Advocate Grant Program Evaluation Findings 2017-2019

September 2019

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EXECUTIVE SUMMARY

The Society for Science and the Public's Advocate Grant Program provides selected Advocates with funding, resources, and information. The role of the Advocates is to support underserved middle and high school students in the process of advancing from conducting a scientific research or engineering design project to entering a competition. This evaluation report focuses on two cohorts of Advocates and their students. The 2017-2018 cohort of 44 Advocates supported at least 375 students in entering competitions, and the 2018-2019 cohort of 50 Advocates supported at least 682 students. Based on student survey data, students supported by Advocates entered competitions at very high rates (86.73% of student respondents in 2018 entered and 82.89% in 2019 entered) accomplishing an important program goal.

Data for the evaluation include survey responses from Advocates in both cohorts, survey responses from their students, and questionnaire responses from Society staff members.

Evaluation Findings

Findings summarized here focus on the impact of the program on Advocates and on their students.

- Advocates gained awareness of the Society as a resource for teachers.
- Advocates gained awareness of competition deadlines, requirements, and range of competitions.
- Advocates developed a sense of camaraderie with others in the student research and competition community.
- Advocates' motivation to support underserved students remained high.
- Advocates' abilities to support students showed moderate gains.
- Total *Gain* scores as a measure of impact were very similar between the two cohorts of Advocates.
- Advocates, and their students, benefited in many ways, particularly from the additional resources and support from Society staff and other Advocates.
- Advocates found the Advocates Training Institute to be particularly helpful.
- Most Advocates plan to continue to support underserved youth in entering competitions after their participation in the program.
- Advocates were the primary source of help to students with most aspects of their projects.
- Students gained in awareness, skills, knowledge, interest, and confidence.
- Most students reported that they were unlikely to have completed projects and entered competitions without Advocate support.
- Advocate and student perceptions on why students enter competitions were similar, with encouragement and awards rated highly.
- Advocate and student perceptions on the benefits of research and competition varied.
- Advocates saw access to resources and awareness of competitions as program benefits for their students.

Recommendations and Conclusions

The conclusions provided in the report address each evaluation question and are summarized as follows.

- The Advocate Grant Program accomplished its goals for the target audiences.
- The support provided to Advocates by the Society influenced the program impacts.
- An unintended program impact was an increase in the average number of students supported from the 2017-2018 cohort to the 2028-2019 cohort.
- Student impacts differed by school level (middle vs. high school) and whether or not they won an award.
- Stipends and direct support to Advocates influenced the intended impacts.
- The main difference in characteristics between the cohorts was the difference in grade levels that Advocates supported and the resulting difference in grade levels of the student survey respondents. These differences likely contributed to many of the other differences noted in the report between the two cohorts.

Advocates offered recommendations for program improvement, which are provided on pages 26-28 of the report. Recommendations from the evaluators (pages 41-43) can be summarized as follows.

- Continue to monitor broad program outreach.
- Gather additional information from Advocates to determine, and potentially improve, student survey response rates.
- Build in time for staff reflection to use Advocate input and survey results to continue program improvement.
- Consider revisions to the worksheet Advocates use to record their goals.
- Continue to add support for Advocate alums.
- Consider adding roles for Advocate alums to provide services requested by Advocates.

Quotes are used throughout the report to illustrate findings. We offer a few additional quotes here to capture the importance of the program in the eyes of many Advocates.

It was very rewarding to see students who would've never entered into a program like this actually win awards at competitions. Thanks for allowing me to be a part of this program!
– Advocate 2023

My students experienced success at things they never saw themselves capable of doing!
– Advocate 2039

In my 20 years of teaching, this has been the most rewarding thing that I have done!
– Advocate 2040

The Advocate Program has been a positive life changing experience. The knowledge, respect, and pride I have gained are wonderful. – Advocate 2022

Evaluation Team

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PROJECT OVERVIEW

The Society for Science and the Public's Advocate Grant Program provides selected Advocates with funding, resources, and information. The role of the Advocates is to support underserved middle and high school students in the process of advancing from conducting a scientific research or engineering design project to entering a competition. This evaluation report focuses on the 2017-2018 and 2018-2019 cohorts (indicated as 2018 and 2019, respectively, throughout this report).

The 2017-2018 cohort of 44 Advocates supported at least 375 underserved students[1] in entering competitions, as described in the September 2018 evaluation report submitted to the Society. The 2018-2019 cohort of 50 Advocates across the United States and Puerto Rico supported at least 682 underserved students in entering competitions, as seen on the map below. This report describes findings from Advocates and their students who responded to online surveys each spring. Survey data for the number of students supported in entering competitions differs from data collected by the Society via Advocate reports.

Advocate Reach Nationwide in 2018-2019

45 Advocates supported 682 underserved students in entering competitions in 2019.

Numbers in red represent # of underserved students entering competitions for each of 45 Advocates responding to the survey question. Red dots indicate non-responding Advocates.
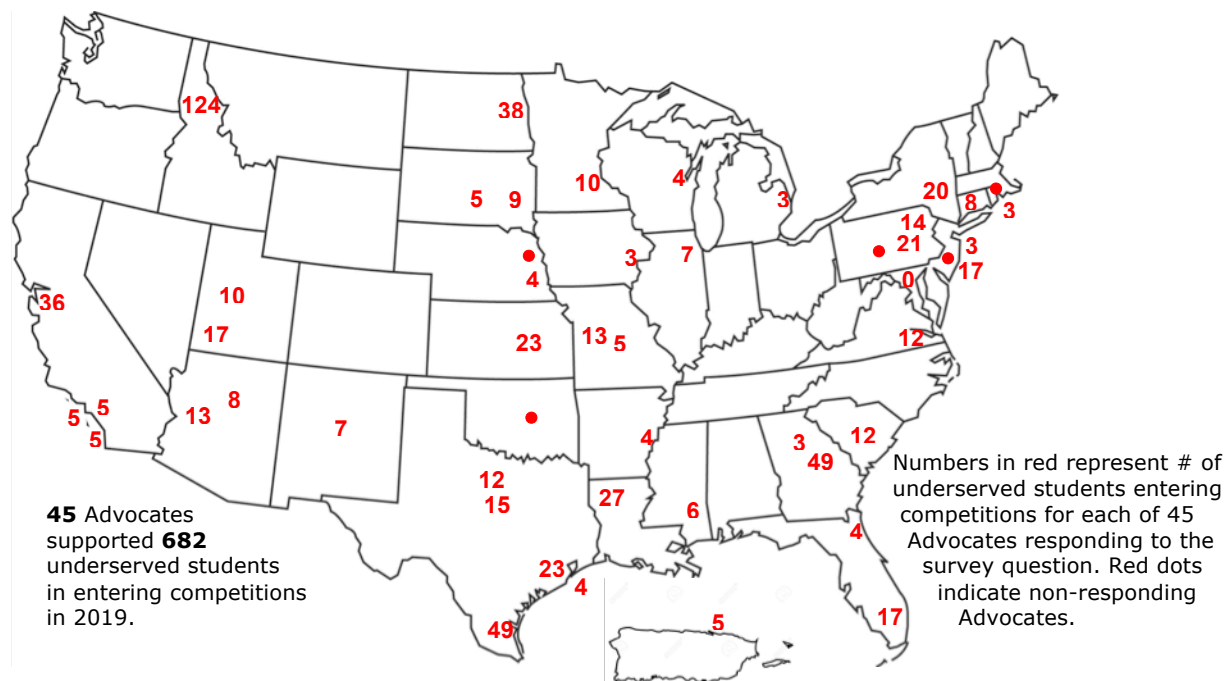
Figure 1. Map of number of students entering competitions by 2018-2019 Advocate's location

For a map of the 2018-2019 Advocates, see the September 2018 report.

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[1] The 375 total is based on survey responses from 33 Advocates in the 2017-2018 cohort on questions regarding the number of underserved students supported who entered competitions. Similarly, the 682 total from the 2018-2019 cohort was calculated from survey responses from the 45 Advocates responding to the 2019 survey.

EVALUATION OVERVIEW

This evaluation of the Advocate Grant Program (AGP) focuses on the 2017-2018 and 2018-2019 Advocate cohorts and their students by addressing these questions:

1. To what extent did the program accomplish its goals? (i.e. implementation of program as designed, serving a specific number of youth, recruiting youth from the intended target audiences)
2. To what extent and in what ways did the program experience influence the intended impacts?
3. Did the program have unintended impacts?
4. Were there differences among youth groups? (e.g., by age, gender, ethnicity, urban/rural)
5. Which program elements appear more or less successful in influencing intended impacts?
6. Were there any important differences between the 2017-2018 and 2018-2019 cohorts?

Insight for Learning Practices LLC, in collaboration with Tisdal Consulting, conducted the evaluation.

Data Sources

Data for the evaluation include survey responses from Advocates in both cohorts, survey responses from their students, and questionnaire responses from Society staff members. Online survey links distributed to Advocates each spring (2018 and 2019) produced data from the following numbers of respondents.

Table 1. Number of Survey Respondents by Cohort

	2017-2018	2018-2019
Advocates	33	45
Students	98	228

These reflect a response rate from Advocates of 73% in 2018 and 90% in 2019. It is difficult to determine a response rate from students since there is no way to determine how many students received the link to the survey from their Advocate. However, based on the number of students reported by Advocates to the Society, we can say that student survey data represent 13.67% of program students in 2018 (98/717) and 25.31% in 2019 (228/901).

Advocates were assigned random, unique case ID numbers. All numbers for the 2017-2018 cohort are in the 1000 – 1050 range and all in the 2018-2019 cohort are in the 2000 – 2060 range. These are included here with quotations to maintain anonymity while allowing for reference. Since many quotes from the 2017-2018 cohort were included in the September 2018 report, this summative report primarily includes quotes from the 2019 survey.

Data Details

The body of this report focuses on the overall characteristics and findings of the two program cohorts. For those who want to explore the data details, Appendix C presents detailed data tables and figures for data collected through the surveys.

CHARACTERISTICS OF SURVEY RESPONDENTS

Most Advocates and some of their students responded to requests to complete online surveys. This section of the report describes the characteristics of those respondents. We include a discussion of the representativeness of the samples; however, Society staff may wish to apply additional knowledge of program participants to determine representativeness of each cohort for each program year.

Advocate Respondents' Characteristics

Thirty-three of the 44 Advocates responded to the survey in 2018 (73%), and 45 of the 50 Advocates responded in 2019 (90%). The increase in response rate is most likely related to the Society's new policy (with the 2018-2019 cohort) of requiring survey completion prior to final stipend receipt. Surveys were collected May 23, 2018, through July 26, 2018, and March 5, 2019, through June 2, 2019.

The samples are consistent between the two Advocate cohorts, with only minor differences. Comparison of data on characteristics from the two years' of Advocate survey responses resulted in no significant difference using Contingency Coefficients for comparisons unless otherwise noted (and figures provided). Thus, we can say the samples are reliable. With the high response rate from Advocates, the sample is most likely a valid reflection of the entire population of Advocates, though we cannot be certain. Student data may be less representative of the entire population of students served due to lower return rates.

Details of the characteristics summarized here are included in Appendix C, with additional tables and figures. Because the number of responses varied by cohort, percentages are used in the figures to allow for comparison between the two years.

Demographic Characteristics of Advocate Respondents

Advocate respondents from both cohorts were predominately white females with a broad range of ages.

Gender Identity. Advocates responding to the surveys were 68.75% female in 2018 and 71.11% female in 2019.

Race/Ethnicity. Advocates could choose up to two responses for race/ethnicity. The majority selected White/Caucasian, 81.82% in 2018 and 68.89% in 2019. While the difference between the two cohorts was not significant, the recent cohort included a higher percentage of African-American (13.33%) and Asian (11.11%) Advocates.

Age Range. Advocates in 2018 were younger though there was no significant difference. The median age range in 2018 was 35-44. In 2019, however, the median fell between the 35-44 and 45-54 age ranges. Two Advocates in 2018 and one in 2019 did not provide an age range so were not included in determining the medians.

