

# Science Adventure School

2019 RESEARCH REPORT

PREPARED FEBRUARY 2021



West Virginia University

BRAD AND ALYS SMITH OUTDOOR ECONOMIC  
DEVELOPMENT COLLABORATIVE

Report prepared by Dr. Alice Morgan



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"It was overwhelming in a great way. I can retire and be like that was the greatest time of my life teaching. I feel like West Virginia is the last to pick something up, and I feel like we're the first in Science Adventure School!"

-2019 6th grade Teacher

## GOAL

Science Adventure School is an adventure-based outdoor science school dedicated to empowering and educating West Virginia's youth. We integrate adventure sports-driven STEM curricula with a hands-on engaging environmental curriculum to inspire inquiry, instill confidence, and empower the leaders of tomorrow. The goal of our yearly evaluation is to collect consistent data that allows us to assess the impact of our programming on students. Our intent is to build understanding of our outcomes and support program improvement.





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## METHODS

SAS research in 2019 used a quasi-experimental study designed with a mixed methods framework, so that both qualitative and quantitative data could be collected. This allowed for the best of both approaches with the strengths of one method compensating for the weakness of the other. SAS had two primary areas of assessment:

**STEM Attitudes** - assess ways in which SAS encourages students to develop positives attitudes toward STEM subjects and activities

**Positive Youth Development** - assess ways in which SAS impacts students inter-personally and intra-personally

“Going to Science Adventure School totally showed me that I’m capable of doing a lot more things than I thought I was.”

-2019 6th grade Student

## RESEARCH DESIGN

To fully understand the SAS experience, it was important to gather data from both students and their teachers. All students who were able to participate in research efforts were given surveys and a small sub-group of participating students were interviewed. Teachers were also given surveys and interviewed. These four points of data helped to form a more comprehensive view of SAS outcomes and areas for growth and improvement in the program.



Students learn physics principles with "George", the sock monkey, in Science Behind Ziplining.

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### DATA COLLECTION

Data collection occurred before and after SAS. Most data was collected while students were at school. Surveys were primarily electronic and were completed via computer or tablet. All interviews were recorded and transcribed. Student interviews were in person while teacher interviews were conducted via telephone.

### STUDENT SURVEYS

Students were first given the survey at their schools the Monday before attending SAS. They were given the survey again the Monday after they returned from SAS, which allowed for comparison between the two points. Surveys collected demographic data as well as information on STEM and Positive Youth Development outcomes.

### TEACHER SURVEYS

Twenty-one teachers from eleven schools took part in a post SAS survey a month after the final programmatic week of SAS. Teacher surveys collected data on perceived differences in students' STEM and Positive Youth Development outcomes, as well as changes in the school classroom community as a result of students' time at SAS and teachers' general satisfaction with the SAS experience.

### STUDENT INTERVIEWS

Fourteen students from eleven schools were interviewed about their thoughts on SAS. This occurred the Monday after SAS, after the students completed their survey. Interviews were semi-structured, allowing the researcher the flexibility to ask questions beyond an established script.

### TEACHER INTERVIEWS

Eight teachers from six different schools were interviewed via phone approximately a month after returning from SAS. Six teachers taught STEM subjects and two did not. Additionally, three teachers had zero to five years of teaching experience, and the other five had eleven or more years of teaching experience. The content and structure of teacher interviews were similar to student interviews.

"You get to know more friends  
and make new friends and  
learn about other people that  
you never knew before."

-2019 6th grade Student



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## STUDENT DEMOGRAPHICS

Over the course of six weeks, 393 sixth grade students attended the Science Adventure School. Of that group, demographic information was collected from 344 students who attended and 74 students who did not attend. Demographic questions were given as pre-written options for students to choose. Each set of questions had an "Other" option with a text box allowing students to fill their gender or racial and ethnic identity if it was not given as an option.

