.
- There are no reasonably foreseeable risks or benefits to the participant.

Securing Your Child's Responses

- Protecting your child's privacy is very important to us.
- NNPS and the external evaluator will follow strict rules to protect your child's privacy and keep his/her responses confidential.
- We will not share information that identifies your child to anyone outside the evaluation team.
- All data held by the evaluator that can be identified by student name will be destroyed by January 31, 2019.

For More Information

Parents, please be aware that under the Protection of Pupil Rights Act, you have the right to review a copy of the questions asked of or materials that will be used with your children. If you would like a copy of the questions or materials, or would like more information about the evaluation, please contact the researcher, Dr. Kristi Wagner, at kristi.wagner@shafferevaluation.com to obtain a copy of the questions or materials. If you would like more information about the project, please contact The Extended Learning Administrator, Anthony Tyler at (757) 283-7791 x38851.

STEM Classroom Observation Protocol[19]

Adapted from the SERVE STEM Learning Classroom Observation Protocol

Observer:________________________ School Site:__________________________

Grade level:_______________________________ Classroom Number: ________________________

Observation date: ____________ Time Start: _______End: ______

Grade Level(s) of students: _______ Student Count: ______

Please give a brief description of the class observed, including:

- the classroom setting in which the lesson took place (space, seating arrangements, environment and personalization, *etc*.),
- when in the overall lesson sequence this class takes place (toward the beginning of a unit, in the middle of a unit, toward the end)
- any unusual context of the lesson (interruptions, etc.)

Use diagrams if they seem appropriate.

Lesson Topic:

Lesson Goals *as presented by the teacher to the students*:

Curriculum Materials Used: (include any textbook, lab materials, or resources used)

Lesson Structure: Briefly describe the structure of the lesson (e.g. 5 min quiz, followed by 25 min of homework review, followed by 10 min of whole class discussion, followed by 15 min individual work on worksheets; note whether there was a conceptual summary at the end of the lesson; if summative assessment is present, please describe.)

Lesson Topic:

[19] Arshavsky, N., Edmunds, J., Charles, K., Rice, O., Argueta, R., Faber, M., Parker, B. (2012). STEM Classroom Observation Protocol. Greensboro, NC: The SERVE Center, University of North Carolina at Greensboro. Available at http://www.serve.org/STEM.aspx

Mathematics and Science Content

Select one from scale: 0 = not observed, 1 – minimal, 2 – to some extent; 3=very descriptive of the observation. DK = Observer does not know or is not able to make this determination.

	Not Observed	Minimal	To Some Extent	Very Descriptiv	Don't Know
1a. Math and science content information was accurate.	[0]	[1]	[2]	[3]	DK
1b. Teacher's presentation or clarification of mathematics or science content knowledge was clear.	[0]	[1]	[2]	[3]	DK
1c. Teacher used accurate and appropriate mathematics or science vocabulary.	[0]	[1]	[2]	[3]	DK
1d. Teacher/students emphasized meaningful relationships among different facts, skills, and concepts.	[0]	[1]	[2]	[3]	DK
1e. Student mistakes or misconceptions were clearly addressed (emphasis on correct content here).	[0]	[1]	[2]	[3]	DK
1f. Teacher and students discussed key mathematical or science ideas and concepts in depth.	[0]	[1]	[2]	[3]	DK
1g. Teacher connected information to previous knowledge.	[0]	[1]	[2]	[3]	DK
1h. Appropriate connections were made to other areas of mathematics/science or to other disciplines.	[0]	[1]	[2]	[3]	DK
1i. Appropriate connections were made to real-world contexts.	[0]	[1]	[2]	[3]	DK
Summary: Quality of Mathematics and Science Content	[0]	[1]	[2]	[3]	DK

Record specific examples below

Student Cognitive Engagement in Meaningful Instruction

Select one from scale: 0 = not observed, 1 – minimal, 2 – to some extent; 3=very descriptive of the observation.