Context Characteristics of Advocate Respondents

Advocates worked in a variety of contexts. The typical Advocate from both cohorts supported urban high school students in a Title 1 school setting.

Grade Level. The majority of Advocates in both cohorts supported high school students. Advocates were asked for the grade levels of students they supported and could check all that applied. Figure 2 compares the percentage of Advocates from each cohort that supported students at each grade level. For example, few Advocates supported students in grade 6 (9.09% of all Advocates respondents in 2018 and 8.89% of Advocate respondents in 2019) while the majority supported high school juniors (63.64% of all Advocate respondents in 2018 and 71.11% in 2019). These results are consistent with the responses from students on their surveys, with only 9.18% in middle school (grades 6-8) in 2018 and 23.25% in 2019.
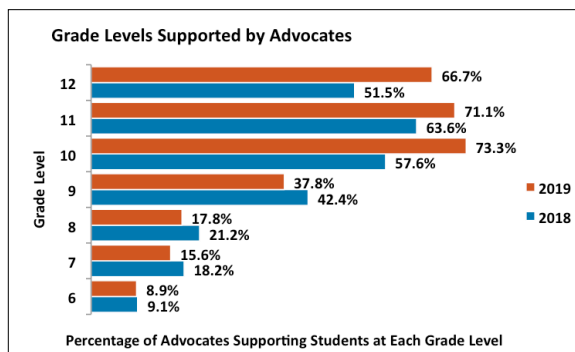
Figure 2. Percentage of Advocates supporting students at each grade level for each cohort

Community Setting. About half of the Advocates in each group reported that they worked in an urban setting, 54.55% in 2018 and 46.67% in 2019. There were more rural Advocate respondents in 2019 (26.67%) than in 2018 (9.09%), though the differences in settings between the two cohorts were not significant. It should be noted that Advocates self-reported their setting, and we did not confirm this with data from the National Center for Educational Statistics (NCES). It appears that Advocates may have used different definitions for urban, suburban, small town, and rural.

> I love my school and its student population (Title 1, immigrant, EL and high poverty). My students need the opportunities that the Society for Science and the Public provides.
> – Advocate 2038

Title 1 Schools. Over half the Advocates in both cohorts supported students attending Title 1 schools, with 51.52% in 2018 and 55.56% in 2019 stating that all the students they supported attended a Title 1 school. Since these schools serve students from low-income populations, this distribution indicates that Advocate selection was successful in meeting the program goals.

Organizational Setting. When asked, "In what type of organizational setting did you serve as an Advocate?" over 70% of Advocate respondents in 2018 (72.72%) and 2019 (75.56%) reported that they served in a classroom or school. The two in each cohort that reported an "Other" setting listed an afterschool club, which could have been in a single school, district-wide, or community organization. The differences in settings between the two years were not significant. This mix shows consistency in Advocate selection across the two years.

Prior Experience of Advocate Respondents

Advocates were asked if they had prior experience (prior to their participation in the Advocate Grant Program) as a research teacher/mentor, science competition leader/mentor, engineering competition leader/mentor, or other experience. They were also asked about their prior experience working with underserved students.

> Being an Advocate has truly transformed my teaching philosophy and skills. I have learned SO much, and I am so much better prepared to help my students.
> – Advocate 2003

Figure 3 provides a comparison of the percentages of respondents with experience in each area by cohort. The difference between the two cohorts for Research Teacher or Mentor was significant (*p* < .05) with 45.45% in 2018 and 68.89%

in 2019. This difference may reflect changes in recruitment of Advocates. Few Advocate respondents had experience with engineering competitions (21.21% in 2018 and 13.33% in 2019). (See Appendix C for other experiences listed by Advocates.)
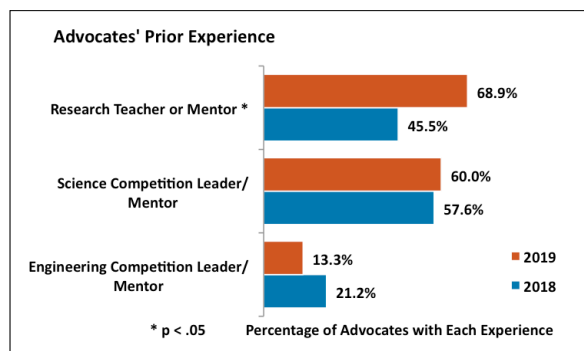
Figure 3. Percentage of Advocate respondents in each cohort with each type of prior experience

Beginning with the 2019 survey, Advocates were asked if they had worked with underserved students prior to participating in the Advocate Grant Program. They were given the following options:

- No, this is the first time I have worked with underserved students
- Yes, I have worked with underserved students previously, but not on entering STEM research competitions
- Yes, I have mentored underserved students entering STEM research competitions prior to participating

All Advocates had experience working with underserved students. About half (51.11%) had experience mentoring them in entering competitions, and 48.89% did not. Since the question asked about experience prior to their participation as an Advocate rather than in the prior year, the results indicate that the program is recruiting Advocates who are experienced at working with underserved students, and is recruiting many Advocates (48.89%) who have no prior experience in supporting these students in competitions. From discussion with the program staff, this appears consistent with the program goals.

> Prior to participation in the AGP, I would say I would have welcomed any student underserved or otherwise into my research class. The program has opened my eyes to actually recruiting students who either may not know about the course offering or who may not have the confidence to enroll without encouragement. The program has also helped me realize that my class demographics should match the demographics of my school as a whole. This is a new goal for me since joining the AGP.   – Advocate 2018

We also asked for information about the Advocates' roles and whether or not they were returning from the previous year. Five Lead Advocates responded to the survey in 2018 (15.15% of total survey respondents and 71.43% of the seven Lead Advocates), and six responded in 2019 (13.33% of all survey respondents and 85.71% of the seven Lead Advocates). Survey responses were received from 69.70% new Advocates in 2018 and 64.44% in 2019, which is comparable to the actual percentages of all returning Advocates (70.45% in 2018 and 68.00% in 2019).

Number of Students Supported by Advocate Respondents

On the survey, the Advocate respondents provided the number of students they supported in scientific research and engineering design projects and in entering competitions. They were asked for the total number of students and the number of underserved[2] students for the current year and the prior year. Table 2 provides results for the "current year" on each survey (2018 and 2019). To compare the two cohorts, the average per Advocate is used in Figures 4 - 6.

Table 2. Number and Average of Students Supported by Advocate Respondents by Cohort

	2018		2019	
	Total	**Average**	**Total**	**Average**
All students **supported** in projects	734	22.24	1341	29.80
Underserved students **supported** in projects	556	16.85	947	21.04
All students **completing** projects	642	19.45	1140	25.33
Underserved students **completing** projects	489	14.82	766	17.02
All students **entering competitions**	517	15.67	978	21.73
Underserved students **entering competitions**	375	11.36	682	15.16

Data reported to the Society by Advocates in their Phase Reports differed from the above. This may be due to timing or how Advocates approached the survey that asked for broad numbers versus the reports that asked for individual student data.

In each category in Table 2, the average number of students supported by the Advocates who responded to the survey increased from the 2018 to the 2019 cohort. With the recruitment of Advocates each year from different settings and with differing access to students, increasing the *average* number of students per Advocate each year is not a stated goal of the program nor is it to be expected. The increases between these two cohorts are a nice, unanticipated program outcome.

By comparing the average number of students supported during the current year with the average number from the previous year in the figures below, we can see the increase in each category. All Advocate respondents are included in the calculation of the averages, those new to the program and those returning for another year. Regardless, the increases show the reach and impact of the Advocate Grant Program.

The largest increases from previous year to current year occurred in supporting student projects by the 2018-2019 cohort for all students and underserved students (Figure 4).
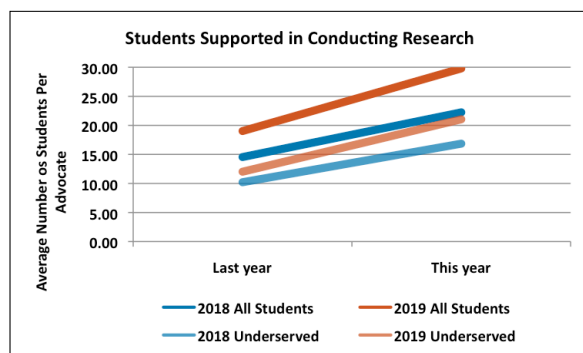
Figure 4. Average number of students supported in **conducting** research and engineering projects
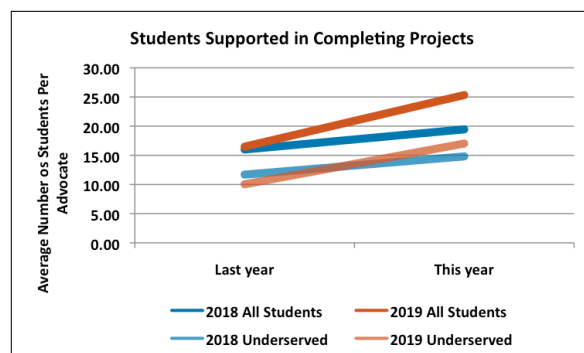
Figure 5. Average number of students supported in **completing** projects

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[2] Underserved is defined by the program as low-income or ethnic minority (other than white/Caucasian or Asian).
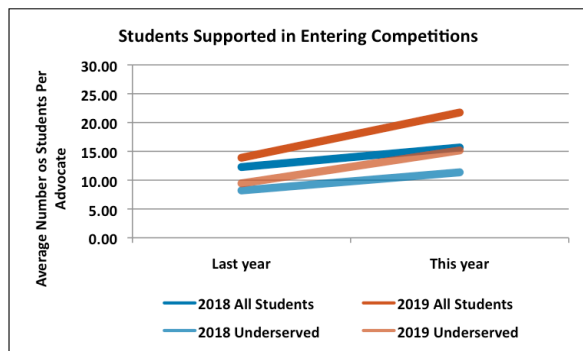
Figure 6. Average number of students supported in **entering competitions**

Advocates were also asked, "Of the number of underserved students entering competitions [included in the totals] above, how many of those students do you think would <u>not</u> have entered without your support?" Advocate respondents reported that 318 underserved students in 2018 and 531 in 2019 entered competitions who would not have done so without the support of their Advocate.

> It was very rewarding to see students who would've never entered into a program like this actually win awards at competitions.
> – Advocate 2023

While this reflects an increase in the number of students served from 2018 to 2019, comparing two cohorts with different numbers of Advocates requires that we compare the average number of students per Advocate who would not have otherwise entered. The average increased from 9.64 in 2018 to 11.80 in 2019. From this data reported by Advocates, we can see the impact of the program on underserved students and see an increase in 2019.

From statements of the Advocates on the surveys, and results from the student survey reported later in this report, it appears that many Advocates successfully nudged students to enter competitions that they hadn't previously considered. Because schools and districts often have a limited number of spots available to send students to the next level, the numbers of students entering some competitions may have had the potential to be higher had space been available.

> Many of my students tell me that they would not have done science fair or entered a competition if I had not coerced them and supported them to do so.
> – Advocate 2031

Student Respondents' Characteristics

Not all Advocates had students respond to the surveys. In 2018, student respondents represented 55% of the Advocates. In 2019, student respondents represented 60% of Advocates. The 98 students completing a survey in 2018 came from 24 Advocates and the 228 students completing a survey in 2019 represented 30 Advocates.