### ATTENDING STUDENTS (TREATMENT)

#### Gender Identity

Female/Girl: 51.6%

Male/Boy: 47.6%

Other: .8%

#### Racial and Ethnic Identities

White/Caucasian: 74.4%

Black/African American: 4.1%

Hispanic/Latino: 2%

Asian: 1.2%

Native/Indigenous Indian: .8%

Two or more Races: 10.6%

Other: 3.3%

Prefer not to provide: 3.7%

### NON-ATTENDING STUDENTS (CONTROL)

#### Gender Identity

Female/Girl: 51.9%

Male/Boy: 48.1%

#### Racial and Ethnic Identities

White/Caucasian: 86.5%

Two or more Races: 3.8%

Other: 1.9%

Prefer not to respond: 7.7%

Students work with their peers to solve challenges and learn cooperatively.



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### STUDENT SURVEY RESULTS

Of the 393 SAS students at SAS, 344 were surveyed, yielding a completion rate of 87.5%. Ninety-eight responses were eliminated due to completion issues, leaving 246 completed surveys and a final response rate of 62.6%. Seventy-four students who did not attend SAS were surveyed to establish a control group. Of these surveys, 22 were eliminated due to completion issues, which left 53 completed surveys and a final response rate of 71.6%. Students were asked to rate statements on a scale of 1-5. A paired t-test analysis of the test and control group was used to determine significant changes in attitudes between pre- and -post surveys.

### STEM ATTITUDES

Based on data from the students who attended SAS, there were significant increases in two items from the science identity scale, one item from the science value scale, one item from the science self-efficacy scale, one item from the science career interest scale, and in the science career knowledge item. There was one significant decrease in an item on the science value scale. The items that experienced change are listed below with (+) indicating a positive change and (-) indicating a negative change.

#### STEM Identity

- My family thinks of me as a "science person". (+)
- My teachers/instructors think of me as a "science person". (+)

#### STEM value

- Knowing science is important. (-)
- Thinking like a scientist will help me do well. (+)

#### STEM self-efficacy

- I think I am very good at coming up with questions around science. (+)

#### STEM career interest

- I would like to be a scientist when I leave school. (+)

#### STEM career knowledge

- Name three potential STEM careers. (+)

### POSITIVE YOUTH DEVELOPMENT ATTITUDES

There were significant increases in one item from the persistence scale, two items from the environmental attitudes scale, and one item from the social self-efficacy scale. As with STEM attitudes, the items that experienced change are listed below.

#### Persistence

- I have overcome setbacks to conquer an important challenge. (+)

#### Environmental attitudes

- I feel it is important to take good care of the environment. (+)
- I have the power to protect the environment. (+)

#### Social self-efficacy

- How well can you tell other children that they are doing something that you don't like? (+)

There was no significant change from pre-test to post-test found for the 53 students who did not attend SAS. However, analysis revealed that the two groups were significantly different.

“There is a lot more  
in science to do  
than I thought  
there would be.”