	Not Observed	Minimal	To Some Extent	Very Descriptive	Don't Know
2a. Students experienced high cognitive demand of activities because teacher did not reduce cognitive demand of activities by providing directive hints, explaining strategies or providing solutions to problems before students have a chance to explore them, etc.	[0]	[1]	[2]	[3]	DK
2b. Students were asked to explain or justify their thinking.	[0]	[1]	[2]	[3]	DK
2c. Students were given opportunities to summarize, synthesize, and generalize	[0]	[1]	[2]	[3]	DK
2d. Students used a variety of means (models, drawings, graphs, concrete materials, manipulatives, etc.) to represent phenomena.	[0]	[1]	[2]	[3]	DK
2e. Students were asked to apply knowledge to a novel situation.	[0]	[1]	[2]	[3]	DK
2f. Students were asked to compare/contrast different answers, different solutions, or different explanations/interpretations to a problem or	[0]	[1]	[2]	[3]	DK
Summary: Quality of Student Cognitive Engagement in Meaningful Instruction	[0]	[1]	[2]	[3]	DK

Record specific examples below.

STEM Learning

Select one from scale: 0 = not observed, 1 – minimal, 2 – to some extent; 3=very descriptive of the observation. NA = not applicable to activity being observed (since projects may not occur in every lesson)

	Not Observed	Minimal	To Some Extent	Very Descripti	Don't Know
3a. Students were engaged in open-ended tasks or questions.	[0]	[1]	[2]	[3]	DK
3b. Students engaged in hands-on or real-life problem-solving activities or a lab experiment.	[0]	[1]	[2]	[3]	DK
3c. Students developed their own questions and/or hypotheses to explore or test.	[0]	[1]	[2]	[3]	DK
3d. Students engaged in scientific inquiry process (tested hypotheses and made inferences)	[0]	[1]	[2]	[3]	DK
3e. Students determined which problem-solving strategies to use.	[0]	[1]	[2]	[3]	DK
3f. Students had to present or explain results of project.	[0]	[1]	[2]	[3]	DK
3g. Students worked on a project requiring creativity.	[0]	[1]	[2]	[3]	DK
3h. There was an explicit evidence of teacher modeling engineering (or reverse engineering) design process.	[0]	[1]	[2]	[3]	DK
3i. There was an explicit evidence of students using engineering (or reverse engineering) design process.	[0]	[1]	[2]	[3]	DK
Summary: Quality of Inquiry learning; Project-based learning; and Problem-based instruction	[0]	[1]	[2]	[3]	DK

Record specific examples below

Common Instructional Framework

Select one from scale: 0 = not observed, 1 – minimal, 2 – to some extent; 3=very descriptive of the observation.

	Not Observed	Minimal	To Some Extent	Very Descripti	Don't Know
5a. Students worked collaboratively in teams or groups.	[0]	[1]	[2]	[3]	DK
5b. Students used writing to communicate what they had learned.	[0]	[1]	[2]	[3]	DK
5c. Teachers asked open-ended questions that required higher level thinking.	[0]	[1]	[2]	[3]	DK
5d. Teachers provided assistance/scaffolding when students struggled.	[0]	[1]	[2]	[3]	DK
5e. Students engaged in discussion with each other.	[0]	[1]	[2]	[3]	DK
5f. Students participated in guided reading discussions.	[0]	[1]	[2]	[3]	DK
Summary: Overall rating of Quality of Common Instructional Framework implementation	[0]	[1]	[2]	[3]	DK

Record specific examples below

Focus Group Consent Protocol

Thank you for taking time today to speak with us today about the Extended Learning SPARK program. The school division is collecting feedback on the program to better understand the program's impact on student learning.

My name is ______________________________ and I am the external evaluator. Today, I would like to ask you several questions about the program and your perceptions of its impact on students' readiness to learn. These will help, in part, with the development of the final evaluation report.