The samples are consistent between the two cohorts of students for most characteristics. When significant differences occurred, using the Contingency Coefficients for comparisons, discussions of those characteristics below include information on the difference. From this analysis, we can say the samples of students may be reliable from year to year; however, they may not be valid reflections of the entire population of students since over 50% of responses came from only five (2018) or six (2019) Advocates as indicated in Figures 7 and 8.
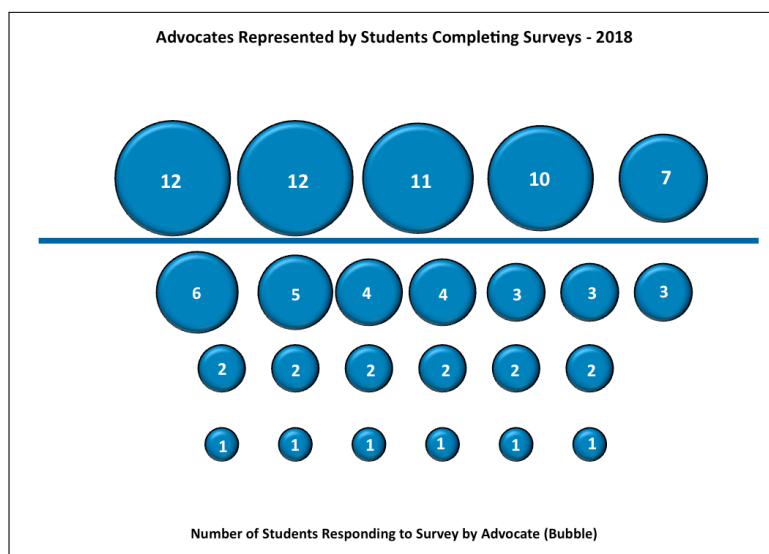
The five Advocates (bubbles) above the line account for 53.06% of student respondents (52 students), while the remaining 19 Advocates below the line account for 46.94% (46 students). An additional 20 Advocates were not represented by student surveys and are not pictured here.

Figure 7. Number of students (in white) by Advocate (blue) in 2018 who completed the survey
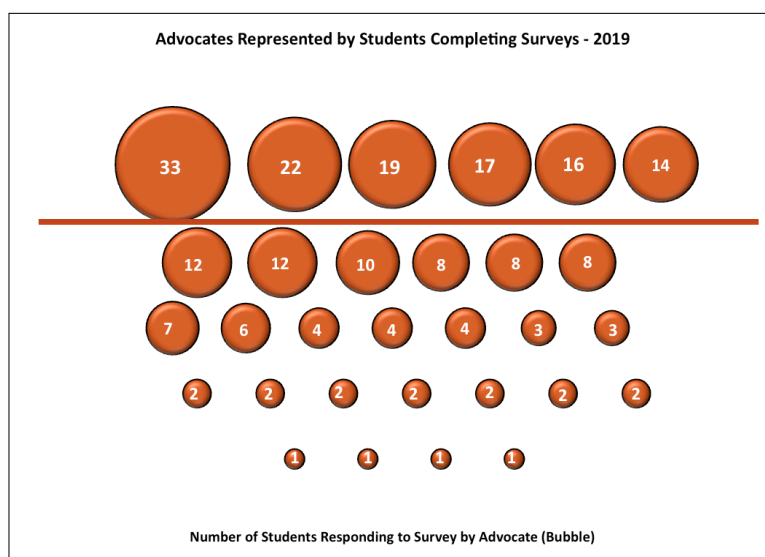
The six Advocates (bubbles) above the line account for 53.07% of student respondents (121 students), while the remaining 24 Advocates below the line account for 46.93% (107 students). An additional 20 Advocates were not represented by student surveys.

Figure 8. Number of students (in white) by Advocate (red) in 2019 who completed the survey

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Demographic Characteristics of Student Respondents

Respondents from both cohorts were diverse. Where differences between the two cohorts were significant, figures are included below. Percentages, rather than numbers of students, are used to allow visual comparison. Additional details are included in Appendix C.

Gender Identity. Students responding to the surveys were 65.31% female in 2018 and 60.53% female in 2019.

Race/Ethnicity. Students could choose up to two responses for race/ethnicity. The most common selections were Hispanic/Latinx, 51.02% in 2018 and 33.33% in 2019, and White/Caucasian, 36.73% in 2018 and 39.91% in 2019. The difference between the two cohorts for Hispanic/Latinx was significant at $p < .05$ using a Contingency Coefficient. This difference could be due to the geographic locations of the Advocates or the larger number of student respondents from Hispanic/Latinx populations. Black/African American students comprised less the one-fifth of the sample for both years. (Only categories with results over 5% are shown in Figure 9.) (See additional data in Appendix C.)
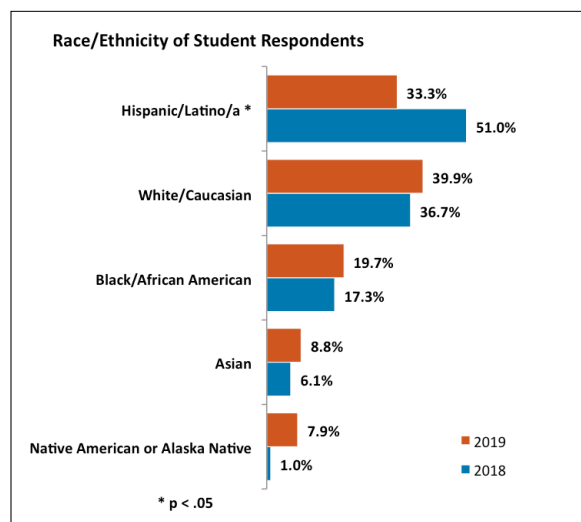
Figure 9. Student respondents' race and ethnicity

Grade Level. Most students responding to the survey were in high school. A comparison of the grade level distributions for the 2018 and 2019 samples was significantly different at $p < .001$. The 2018 distribution includes primarily high school participants, with only 9.18% of responses at the middle school grades. In the 2019 sample, 23.25% (nearly one-quarter of the sample) are 7th graders (with no other middles school students). In the 2018 sample, about a quarter of the respondents are distributed in each grade level 10, 11, and 12. In contrast, the 2019 distribution had 39.04% in the 11th grade. Advocate selection appears to underlie these differences in the two samples, perhaps with more emphasis on the selection of Advocates working with middle school students in 2019.
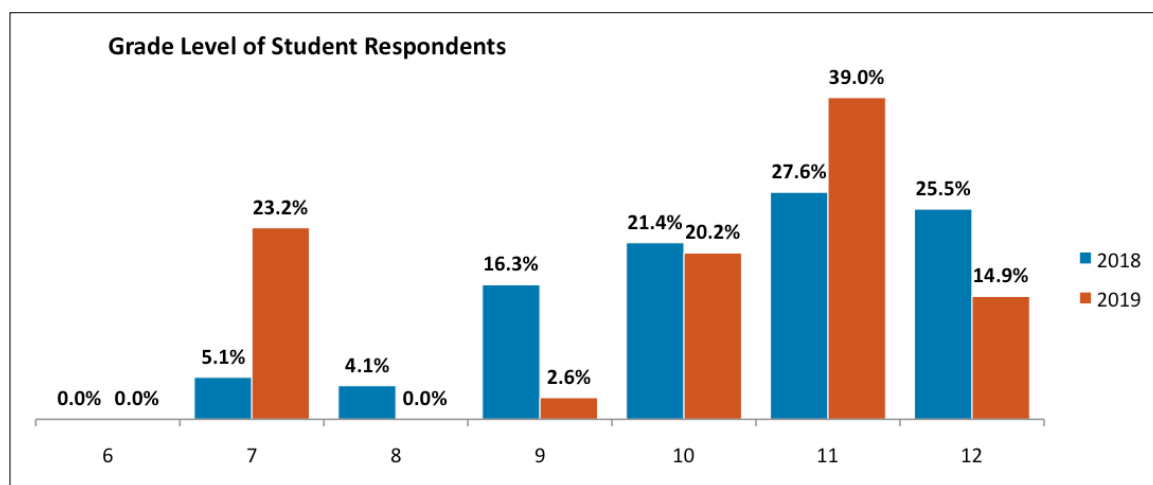
Figure 10. Student respondents' grade level by cohort (year)

To account for grade level differences, we used the variable School Type (middle school or high school) for some analyses described in the report. In 2018, 9.18% of student respondents were in middle school, and 90.82% were in high school. In 2019, the percentages were 23.25% in middle school and 74.12% in high school.

Project Characteristics of Student Respondents

Project Requirement. In the 2018 sample, only 39.80% of the students reported that they were required to complete a STEM project compared 60.09% to in the 2019 sample. This difference was significant at *p* < .001. This appears to be associated with Advocate selection and grade level of the students. In 2019, students from two Advocates serving seventh-grade students accounted for over a third of the students reporting that they did their project because it was required. The most likely explanation for the significant difference between 2018 and 2019 survey results is the large number of students responding from the two middle school Advocates who required projects. Because of the small numbers of middle school Advocates in both surveys, we cannot confirm that projects are more likely to be required at the middle school level.
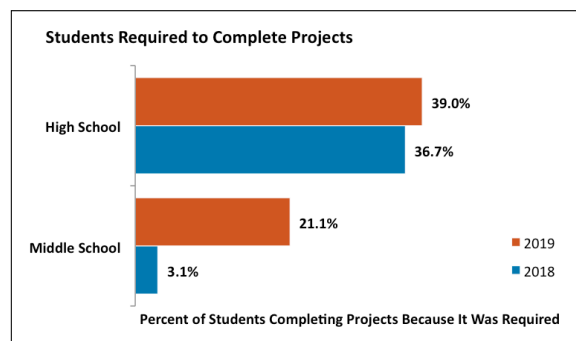
Figure 11. Student respondents required to complete projects by school type and cohort

Project Type. Students were asked to identify the type of project they had undertaken. While the majority of student respondents in both years did science research projects, responses were significantly different (*p* < .001) between the two cohorts. In 2018, 57.14% of student respondents had science research projects, while in 2019 this number was 78.07%. The higher percentage of students with engineering and behavioral studies in 2018 could be related to having Advocates who were more comfortable with supporting students with those project types. In examining the data by Advocate, no distinct patterns were found.

"Other" projects included building an outdoor classroom and creating a brochure in 2018 and material science in 2019. Additional details are in Appendix C.
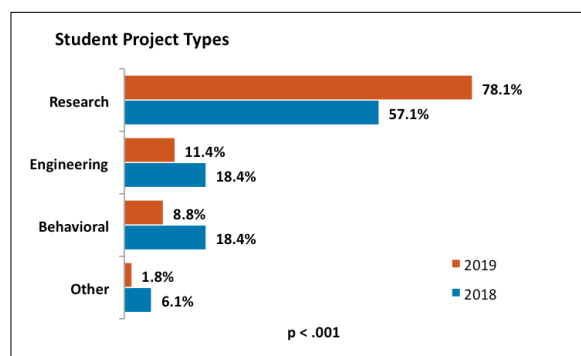
Figure 12. Student respondents' project types by cohort

Project Status. Students were asked if they had completed their project at the time of the survey and most had. In 2018, 86.73% had completed their project. In 2019, the percentage of students with completed projects was 90.35%. The difference was not significant.

Reasons for Doing a Project. Respondents in the two cohorts reported different reasons for doing a STEM project, with three reasons significantly different between the two cohorts. As described above, more students in 2019 reported being required to complete a project than students in 2018 ($p < .001$). Additionally, a significantly different ($p < .05$) percentage of students listed an interest in STEM as a reason (45.92% in 2018 compared to 33.77% in 2019) and listed the experience of working on a STEM project (36.73% in 2018 compared to 20.61% in 2019). See Appendix C for "other" reasons listed by students.)