-2019 6th grade Student

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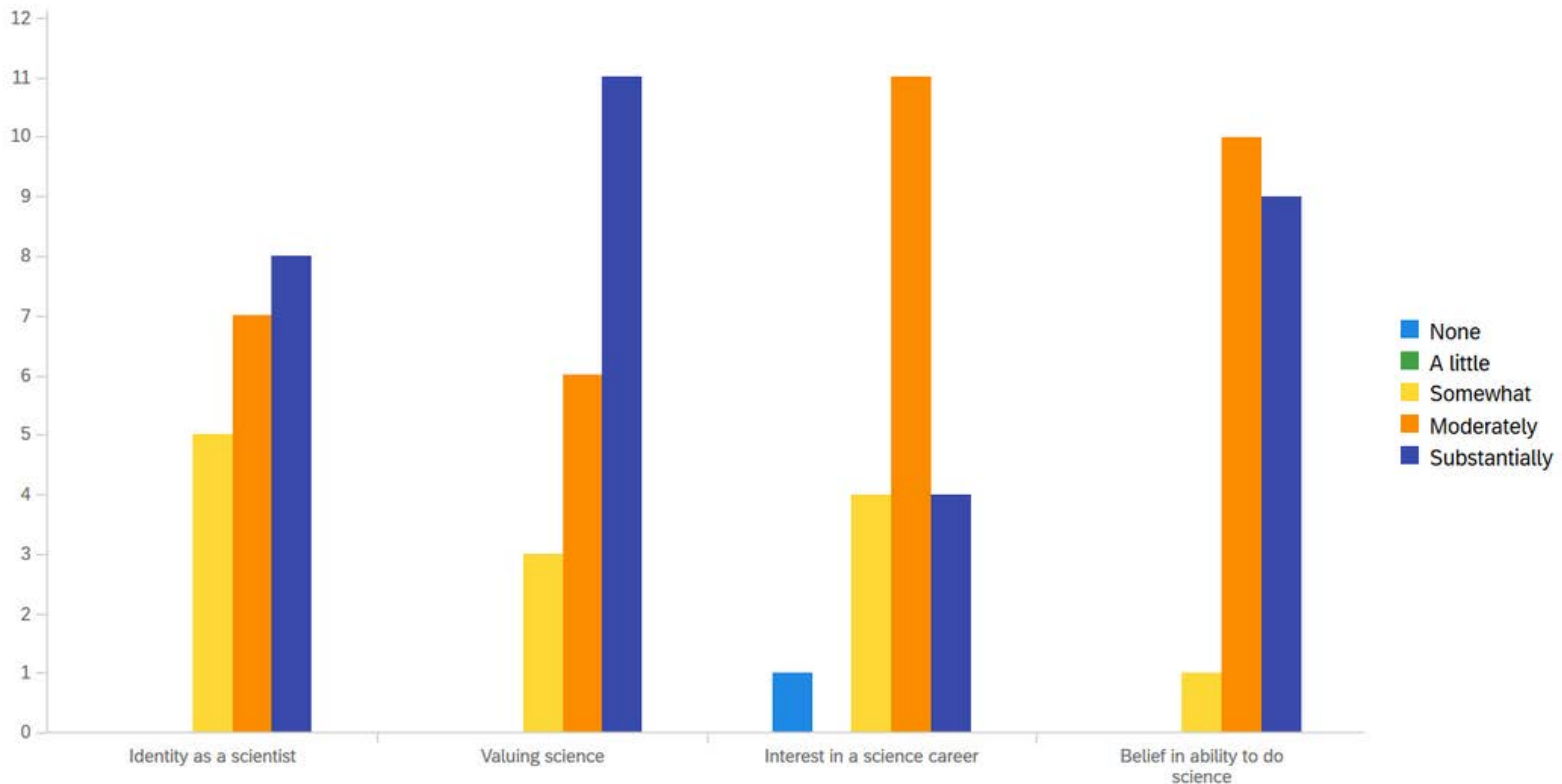
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## TEACHER SURVEY RESULTS

In their post-SAS survey, teachers were asked to provide feedback on a variety of topics including satisfaction with food, lodging, activities, pre-SAS communication, safety, and overall quality of the experience. They were also asked evaluative questions about SAS impacts and student outcomes from participating in the program.

### STEM ATTITUDES

Teachers were asked to rank the degree to which they felt that SAS developed students' STEM skills, attitudes and abilities.