Please know that there is no "right" answer, and we encourage you to respond to each question. We deeply appreciate your time. Our conversation today will last no longer than one hour.

I am audio-recording today's discussion for the purpose of transcribing your comments for analysis. Please know that all responses will remain confidential. This means that your responses will only be shared with other members of the evaluation team, and we will ensure that any information we include in our report does not identify you as the respondent. You are free to withdraw from this discussion at any time without penalty.

Before we begin our conversation, I have some group norms that I am asking each of you observe:

> First, please do not identify other people (students, teachers or administrators) by name when you talk. You might say instead, for example, "a middle school girl," "a math teacher at my school," or "my principal."
>
> Secondly, respect everyone's point of view. I don't expect you to agree with one another about everything, and there are no right or wrong answers to my questions. Everyone's contributions are valuable.
>
> Because your comments are being recorded, I need one person to speak at a time. You do not have to raise your hand; just wait until the person who is speaking stops before you begin.
>
> Finally, please do not repeat or discuss comments made during this session with others. Please do not repeat or discuss with other students/parents/staff/military service providers what members of your group may say. If you are asked, you may say that the group talked about ways to improve student learning, but please keep specific remarks confidential.

Did you have any questions for me before we begin?

Teacher Discussion Guide

1. As a teacher in the SPARK program, how would you describe the program? A typical unit or lesson?

2. What activities do students find most engaging? Please describe.

3. Are there activities students find challenging? If so, please describe.

4. When thinking about SPARK participants, how would you describe their readiness to learn at the start of the new school year?

5. From your perspective as a teacher in the program, what do you perceive is the most valuable contribution this program makes to participating students?

Student Discussion Guide

1. Tell me about the types of activities you did this summer in the SPARK program?
    a. What did you like about it?
    b. Were there any parts you didn’t like as much?

2. How do you feel about studying math this year?
    a. How does that compare to last year?

3. How about science?
    a. How does that compare to last year?

4. Was there anything about the summer SPARK program that has helped you in math/science this year?
    a. Probe for examples

5. Do you participate in any STEM related clubs or activities at school? Outside of school?
    a. Probe for examples

6. Are you interested in studying STEM, taking STEM classes, [secondary: working in a STEM field] in the future?
    a. Probe for why/why not

7. Did the SPARK program help prepare you for school this year?
    a. Probe for why/why not

Student PRE/POST STEM Survey Student Attitudes Toward STEM (S-STEM) Survey

Elementary Survey (Grades 4-5)

1. Please enter your school lunch number? [student ID #]

1. What grade will you be in this fall? (Post: Please select your current grade)
   [select response: Grade 4 or Grade 5]

2. Where do you attend school?
   [select response: NNPS school list]

Directions

Read and respond to each statement. There are no *"right"* or *"wrong"* answers. The only correct responses are those that are *true for you*.

Click on the circle that describes how you feel.

MATH

	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
1. Math has been my worst subject.					
2. When I'm older, I might choose a job that uses math.					
3. Math is hard for me.					
4. I am the type of student who does well in math.					
5. I can understand most subjects easily, but math is difficult for me.					
6. In the future, I could do harder math problems.					
7. I can get good grades in math.					
8. I am good at math.					

Science

	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
9. I feel good about myself when I do science.					
10. I might choose a career in science.					
11. After I finish high school, I will use science often.					
12. When I am older, knowing science will help me earn money.					
13. When I am older, I will need to understand science for my job.					
14. I know I can do well in science.					
15. Science will be important to me in my future career.					
16. I can understand most subjects easily, but science is hard for me to understand.					
17. In the future, I could do harder science work.					

Engineering and Technology

	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
18. I like to imagine making new products.					
19. If I learn engineering, then I can use improve things that people use every day.					
20. I am good at building or fixing things.					
21. I am interested in what makes machines work.					
22. Designing products or structures will be important in my future jobs.					
23. I am curious about how electronics work.					
24. I want to be creative in my future jobs.					
25. Knowing how to use math and science together will help me to invent useful things.					
26. I believe I can be successful in engineering.					