Students' Reasons for Doing Their Project

Reason	2019	2018
It was required **	60.1%	39.8%
Interest in topic	48.7%	52.0%
Interest in STEM *	33.8%	45.9%
To try something new	32.5%	41.8%
Encouraged by an adult	23.7%	28.6%
The experience *	20.6%	36.7%

** p < .001   * p< .05
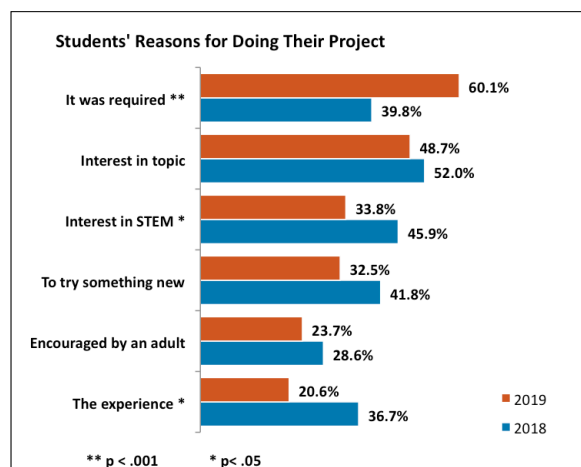
Figure 13. Student respondents' reasons for doing projects by cohort

Student Experience with Projects and Competitions. About two-thirds of both cohorts of student respondents reported that the year they worked with an Advocate was the first time they had completed a STEM project, been required to do a STEM project, and had entered a STEM competition. This means that the majority of students with whom Advocates were working were having their first experiences in completing STEM projects and entering competitions. In 2018, 65.31% of respondents were completing a project for the first time, with 67.98% in 2019. When asked how many years of experience they had in entering competitions, 56.12% in 2018 and 64.04% in 2019 reported one year, which was most likely the current year with the Advocate. (A few reported zero years of experience, 5.10% in 2018 and 13.16% in 2019.)

Where Students Collected Data. Students reported where they collected most of their data, with most collecting data at school (77.55% in 2018 and 71.05% in 2019). The second most common location was at home (26.53% in 2018 and 34.21% in 2019). Additional details are in Appendix C.

When Students Received Help with Projects. Students were asked to select the best possible response to the question asking when they received help. The difference between 2018 responses and 2019 responses was significant ($p < .05$). More students received help during class in 2019 (51.75%) than in 2018 (45.92%), while more students received help outside of class or in the summer in 2019. Several Advocates with higher numbers of student respondents account for this difference.

When Students Received Help

When	2019	2018
During class	51.8%	45.9%
Before and/or after school	25.4%	35.7%
Weekend	14.0%	5.1%
Evening	5.7%	5.1%
Summer	2.6%	7.1%

p < .05
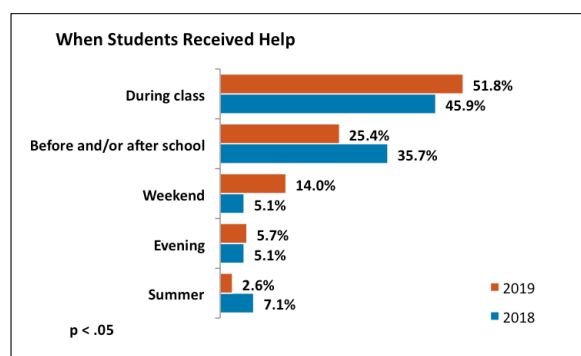
Figure 14. When student respondents' received help with projects by cohort

Internships. When asked if an internship was part of their project, only 6.12% in 2018 and 7.86% in 2019 reported that it was.

Trips. A new question was added in 2019, "Did you participate in any trips related to your project or the class/club where you did your project?" Almost one-third (31.58%) did. When

students who took trips were asked to rate the importance of the trip to their overall experience on a scale of 1 to 100, with 100 as very important, the average was 79.26, indicating that these trips were indeed an important experience. It may be helpful to add questions to identify the types or natures of the trips taken, and to match different types to their ratings.

Competition Experience of Student Respondents

When asked if they had entered a competition this year (the year of the survey), 86.73% of the 2018 cohort entered and 82.89% of the 2019 cohort entered a competition. Students were also asked to indicate the fairs they had entered. Figure 15 provides the results for the six competitions with over five percent of students entering (Appendix C includes all of the data). In addition to those in the figure, in 2019 2.19% of respondents entered Broadcom MASTERS (none reported entering in 2018).

In comparing the results from both cohorts, we found significant differences ($p < .05$) for Regional Science Fair and County-wide Science Fair. This may have been due to the availability of county-wide science fairs in the areas in which the Advocates worked. Regional Science Fairs were reported by 41.84% in 2018 and 53.51% in 2019. For the County-wide Science Fairs, 26.53% of students entered in 2018 and 15.35% in 2019.

Competitions Entered by Students

Competition	2019	2018
Regional Science Fair	53.5%	41.8%
School-wide Science Fair *	46.5%	44.9%
County-wide Science Fair *	15.4%	26.5%
JSHS	7.9%	5.1%
ISEF	5.7%	8.2%
eCybermission *	0.4%	5.1%

* p < .05
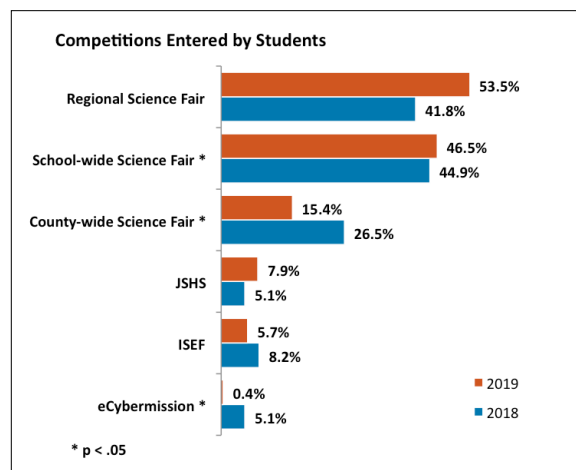
Figure 15. Competitions entered by student respondents by cohort

When asked, the majority of respondents reported that they did win an award (55.29% in 2018 and 56.08% in 2019). Very few (3.53% in 2018 and 4.76% in 2019) reported that it was too early to tell. Even though there were more middle school students and higher percentages of respondents entering regional science fairs in the 2019 sample, prize-winning percentages remained consistent for the two cohorts.

Most students plan to attend college

Most student respondents said they planned to attend college after high school (92.86% in 2018 and 92.11% in 2019). Some did not know yet (6.12% in 2018 and 5.26% in 2019). Six students (2.63%) in 2019 indicated that they did not plan to attend college (this was zero in 2018). These six students were diverse in all characteristics, though all had entered competitions at the school, county, or regional level, with one having entered Broadcom MASTERS. Two of these students collected their data in a university lab, one as part of an internship. The question did not ask about other options for after high school, such as joining the military.

DISCUSSION OF FINDINGS

The characteristics described in the previous section and the related descriptive statistics allow us to compare the two cohorts of Advocates and their students. In most areas, the two cohorts were similar. The differences were taken into account in the analyses that yielded the following findings. These findings focus on the impact of the program on Advocates and their students, as summarized in Table 3.

Table 3. Program impacts for Advocates and Students by Impact Category

Impact Category[3]	Advocates	Students
Awareness & Understanding	Range & requirements of competitions; competition benefits; recognition by peers; Society as a resource	STEM content & opportunities; scientific research process; competition benefits
Engagement & Interest	Motivation to recruit underserved students to enter competitions	STEM education & careers; entering competitions
Attitudes	Comfort with competition applications; camaraderie with other research teachers; passion for getting students involved; confidence in guiding students	STEM enjoyment; self-esteem; perceived value of research & competitions
Skills	Ability to support students with research and competitions	Writing; presentation; organization
Behavior	Advocates support underserved students who would not otherwise enter competitions	Underserved students (who would not otherwise have done so) participate in competitions

Advocate Findings

In this section of findings, we explore changes in the Advocates' awareness, interest, attitude, and ability (skills), along with their opinions on the benefits and impact of the program. The findings are based on responses from the 33 Advocates in 2018 and 45 Advocates in 2019 that completed the survey.

On the survey, Advocates were asked to rate 22 statements regarding their awareness, interest, attitude, and ability to support students *Before* and *After* their participation in the Advocate Grant Program using a scale of 1 to 10, with ten as the highest level. *Gain* scores were then calculated by subtracting *Before* from *After* scores. The mean total *Gain* score was 76.35 in 2018 and 80.06 in 2019. The difference in these totals was not significant.

Figure 16 compares the *Gain* score means for each statement between the two cohorts. None of the differences between items were significant. This probably reflects a consistent response to a mature and stable program. (See Appendix C for *Before*, *After*, and *Gain* score means and standard deviations for each cohort.)

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[3] Impact categories come from *Framework for Evaluating Impacts of Informal Science Education Projects* (2008) edited by A. Friedman and retrieved from http://www.informalscience.org/framework-evaluating-impacts-informal-science-education-projects.

Gain Scores of Advocates in 2018 and 2019

	2019	2018
Awareness of the Society as resource for teachers	5.83	5.85
Feeling of camaraderie in student research community	4.62	4.21
Peers recognize expertise in supporting students to enter competitions	4.44	3.70
Awareness of deadlines for competitions	4.17	4.42
Awareness of how to support students in filling out entry forms	4.11	4.09
Awareness of range of competitions available	4.07	4.18
Comfort with competition application process	4.02	3.94
Awareness of competition eligibility requirements	3.91	4.36
Peers recognize expertise in supporting student projects	3.84	3.47
Ability to support students in entering competitions	3.73	3.50
Motivation to recruit underserved students to enter competitions	3.73	2.82
Confidence in guiding students through competitions	3.47	3.85
Awareness of competitions as source of monetary awards	3.45	3.88
Passion for getting students involved in competitions	3.38	3.48
Motivation to recruit underserved students to participate in projects	3.36	3.50
Ability to support students in preparing competitive entries	3.22	3.39
Awareness of role of competitions in boosting college acceptance	3.13	2.36
Ability to support students in organizing presentations	2.87	2.12
Ability to support students in organizing their research	2.84	2.30
Ability to support students in conducting projects	2.71	2.71
Ability to support students in developing or improving time management skills	2.64	1.91
Ability to support students in developing or improving organizational skills	2.49	2.30

Figure 16. Means of Gain scores by cohort

Figure 17 on the following page shows the *Before*, *After*, and *Gain* scores of the 2018 cohort. Figure 18 on page 18 shows the *Before*, *After*, and *Gain* scores of the 2019 cohort. The statements are not in the same order for the two figures; instead, impact items are sorted from highest to lowest by Gain score in each figure. This allows you to see areas of greatest impact for each cohort. (In 2018, Figure 17, *N* = 33 for all *Before*, *Gain*, and *After* scores, and in 2019, Figure 18, *N* = 45.)

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	Before	Gain	After
Awareness of the Society as a resource for teachers	3.39	[5.85]	9.24
Awareness of deadlines for competitions	4.06	[4.42]	8.48
Awareness of competition eligibility requirements	3.91	[4.36]	8.27
Feeling of camaraderie in student research community	3.73	[4.21]	7.94
Awareness of range of competitions available	4.88	[4.18]	9.06
Awareness of how to support students in filling out entry forms	4.42	[4.09]	8.52
Comfort with competition application process	3.91	[3.94]	7.85
Awareness of competitions as source of monetary awards	5.06	[3.88]	8.94
Confidence in guiding students through competitions	4.55	[3.85]	8.39
Peers recognize expertise in supporting students to enter competitions	4.94	[3.70]	8.63
Motivation to recruit underserved students to enter competitions	5.91	[3.50]	9.41
Ability to support students in entering competitions	4.85	[3.50]	8.34
Passion for getting students involved in competitions	5.58	[3.48]	9.06
Peers recognize expertise in supporting student projects	5.44	[3.47]	8.91
Ability to support students in preparing competitive entries	4.94	[3.39]	8.33
Motivation to recruit underserved students to participate in projects	6.70	[2.8]	9.52
Ability to support students in conducting projects	5.79	[2.7]	8.50
Awareness of role of comp in boosting college acceptance	6.30	[2]	8.67
Ability to support students in developing or improving organizational skills	6.18	[2]	8.48
Ability to support students in organizing their research	5.70	[2]	8.00
Ability to support students in organizing presentations	6.06	[2]	8.18
Ability to support students in developing or improving time management skills	6.00	[2]	7.91

Mean rating on scale of 1 (lowest) to 10 (highest)

Figure 17. Means of *Before, Gain, and After* scores for the 2018 cohort[4]

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[4] There are a few minor differences in the means reported in this report and the report submitted in 2018. These are the result of how missing data for individuals were handled in the two analyses. In both reports, means of the set of scores (*Before*, *After*) were used to replace missing data on individual variables so that the case did not need to be dropped from the analysis. However, means were replaced with different decimal levels in the two analyses. This resulted in ranking differences between the 2018 report and this 2019 report in four statements. These differences are minor and do not substantially affect significance tests or interpretation of the data.