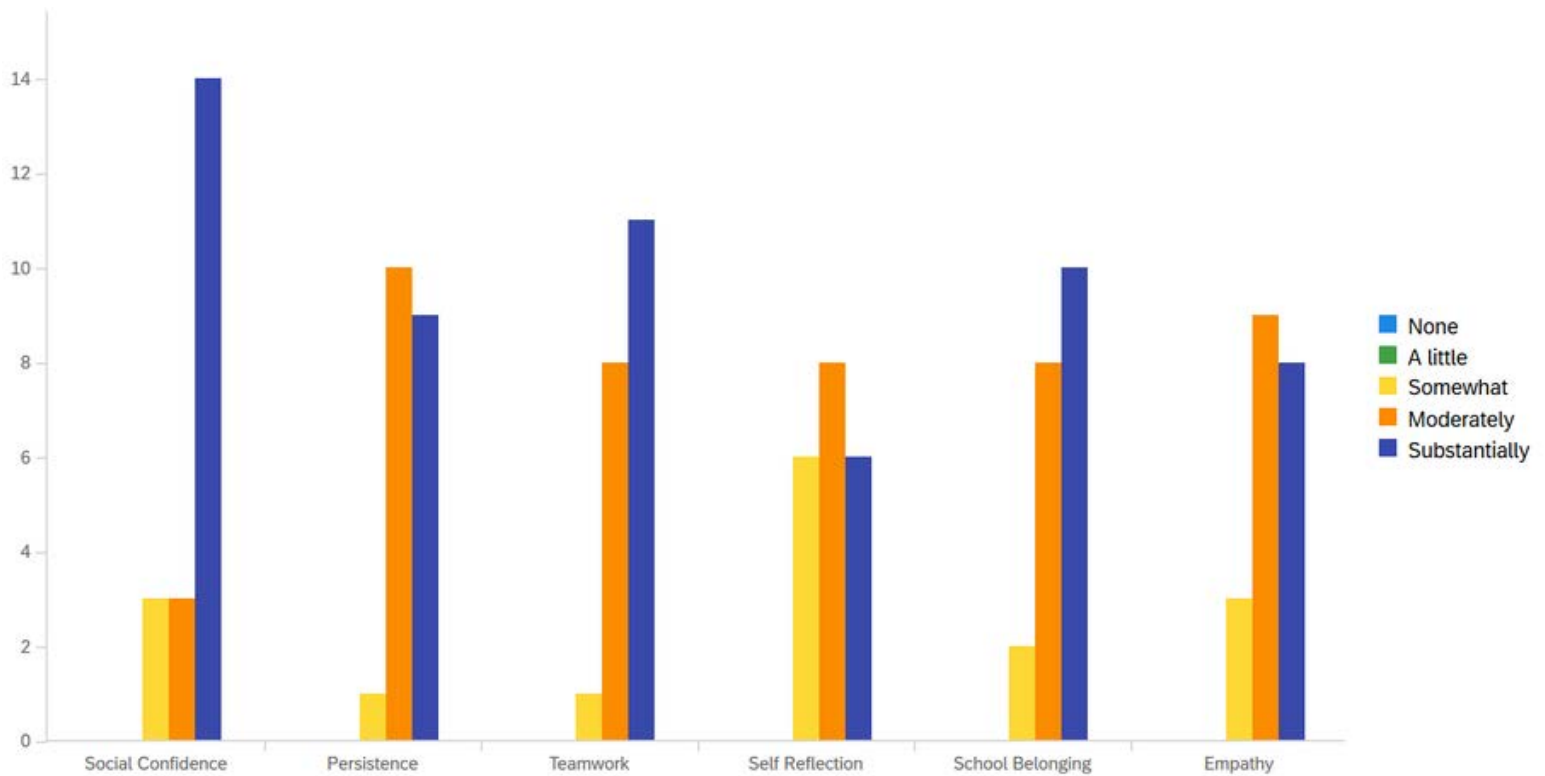


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### POSITIVE YOUTH DEVELOPMENT ATTITUDES

Teachers were also asked to rank the degree to which they felt that SAS developed students' personal and social skills, attitudes and abilities.



Students explore their natural surroundings while learning about the environment.