21st Century Learning

	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
27. I like to help others do their best.					
28. In school and at home, I can do things well.					
29. When things do not go how I want, I can change my actions for the better.					
30. I can make my own goals for learning.					
31. When I have a lot of homework, I can choose what needs to be done first.					
32. I can work well with all students, even if they are different from me.					

STEM Behaviors

33. Last school year, which of the following activities did you participant in? Check all that apply. [need input from NNPS team]
    a. Science club
    b. STEM Club
    c. Gardening Club
    d. Robotics Club or Team
    e. Coding Club
    f. Engineering Club

    POST TEST 38. Which of the following activities are you participating in this year?

34. During last school year, how often did you...
    [matrix options: never, rarely (once or twice this school year), sometimes (every month), often (more than once a month)]
    a. Read science books or magazines
    b. Access web sites for computer technology information
    c. Visit a science museum, planetarium, or environmental center
    d. Play games or use kits to do experiments or build things at home
    e. Watch programs on TV or the internet about nature or discoveries

    POST TEST 39. This school year, how often have you…

Secondary Survey (Grades 6-8)

2. Please enter your school lunch number (student ID #)

3. What grade will you be in this fall? (Post: Please select your current grade)

   [select response options: 6, 7, 8]

4. Where do you attend school?
   [select response: NNPS school list]

Directions

As you read the sentence, you will know if you agree or disagree. Click on the circle that describes how you feel.

There are no *"right"* or *"wrong"* answers. The only correct responses are those that are *true for you*.

MATH

	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
1. Math has been my worst subject.					
2. I would consider choosing a career that uses math.					
3. Math is hard for me.					
4. I am the type of student who does well in math.					
5. I can handle most subjects well, but I cannot do a good job with math.					
6. I am sure I could do advanced work in math.					
7. I can get good grades in math.					
8. I am good at math.					

Science

	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
9. I am sure of myself when I do science.					
10. I would consider a career in science.					
11. I expect to use science when I get out of school.					
12. Knowing science will help me earn a living.					
13. I will need science for my future work.					
14. I know I can do well in science.					
15. Science will be important to me in my life's work.					
16. I can handle most subjects well, but I cannot do a good job with science.					
17. I am sure I could do advanced work in science.					

Engineering and Technology

	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
18. I like to imagine making new products.					
19. If I learn engineering, then I can use improve things that people use every day.					
20. I am good at building or fixing things.					
21. I am interested in what makes machines work.					
22. Designing products or structures will be important in my future jobs.					
23. I am curious about how electronics work.					
24. I would like to use creativity and innovation in my future work.					
25. Knowing how to use math and science together will help me to invent useful things.					
26. I believe I can be successful in a career in engineering.					

21st Century Learning

	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
27. I like to help others do their best.					
28. I am confident I can produce high quality work.					
29. I am confident I can make changes when things do not go as planned.					
30. I am confident I can set my own learning goals.					
31. When I have many assignments, I can choose which ones need to be done first.					
32. I am confident I can work well with students from different backgrounds.					

STEM Behaviors

33. Last school year, which of the following activities did you participant in? Check all that apply. [need input from NNPS team]
    a. Science club
    b. STEM Club
    c. Gardening Club
    d. Robotics Club or Team
    e. Coding Club
    f. Engineering Club

    POST TEST: Which of the following activities are you participating in this year? (repeat above options)

34. During last school year, how often did you...
    [matrix options: never, rarely (once or twice this school year), sometimes (every month), often (more than once a month)]
    a. Read science books or magazines
    b. Access web sites for computer technology information
    c. Visit a science museum, planetarium, or environmental center
    d. Play games or use kits to do experiments or build things at home
    e. Watch programs on TV or the internet about nature or discoveries

    POST TEST: This school year, how often have you…(repeat above options)