Several of the *Before* means in Figure 17 above start with lower ratings than the *Before* means in Figure 18 below, though the results are otherwise very similar.

	Before	Gain	After
Awareness of the Society as a resource for teachers	3.67	[5.83]	9.50
Feeling of camaraderie in student research community	4.29	[4.62]	8.91
Peers recognize expertise in supporting students to enter competitions	4.67	[4.44]	9.11
Awareness of deadlines for competitions	4.46	[4.17]	8.63
Awareness of how to support students in filling out entry forms	4.98	[4.11]	9.09
Awareness of range of competitions available	4.64	[4.07]	8.71
Comfort with competition application process	4.56	[4.02]	8.58
Awareness of competition eligibility requirements	4.78	[3.91]	8.69
Peers recognize expertise in supporting student projects	5.38	[3.84]	9.22
Ability to support students in entering competitions	5.13	[3.73]	8.87
Motivation to recruit underserved students to participate in projects	5.69	[3.73]	9.42
Confidence in guiding students through competitions	5.36	[3.47]	8.82
Awareness of competitions as source of monetary awards	5.45	[3.45]	8.91
Passion for getting students involved in competitions	6.16	[3.38]	9.53
Motivation to recruit underserved students to enter competitions	6.27	[3.36]	9.62
Ability to support students in preparing competitive entries	5.58	[3.2]	8.80
Awareness of role of comp in boosting college acceptance	5.76	[3.1]	8.89
Ability to support students in organizing presentations	6.02	[2.9]	8.89
Ability to support students in organizing their research	5.84	[2.8]	8.69
Ability to support students in conducting projects	6.24	[2.7]	8.96
Ability to support students in developing or improving time management skills	5.84	[2.6]	8.49
Ability to support students in developing or improving organizational skills	6.07	[2.5]	8.56

0.00   5.00   10.00

Mean rating on scale of 1 (lowest) to 10 (highest)

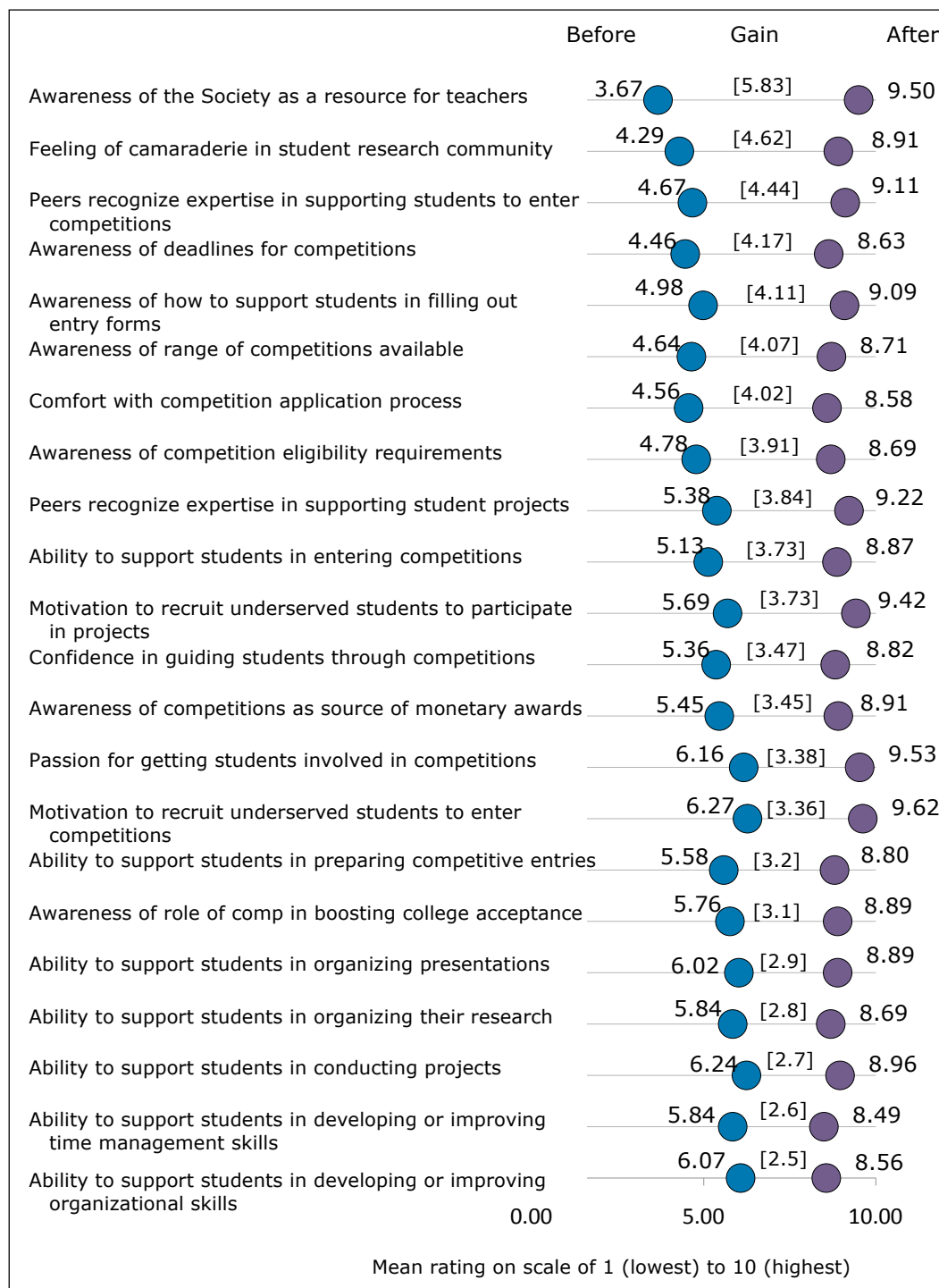*Figure 18.* Means of *Before, Gain, and After* scores for the 2019 cohort

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Advocates gained awareness of the Society as a resource for teachers

The greatest gains (5.85 in 2018 and 5.83 in 2019) were in Advocates' awareness of the Society as a resource for teachers, the top statement in Figures 16, 17, and 18. Advocates in both cohorts rated this with the lowest *Before* mean and an *After* mean above nine, indicating that the program continued to take Advocates with little knowledge of the Society or its resources and brought them up to a very high level of awareness.

> Society staff helped me by providing me with resources that I could pass along to my cohort.
> – Advocate 2002

Advocates gained awareness of competition deadlines, requirements, and range of competitions

Several areas of awareness showed large mean gains in both cohorts. Advocates responding to the survey questions reported gains in awareness of competition deadlines, eligibility requirements, the range of competitions, and the ability to support students in filling out competition entries as seen in Figures 16, 17, and 18. This indicates that the Advocate Grant Program was particularly successful in helping Advocates maneuver the process of competition entry, an important desired outcome of the program.

> The conference calls were an eye opener for me into various grants and competitions which I would not have known otherwise.
> – Advocate 2047

Advocates developed a sense of camaraderie with others in the student research and competition community

Survey results indicate that Advocates developed a "Feeling of camaraderie with others in the student research and competition community." However, both cohorts started the program with a low mean score (second only to awareness of the Society as a resource to teachers) and ended with a low *After* mean score. This indicates that there continues to be room for the program to increase Advocates' sense of community.

> The support was wonderful and the calls were necessary to keep focus and in contact. The reminders were needed and help from others much appreciated!
> – Advocate 2012

Motivation to support underserved students remained high

"Motivation to recruit underserved students to participate in projects" had the highest *After* mean score for both cohorts (9.41 in 2018, 9.62 in 2019), indicating that the program resulted in Advocates with a high motivation to support underserved students in STEM research and design. The *Before* means were also the highest among the items (5.91 in 2018, 6.27 in 2019). This leaves less room for gains overall. (*Gains* were 3.50 and 3.36 respectively.)

"Motivation to recruit underserved students to enter competitions" also resulted in a relatively high *Before* mean (6.70 in 2018, 5.69 in 2019) and a high *After* mean (9.52 in 2018, 9.42 in 2019) with a *Gains* of 2.82 and 3.73, respectively. All gain scores on this item for individual Advocates in both cohorts were zero (no change) or positive, indicating that the program continues to increase that motivation.

> I support all students in entering competitions, but by spending the extra time with my underserved youth, I felt I was able to give them each that personal one-on-one time to help them develop ideas. That just isn't possible in the regular school day.
> – Advocate 2032

Together, the results of these two items indicate that the Society is attracting Advocates who are motivated to work with underserved students on research and design projects and to move them toward competitions, a central desired outcome of the program.

Advocates' abilities to support students showed moderate gains

Advocate respondents rated a number of abilities to support students as very high *Before* their participation in the program (support with conducting projects, organizational skills, presentations, time management, and organizing the research). Advocate respondents reported moderate gains on these items even though there was somewhat less room for growth in these areas. This may reflect the recruitment of experienced research teachers. New Advocates without this experience may need to be identified early and provided some additional support in helping students carry out research projects.

Total *Gain* scores were very similar between the two cohorts of Advocates

The difference in the total *Gain* scores between the two years was not significant. The mean for 2018 was 76.35 points, and the mean for 2019 was 80.06 points. This reflects a mature and stable program with few changes that affected these impacts overall.

Advocates identified program benefits to themselves, their students, and their schools

When asked for the biggest benefits to Advocates from participating in the program, Advocates could select up to three options. The option selected by the largest percentage of respondents in both cohorts was that the program provided additional resources to their students (48.48% in 2018 and 57.78% in 2019). The option selected by the smallest percentage of Advocates in both cohorts was that it provided recognition, as seen in Figure 19. This suggests that Advocates focused more on the benefits to their students than on personal benefit.

Providing credibility was more important for 2018 Advocates, and support from Society staff was more important for 2019 Advocates. The difference between the 2018 and 2019 cohorts for credibility were significant ($p < .05$).
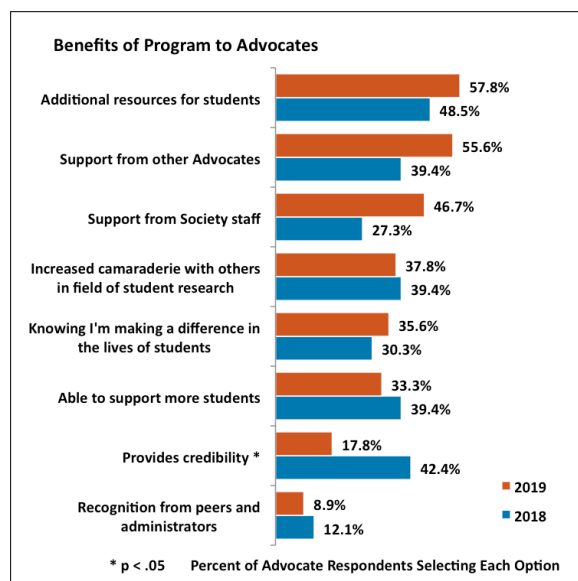

Figure 19. Benefits of AGP as reported by Advocate respondents

When asked to select up to three program impacts on their school or organization, Advocate cohorts were consistent across years as seen in Figure 20, with the exception of "Increased awareness of opportunities for students," the highest-rated item for both groups. In 2018, 48.48% of Advocates selected this item, but in 2019 75.56% percent selected "Increased awareness of opportunities for students." This difference is significance at $p < .05$. The larger percentage of Advocates selecting this item in 2019 probably reflects changes in information flowing to Advocates from Society staff and Lead Advocates.

It should be noted that all Advocates in both cohorts listed at least one impact on their school or organization.