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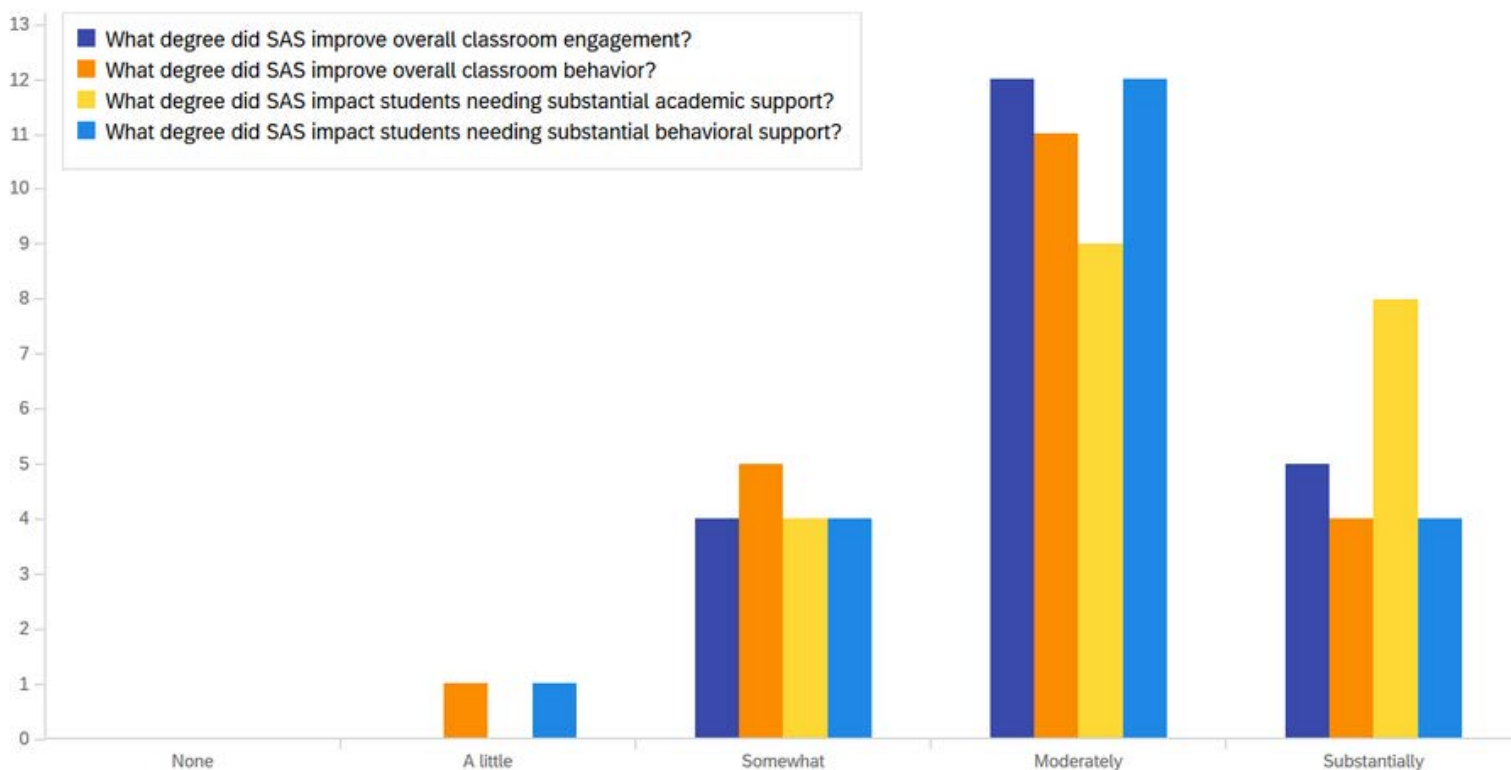
### CLASSROOM BENEFITS

Teachers noticed an improvement in their classroom communities in regard to student engagement and behavior after their return from SAS. Notably, teachers observed this change in students who they identified as needing substantial academic and behavioral support.

The graph below shows the degree to which teachers noticed improvement in their classroom communities. Each color represents a different question asked of teachers and the degree that it impacted an aspect of their classroom or their students.



Group members exchange beads in a final ceremony recognizing each others strengths.