Impact on Advocates' Schools and Organizations

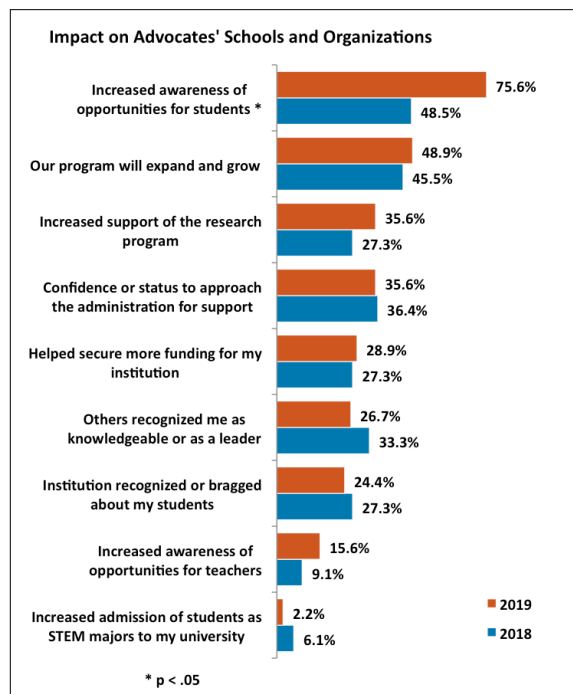|	2019	2018
Increased awareness of opportunities for students *	75.6%	48.5%
Our program will expand and grow	48.9%	45.5%
Increased support of the research program	35.6%	27.3%
Confidence or status to approach the administration for support	35.6%	36.4%
Helped secure more funding for my institution	28.9%	27.3%
Others recognized me as knowledgeable or as a leader	26.7%	33.3%
Institution recognized or bragged about my students	24.4%	27.3%
Increased awareness of opportunities for teachers	15.6%	9.1%
Increased admission of students as STEM majors to my university	2.2%	6.1%

* p < .05

Figure 20. Impacts on schools and organizations as reported by Advocate respondents

2018-2019 Advocates set and worked toward goals

The 2018-2019 cohort of Advocates set individual goals at their initial meeting in Washington, DC. On the 2019 survey, we asked about goal attainment. Most Advocates reported attaining all or some of their goals, as seen in Figure 21. Only two survey respondents reported that they made progress and none said they were unable to achieve their goals. We have no way of knowing about the progress of the five Advocates who did not respond to the survey.

Goal Attainment of Advocate Respondents

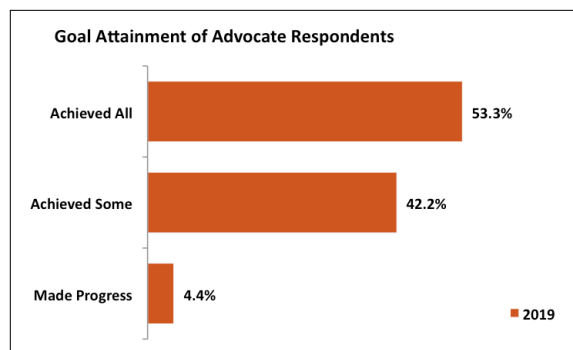|	2019
Achieved All	53.3%
Achieved Some	42.2%
Made Progress	4.4%

Figure 21. Goal attainment of 2019 Advocate respondents

On the 2019 survey, Advocates responded to the question: How did the Lead Advocates or Society staff help you achieve your goals, if at all? Responses to this open-ended question were grouped into the following categories, with the number of responses in each category indicated in parentheses and examples given in the words of Advocates. Only those repeated by more than one Advocate are included here.

- Assistance and advice (16 Advocates): "The lead advocate and Society staff helped give me advice along the way to overcome obstacles" (Advocate 2008)
- Resources (9): "Society staff helped me find resources as needed to help my students be successful with their goals" (Advocate 2031)
- Calls and Meetings (8): "The monthly calls provide a check-in/check-up opportunity. … This helped me achieve my goals" (Advocate 2004)

- Motivation (6): "Helped me to stay on track … and keep me motivated" (Advocate 2001)
- Accountability (5): "Having our call-in meetings not only held me accountable in my goals, but also let me know the strengths and struggles of others who have the same passion trying to achieve the same task" (Advocate 2011)
- Opportunities for questions (5): "The Society staff was always available for questions" (Advocate 2046)
- Meeting deadlines (2): "They send out reminders about deadlines and events" (Advocate 2026)

The wide variety of responses reflects the variety of Advocates and their goals. Advocates seem to have found the help they needed to achieve some or all of their goals.

Advocates were also asked, "What additional support did you need to achieve your goals?" Categories of responses by more than one Advocate are as follows.

- Local support (9): "More support from administration and funding!" (Advocate 2001); "I needed local support" (Advocate 2015)
- More time (4): "Time - there never seems to be enough of it" (Advocate 2013)
- Information (2): "I hope to apply for other competitions in the future, but need more information" (Advocate 2012)
- Networking (2): "work with teachers in similar situations" (Advocate 2037)

In addition, five Advocates listed their own strategies, such as recruiting more teachers "to share the commitments and responsibilities" (Advocate 2008).

Most of the responses to the question asking about additional support showed that Advocates were thinking about what they needed to achieve their goals and who could help. While the Society can't add more hours to the day or provide local support, staff may have opportunities to help with information and networking.

Advocates found program elements helpful

Beginning with the 2019 survey, Advocates were asked to rate the helpfulness of various program elements on a scale of one to ten (10 as most helpful). Given the standard error of these means (shown in Appendix C), means with a difference larger than 0.5 can be considered as significantly different. As seen in Figure 22, the Advocates Training Institute in June in Washington, DC to kick off the program was the most helpful. Edmodo was least helpful. The survey question also asked Advocates to rate the Teacher Research Conference, and all who attended rated it a ten.

Helpfulness of Program Elements

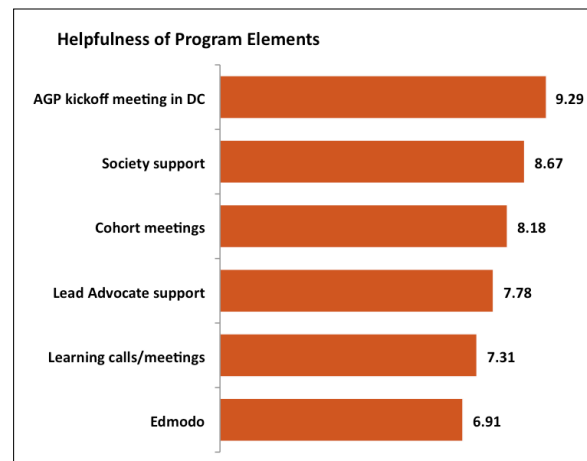| Program Element	Rating
AGP kickoff meeting in DC	9.29
Society support	8.67
Cohort meetings	8.18
Lead Advocate support	7.78
Learning calls/meetings	7.31
Edmodo	6.91

Figure 22. Helpfulness of program elements as rated by 2019 Advocate respondents

Most Advocates directly received stipends and used them to directly support students

Advocates were asked how they received the $3000 stipend and how they used it. Most received the stipend themselves (87.88% of the 2018 respondents and 88.89% in 2019). Figure 23 shows how Advocates spent their stipends (Advocates could select all that applied). The focus was clearly on the students. A small percentage of Advocate respondents reported using the stipends only on themselves (6 Advocates in 2018 and 7 in 2019). (Other uses are listed in Appendix C.)

There was a significant difference between the Advocate responses by cohort on three items. In 2018, 36.36% of the respondents reported that they used their stipend for supplies for student projects compared to 62.22% in 2019. In 2018, 24.24% reported using their stipend for rewards or awards for students compared to 46.47% in 2019. Finally, in 2018, 9.09% of Advocates responded that they used their stipend for student transportation to colleges, labs, and etc. compared to 28.89% in 2019. These responses indicate that the Advocates increased the types of student support by using their stipend.
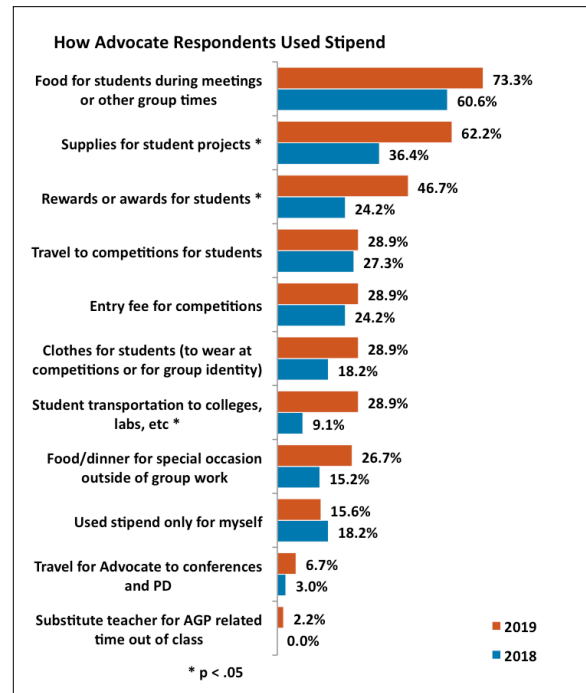

Figure 23. Stipend use by Advocate respondents

Beginning with the 2019 survey, Advocates were asked if the stipend was enough, and 93.33% said it was. Of the remaining Advocates, one said no without explanation. Two Advocates, without saying yes or no, qualified their responses, as did one Advocate who said yes. The following responses are in their own words.

> *I don't know that there will ever be enough funds because I will continue to grow my program. More students mean the need for more finances. I am very thankful for the stipend this year. It has been a tremendous help.* – Advocate 2032

> *I would say yes because it helped tremendously, but being rural, I still had to budget so much of it and pay out of pocket to get kids to locations and project materials, let alone transportation cost the district could not help to afford to pay.*
> – Advocate 2001

> *… but only because of the travel costs for them to go and present in other counties and activate other youth and student organizations* – Advocate 2003

Most Advocates plan to continue to support underserved youth in entering competitions

Advocates were asked if they planned to continue to support underserved youth in entering competitions next year after the Advocate Grant Program, and why or why not. Responses were very positive with 87.88% in 2018 and 93.33% in 2019 saying they would continue.

The most often cited reason for continuing was related to the impact on students, with many Advocates adding how rewarding it is to the Advocate to see their students grow. Impacts of research and competitions on students as stated by both cohorts of Advocates include the following, which are consistent with the benefits in the next section of this report though in the words of the Advocates.

> I have witnessed first hand how the competitions help my students grow as individuals. This is enough motivation to keep engaging, mentoring, and pushing students to enter competitions.
> – Advocate 2008

- Gives students an opportunity to describe their thinking and an audience
- It gives students "a spurt in confidence and motivation"
- Students experience success "at things they never saw themselves capable of doing"
- Supports students who have a desire to reach higher goals in STEM-related fields
- Students develop academic and soft skills that will "benefit them in their future endeavors, no matter what they are"
- Competitions help students grow as individuals
- Students "blossom into researchers that are confident in their knowledge and abilities"
- The experience is rewarding for the students

Overall, reasons Advocates in both cohorts gave for continuing their support of students included the following categories, with some Advocate respondents giving more than one reason and some leaving the question blank.

- They see the positive impact on the students (18 Advocates)
- They recognize the need for the work (12 Advocates)
- They now have the resources, skills, knowledge, and system in place to support their students (7 Advocates)
- They have a passion for the work (7 Advocates)
- They are now excited, energized, and re-energized to do the work (5 Advocates)
- This is now a goal of theirs (3 Advocates)
- They see the importance of working with underserved students to work toward equity (2 Advocates)

Of the six Advocates not planning to continue to support students in research and competitions after the program, four mentioned job changes or relocation (as did two who plan to continue the support). One Advocate wouldn't be able to devote class time without AGP support. Another wouldn't have the financial resources or time to support the students, though would have them conduct the research even if the Advocate couldn't support them through the competitions. In 2018, one Advocate did not respond to this question.

> I will continue to work with students on research projects, but without the support of the Advocate program, I don't think it would be possible for me to work with the students through the science fair. I used the resources from this program to help with transportation costs, meals, and fair supplies. That would all be out of pocket for me otherwise. – Advocate 2021

After explaining why or why not Advocates plan to continue after the program, Advocates who planned to continue were asked how the Society could best support them (they could check all that applied). Figure 24 provides the percentage of these Advocates from each cohort selecting each item (*N* = 29 in 2018 and *N* = 42 in 2019). Helping Advocates find funding for equipment and providing opportunities for meeting like-minded teachers in their area were selected by over half of the Advocates in each year.
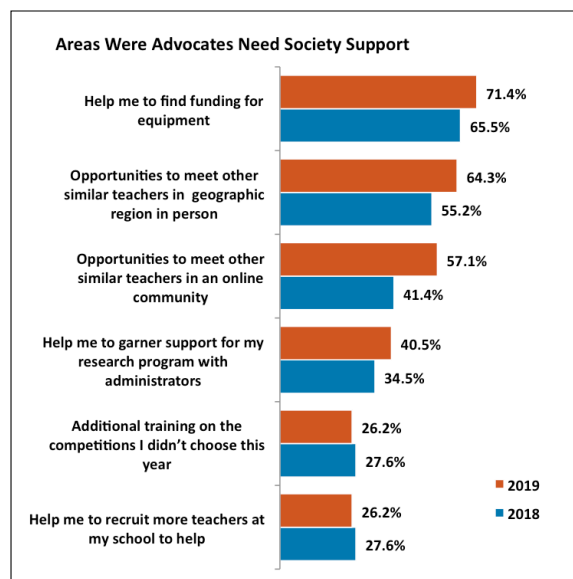

Areas Were Advocates Need Society Support

	2019	2018
Help me to find funding for equipment	71.4%	65.5%
Opportunities to meet other similar teachers in geographic region in person	64.3%	55.2%
Opportunities to meet other similar teachers in an online community	57.1%	41.4%
Help me to garner support for my research program with administrators	40.5%	34.5%
Additional training on the competitions I didn't choose this year	26.2%	27.6%
Help me to recruit more teachers at my school to help	26.2%	27.6%

Figure 24. How the Society could support Advocate respondents in the future by cohort

Advocates provided additional insights and recommended program improvements

Advocates provided additional insights on the program in open-ended survey questions. These go beyond the impacts described above and include ideas for program improvement. Most comments from the 2018-2019 cohort are grouped and listed below. Those not listed were comments on the information presented above or were explanations of answers incorporated into this report. Responses from the 2017-2018 cohort were included in the 2018 report; many 2017-2018 Advocates' recommendations were addressed by staff prior to the 2018-2019 program, and are not repeated here.

Advocates expressed gratitude

> *Love the advocacy program! THANK YOU!* – Advocate 2001

> *Thank you for all of the amazing resources and opportunities provided through these programs!* – Advocate 2003

> *I really cannot adequately express my gratitude to the Society and its wonderful staff!* – Advocate 2004

> *Thanks for allowing me to be a part of this program!* – Advocate 2023

> *Thank you for all of the information provided and the new opportunities I learned about for my students.* – Advocate 2048

> *This program has meant the world to me! It was so wonderful being motivated to help my students. For the first time in a long time, I feel like I made a real difference. Our school has a big gap in achievement between the minority kids and the non-minority kids. I feel like I helped close the gap a bit, but I want to do more!*
> – Advocate 2040

Advocates commented on working with underserved students

> *My students come from a diverse background- many with limited English language skills. I am most proud of the eight EL students that participated in the … Regional Science Fair.*   – Advocate 2038

> *Focusing extra time on the underserved students helps insure success.*
>   – Advocate 2048

> *My students who come from underserved backgrounds have made the biggest leaps and bounds in learning about themselves and their ability to do/explore science (and for some, realizing it isn't a pathway they actually want to do). One of the biggest heartbreaks for us is that we feel like if we were coming out of a different aligned fair, maybe one that is less prestigious, we'd probably have at least one or two each year who would qualify. Being a part of the Advocates grant program has reassured me that it's OK for us to feel that way... that it's OK to keep pushing students and helping them explore, and feeling validated that we are doing the right thing despite the obstacles that we face.*   – Advocate 2031

> *The majority of the students I teach are black students from low socioeconomic households, and when we attend competitions, it can be very disheartening to see that there aren't a lot of other students like them. AGP has helped my confidence and helped me boost my students' confidence in "going up against" the Governor's School types of students. The process and the experience is more rewarding than worrying about whether they will place and be able to go on to national competitions.*
>   – Advocate 2049

Advocates recommended program improvements

Thirty-eight Advocates in the 2018-2019 cohort responded to a survey question asking for ideas to improve the program. Six simply complimented the program and said to keep doing what you are doing.

Specific program improvements include the following items by category. Since only one Advocate suggested each, it is difficult to know how many others would agree with the suggestion.

Communication:
- Create a social media site for Advocate communication, feedback, and sharing of successes
- Provide a flyer with timely tips
- Distribute written questions and answers from the calls
- Explicitly discuss "the issue of race within science education"
- Place recordings of learning calls in one place on the website or Edmodo so they are easier to find

Resources:
- Create a database or spreadsheet of all competitions per state
- Include school visits by SSP or *Science News* staff
- Provide examples of completed paperwork for high-quality projects as references, particularly "research plans and abstracts for engineer or invention types of projects"

- Provide specific feedback for grant applications that aren't accepted by SSP so Advocates can improve applications for the future
- Provide access to *Science News* as early as possible in the school year

Stipends:
- Provide a "more concrete method of distributing checks" (suggested by a Lead Advocate)
- Provide a timetable for disbursement of stipends
- Provide part of the stipend at the beginning of the school year to allow Advocates to have funds to begin the research activities

Cohorts:
- Create a more systematic grouping of Advocates by experience

Lead Advocates:
- Hold periodic Lead Advocate online meetings
- Provide Lead Advocates with outlines of possible topics to cover at each online meeting "to ensure that they feel more purposeful"

Working with Researchers and Professors:
- Create a network of industry professionals and professors interested in helping students (using the reputation of SSP to support Advocates in networking with them)

Students:
- Add "Student Advocates" – older students who have been to ISEF that are trained as advocates for younger students

In addition to these specific suggestions, Advocates addressed several issues and areas of concern, often without suggestions for improvement.

Five Advocates commented on online communication. Four of those addressed Edmodo specifically with one wanting a "better format than Edmodo," one simply "not a huge fan of Edmodo," another saying she liked "the Edmodo idea, but didn't use it after the initial meeting," and the fourth saying she thought "Edmodo could be more focused as far as what you'd like teachers to post and share." One other Advocate addressed online communication in more general terms, suggesting the creation of "a social media site (Facebook, Instagram, Twitter) to have immediate communication and feedback. Also instant sharing of successes and challenges" (Advocate 2039).

Several Advocates addressed communication and collaboration. Four wanted more: more than "just an irregular phone call;" more face-to-face meetings of all Advocates; more frequent cohort meetings "so we can see what people outside of the groups are working on and can get more resources outside of Edmodo;" more learning sessions at the conference; and more Advocates allowed to attend the Research Teacher Conference. One Advocate (who will be a Lead Advocate next year) wanted more structure to the cohort calls, something echoed by others. Another Advocate expressed gratitude for the recordings of the calls, though sometimes had difficulty finding them. One simply said, "LOVED my cohort calls and leader."

Five Advocates mentioned funding. One stated more funding would be helpful. The others provided suggestions incorporated in the bulleted list above.

Two Lead Advocates addressed accountability. One wanted more accountability for herself and her cohort to attend online meetings, which would be "helpful in creating cohesion and consistency." The other wanted more accountability for Advocates to join the check-in calls.

Two Advocates wanted the Society to continue to provide access to resources for Advocates and to provide even more.

One Advocate mentioned sorting her cohort, which seemed to be a reference to her students (those in the Advocate Grant Program) and her desire to give the evaluation survey to all of her students without singling out those not eligible for the program (i.e., not minority or low-income):

> *The only glitch I ever hit was sorting my cohort. I never tell the kids that not everyone is in the cohort. For example, distributing the survey to only a "select" group is a little tricky. I do not want to disclose who is actually classified as undeserved. Not sure how to overcome this glitch.* – Advocate 2046

Student Findings

To explore program impact, we asked students where and when they turned for help with their projects and the competitions. We asked students to rate their awareness, skills, knowledge, interest, and confidence *Before* and *After* working on their project and looked at gains in the scores.

Advocates provided students with help in many aspects of their projects

Students were asked who helped or guided them in completing their projects and could select all that applied (thus, totals do not equal N and percents do not total to 100). For both cohorts, students largely turned to their Advocate (63.27% in 2018 and 70.18% in 2019). Many students also turned to other teachers, and in 2019 almost a third (31.58%) turned to family members, which may be in part due to the larger percentage of middle school students in 2019.
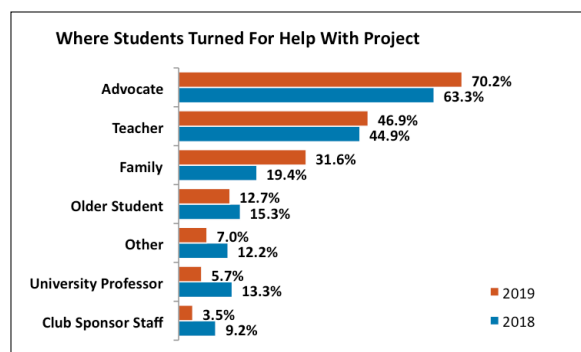
Where Students Turned For Help With Project

	2019	2018
Advocate	70.2%	63.3%
Teacher	46.9%	44.9%
Family	31.6%	19.4%
Older Student	12.7%	15.3%
Other	7.0%	12.2%
University Professor	5.7%	13.3%
Club Sponsor Staff	3.5%	9.2%

Figure 25. Where student respondents' turned for help with projects

Students were given a list of aspects involved in completing a project and entering a competition. They were asked who helped them the most with each. They could identify their Advocate, another teacher, club sponsor staff member, university professor, older student, family member, no one, or other. For each aspect, Advocates were listed the most often, with the percentage of students selecting Advocates by each cohort in Figure 26. Additional details are in Appendix C.

The difference between the two cohorts' responses was significant ($p < .05$) for help with references, finding experts, deadlines, and filling out competition applications. This may be due to the different grade levels represented by each cohort and the nature of conducting projects in middle versus high school. While significantly different, the size of the difference is not large.
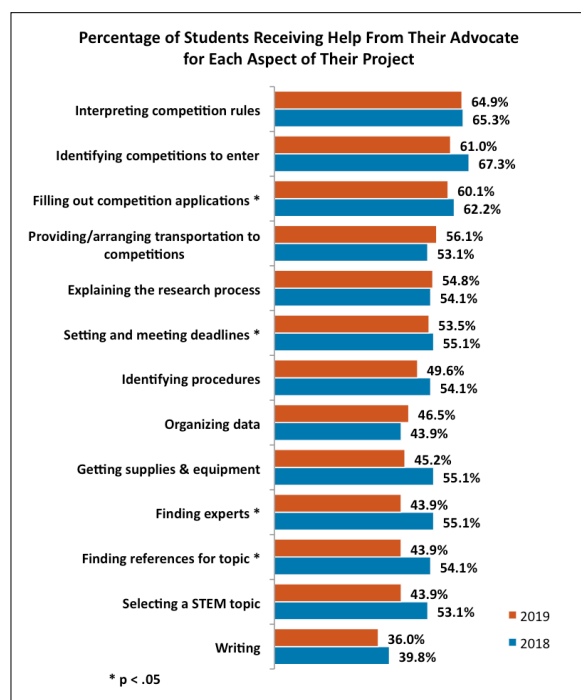
Percentage of Students Receiving Help From Their Advocate for Each Aspect of Their Project

	2019	2018
Interpreting competition rules	64.9%	65.3%
Identifying competitions to enter	61.0%	67.3%
Filling out competition applications *	60.1%	62.2%
Providing/arranging transportation to competitions	56.1%	53.1%
Explaining the research process	54.8%	54.1%
Setting and meeting deadlines *	53.5%	55.1%
Identifying procedures	49.6%	54.1%
Organizing data	46.5%	43.9%
Getting supplies & equipment	45.2%	55.1%
Finding experts *	43.9%	55.1%
Finding references for topic *	43.9%	54.1%
Selecting a STEM topic	43.9%	53.1%
Writing	36.0%	39.8%

* p < .05

Figure 26. Percentage of student respondents' getting help from Advocates for aspects of projects

For most aspects, students selected "no one" (i.e., they did it themselves) or "other teacher" less frequently than "Advocate" though more than the other options. The exception for this was on help obtaining equipment and supplies where "family" was listed more often than "no one" and more often than "other teacher" in 2019. "Family" was also selected frequently for help with transportation, though less frequently than Advocate, another teacher, and no one. Clearly, the Advocates play a central role in supporting their students with their projects. (See Appendix C for additional details.)