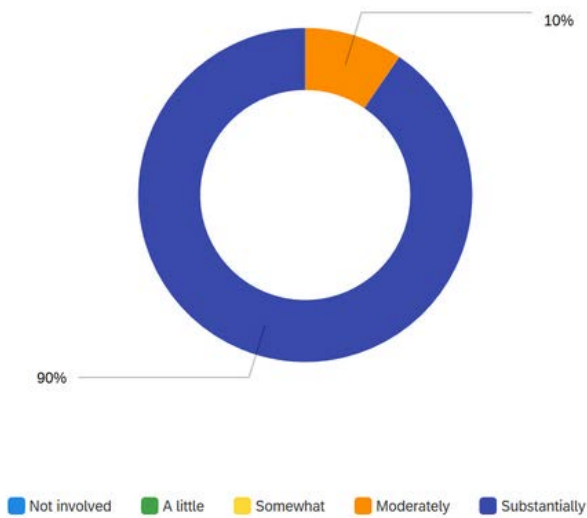
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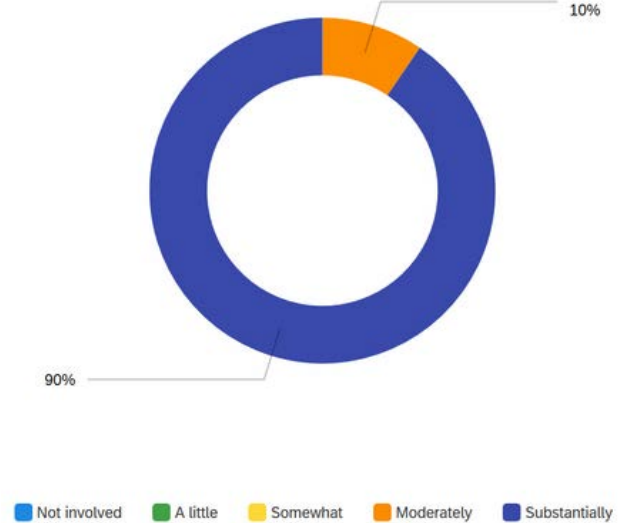
### SATISFACTION

Teacher surveys also indicate that teachers are pleased with the quality of the program. A majority believed that SAS was a substantially valuable experience for their students and indicated that their schools were supportive of a continued relationship with SAS. When asked to give SAS a letter grade, 95% gave the program an "A" and 5% gave it a "B".

How supportive is your school community of SAS?



How valuable was the SAS experience?



The Science Behind Climbing teaches students about gravity, geology and anatomy which they then try out while climbing.



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### STUDENT INTERVIEW RESULTS

Fourteen students from eleven schools were interviewed about their thoughts on SAS. Nine identified as female and five as male. Half of students had a parent working in a STEM field and 79% has some degree of interest in STEM before attending SAS.

### INTERVIEW SNAPSHOT

- 86% gained increased STEM knowledge
- 86% were interested in pursuing a STEM career
- 76% saw the relevance of STEM to their lives
- 71% of students reported that "science is fun"
- 71% saw value in learning about STEM
- 71% expressed they had the ability to be successful at STEM activities
- 64% expressed that anyone can be a scientist
- 50% believed that "science is bigger" than their classrooms

### THEME ONE: ELEMENTARY STEM SCHOOL EXPERIENCE

Students reported that they spent most of their elementary school science classes reading from books, writing and taking notes, and memorizing material. Hands-on experience with the subject was limited. The following quote is from a student illustrating what science class in elementary school was like. This is in contrast to the teaching style at SAS, which students indicated a preference for.

*"All we did was, like, a science book. We just read it and found the facts of the book. Like, they'd give us a piece of paper that was all questions and we'd have to answer it. Like a four-page thing we'd read."*

SAS gives students time to practice social skills such as talking and listening in a group.



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SAS curriculum includes time for discussion and sharing with the group.

## THEME TWO: PREFERENCE FOR LEARNING STYLE AT SAS

Students reported that it was easier learning at SAS than in their classrooms. They attributed this to their ability to immediately put new knowledge into practice. Students also spoke about finding the lessons enjoyable, which they felt aided their learning and undermined their previous idea that learning science was boring. The following quote is from a student explaining how SAS made it easier to learn science.

*"I think it was a lot easier to learn at the [SAS] because, uh, you were constantly moving and you were actually doing that thing that they talk about... with rock climbing, they were teaching you about body positions and why, like pulling up with your legs is better than your arms. It's easier to understand because you're actually doing it."*

## THEME THREE: CHANGING STEM ATTITUDES

Interview data supports an increase in positive STEM attitudes in students who attended SAS. Students reported that they had a better understanding of STEM principles, a greater belief that they would be successful doing scientific activities in the future, a greater belief that STEM is valuable to know about, and the belief that STEM would be relevant to their daily and future lives. In this quote a student explains that they used to dislike learning about science. After time at SAS, they are now excited to learn.

*"I'm actually eager to learn more about [science] and before I wasn't eager and [SAS] definitely changed my perspective on it."*



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## TEACHER INTERVIEW RESULTS

Eight teachers from six schools were interviewed about their thoughts on SAS. Six identified as female and two identified as male. Six taught STEM subjects and two taught non-STEM subjects.

### THEME ONE: SAS ENVIRONMENT

Teachers appreciated that students had the opportunity to learn experientially at SAS through hands-on activities and challenges. As this teacher describes, they felt that students were able to make better connections to lessons at SAS because of the learning context.

*"The main reason we wanted to bring them to the SAS is to give them the opportunity to learn the science behind things they do in everyday life...to be able to learn outside of the classroom with hands-on experiences."*

## INTERVIEW SNAPSHOT

- 100% of teachers felt students had a strong sense of school community after SAS
- 100% felt that SAS helped improve peer relationships
- 75% felt that SAS encouraged curiosity and interest in STEM
- 71% expressed that students believed they had the ability to be successful at STEM activities
- 66% believed that students saw that "science is bigger" than their classrooms
- 63% noticed stronger teacher-student relationships after SAS
- 50% saw students grow through challenge
- 50% noticed instances of students being more helpful
- 50% felt that students were more confident socially
- 50% noticed that students were more willing to try new things



Teachers experience SAS alongside their students to help build stronger relationships back in the classroom.

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### THEME TWO: CHANGING STEM ATTITUDES

Teachers had not spent much time with their current students before they attended SAS, but did observe some change in positive STEM attitudes. They noticed a change in STEM efficacy and comfort answering questions, a greater understanding of science outside of the classroom, increased curiosity, and interest in the subject of science. This teacher describes one student who gained confidence at SAS that later translated into confidence in her classroom.

*“One of the students, she’s really weak in math, she’s gotten a couple of skills and she’s gotten great at those and she wants to go and help, so her self-esteem, and I think it’s something that they really have taken away from [SAS].”*

### THEME THREE: CHANGING CLASSROOM COMMUNITY

Teachers reported changes in classroom dynamics and behavior as a result of visiting SAS, particularly in regard to social bonds to each other and their teachers and the development of students' social skills. Teachers also noticed that students became more cooperative in class and were more willing to help their classmates. This quote is from a teacher illustrating that SAS helped students make friends and form peer groups.

*“And I definitely think that it helped kids come out of their shell and gain more confidence in their friend groups. And if they didn’t really have a friend group, I think they found one there.”*

Notably, a teacher who had also participated in the SAS pilot project reported that students who had attended the pilot continued to have strong social bonds two years after their SAS experience.



Teachers and students explore the wetlands boardwalk as they learn about the creatures that live there.



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## CONCLUSIONS

While this is preliminary study to understand how participation in SAS affects STEM and social/emotional attitudes and student and teacher perceptions of the program, data supports that SAS does positively influence a number of these attitudes. Findings showed the strongest support for positive attitudes related to STEM self-efficacy, STEM value, and social self-efficacy as well as relative support for STEM identity, environmental attitudes, teamwork, school belongingness, and STEM knowledge. Analysis indicated low support for persistence, STEM interest, and STEM career interest.

## LIMITATIONS

Analysis found differences between treatment and control groups, making it difficult to draw conclusions about differing experiences. It is also difficult to determine representativeness of our sample of students given its relatively small size. Generalizations should not be made outside of the group of students who attended SAS.

## FUTURE RESEARCH

Research and evaluation will continue to play a part in the yearly SAS operations going forward. Surveys in 2021 will be altered slightly to gather data on students' pride in coming from West Virginia, connection to nature, and feelings of self-worth.

We are also in the planning stages of a longitudinal study that would look at the long-term effects of SAS post-high school.

"I think [SAS has] definitely helped them try to open their mind to new ideas and also try to just be more curious in general, honestly, which is what science is all about."

-2019 Teacher

SAS encourages students to be curious about their surroundings.



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"When you know a kid is very talky and won't sit down, and can't sit still for five minutes to do their homework, who has problems in the classroom... when you take them to the Summit and you're like, "Oh my gosh, this kid needs to have outdoor classroom everyday!"



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Many thanks to our donors for their generosity, for the support of the SBR leadership and staff, and for the wisdom and guidance of Brad and Alys Smith. Additional thanks to all our friends and supporters, especially the SAS teachers and school administrators. You inspire our work.

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