Students gained in awareness, skills, knowledge, interest and confidence

Students were asked on the survey to rate 26 statements regarding their awareness, skills, knowledge, interest, and confidence *Before* and *After* working on their project using a scale of 1 to 10, with ten as the highest level. *Gain* scores were then calculated by subtracting *Before* from *After* scores.

Only 2019 *Gain* scores are included in this section. When analyzing the data, we found that in the 2018 sample (*N* = 98) about a quarter of student respondents left out a *Before* or *After* response, which did not allow for meaningful results. Figure 27 provides the means of the *Gain* scores sorted from highest gain in 2019 to lowest.

Based on the size of the standard error of the mean, we can say that any means that differ by more than 0.20 are significantly different. Thus, it is very clear that the greatest impact of working on their projects was a gain in knowledge about their STEM topic. An increase in awareness that competitions help with college acceptance and give prizes was also a large and significant gain.

Figures on the following page organize these means by category: knowledge, awareness, confidence/interest, and skills. Additional details can be found in Appendix C.
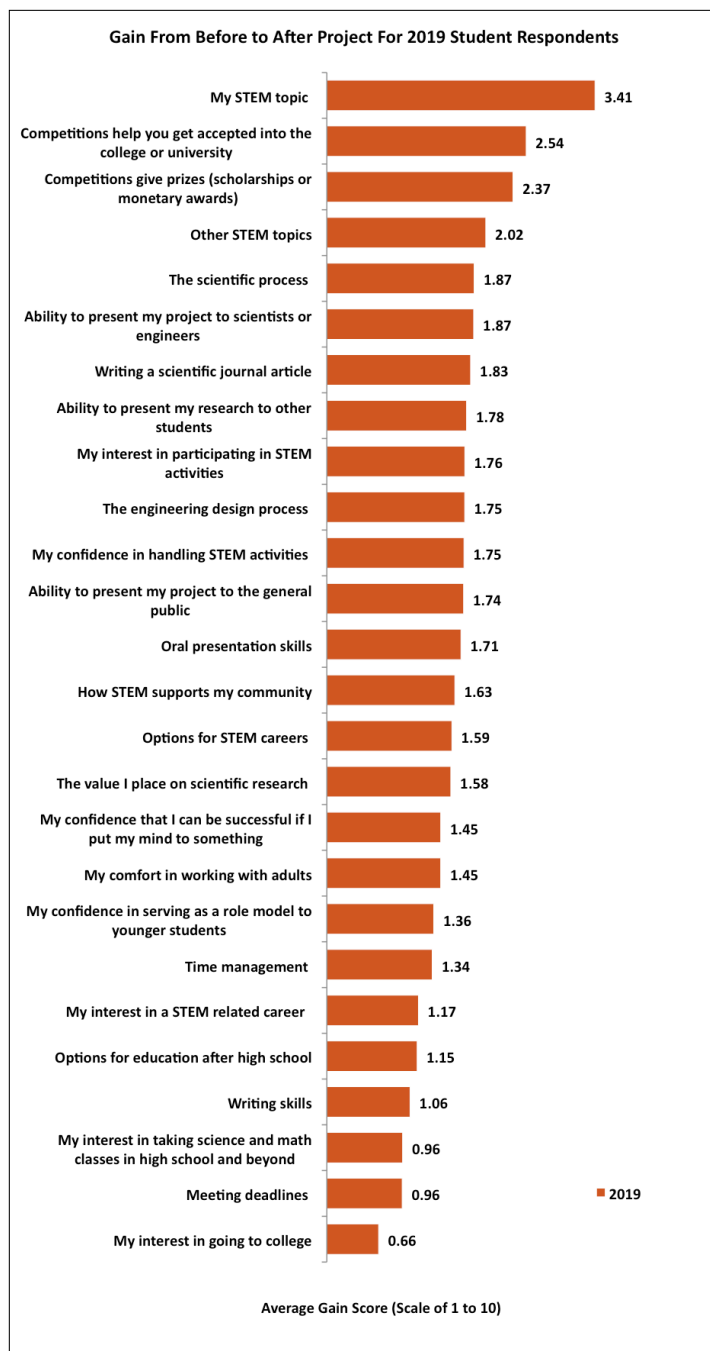
Gain From Before to After Project For 2019 Student Respondents

Statement	Gain
My STEM topic	3.41
Competitions help you get accepted into the college or university	2.54
Competitions give prizes (scholarships or monetary awards)	2.37
Other STEM topics	2.02
The scientific process	1.87
Ability to present my project to scientists or engineers	1.87
Writing a scientific journal article	1.83
Ability to present my research to other students	1.78
My interest in participating in STEM activities	1.76
The engineering design process	1.75
My confidence in handling STEM activities	1.75
Ability to present my project to the general public	1.74
Oral presentation skills	1.71
How STEM supports my community	1.63
Options for STEM careers	1.59
The value I place on scientific research	1.58
My confidence that I can be successful if I put my mind to something	1.45
My comfort in working with adults	1.45
My confidence in serving as a role model to younger students	1.36
Time management	1.34
My interest in a STEM related career	1.17
Options for education after high school	1.15
Writing skills	1.06
My interest in taking science and math classes in high school and beyond	0.96
Meeting deadlines	0.96
My interest in going to college	0.66

Average Gain Score (Scale of 1 to 10)

■ 2019

Figure 27. Means of student *Gain* scores for the 2019 cohort

Gain in Knowledge. Figure 28 shows the high gain in knowledge about "my STEM topic." Students rated their knowledge of their topic and other STEM topics as very low *Before* completing their project (the lowest scores of all 26 statements), which is reflected in the high gain in knowledge for both items. Among the Knowledge category, knowledge about the scientific process had the highest *After* score. Overall, students gained knowledge, particularly about their topic, through their work on their projects.
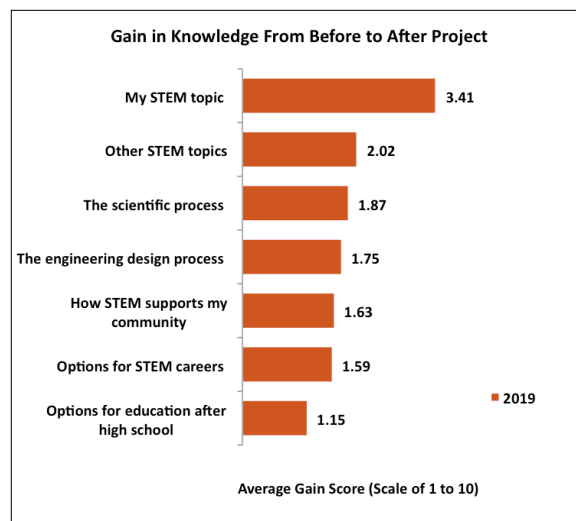
Figure 28. Means of student *Gain* scores in Knowledge

Gain in Confidence and Interest. Figure 29 provides the mean *Gain* scores for gains in confidence and interest. Students in the 2019 cohort had high *Before* scores and thus less room to gain.

For "interest in going to college," students had the largest of all *Before* scores (a mean of 8.36). Even though the mean of *After* scores was also the highest (9.02), there was little room for gain. Students began with a high interest in going to college and ended with slightly more interest.
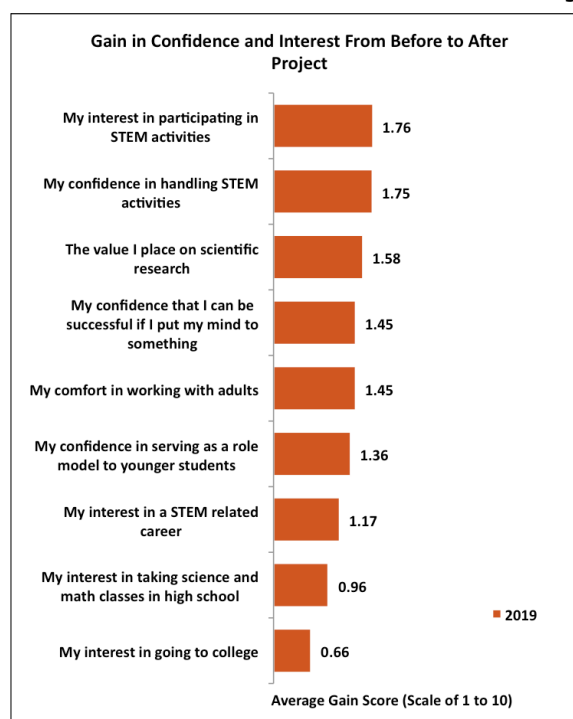
Figure 29. Means of student *Gain* scores in Interest and Confidence

Gain in Awareness. As seen in Figure 30, students reported large gains in awareness that competitions offer prizes and can help with college acceptance. These had *Before* means around five and a half, then had means of about eight for *After* their project work. Thus, students appear to have gone from average awareness to much more aware.
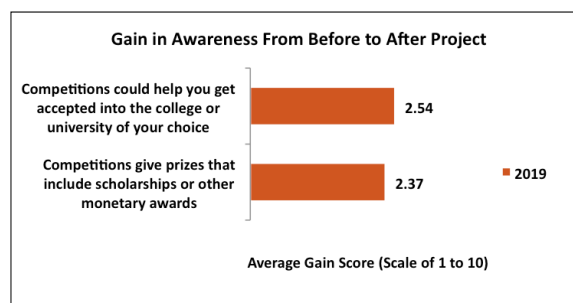
Figure 30. Means of student *Gain* scores in Awareness

Gains in Skills. The lowest gains were found in skills, as seen in Figure 31, particularly in meeting deadlines and writing skills. The means for *Before* and *After* had a wide range, as did the *Gains*. Thus, gains in skills seemed to vary widely among students and depend on their situations.

Gain in Skills From Before to After Project

Skill	Average Gain Score (Scale of 1 to 10)
Ability to present my project to scientists or engineers	1.87
Writing a scientific journal article	1.83
Ability to present my research to other students	1.78
Ability to present my project to the general public	1.74
Oral presentation skills	1.71
Time management	1.34
Writing skills	1.06
Meeting deadlines	0.96

■ 2019

Average Gain Score (Scale of 1 to 10)

Figure 31. Means of student *Gain* scores in Skills

Many Students Were Unlikely to Complete Projects and Enter Competitions without Advocate Support

Students were asked to use a scale of zero to 100 to rate how likely they would have been to complete their project or enter a competition, with zero as very unlikely and 100 as very likely without the Advocate's support. The low averages (30% to 40%), as seen in Figure 32, indicate that many students were unlikely to complete their projects without their Advocate's support and that even more students were unlikely to enter competitions without support. This provides a clear indication of the success of the program in reaching the goal to move students from conducting research and design projects to entering competitions, and suggests that Advocates also move students toward completing projects so they can then enter into the competitions.

Likelihood of Completing Projects and Entering Competitions WIthout Advocate Support

	2019	2018
Likelihood of completing project	40.61	37.19
Likelihood of entering competition	31.00	30.01

■ 2019
■ 2018

Average on a Scale of 0 to 100 - Lower Average is Less Likely
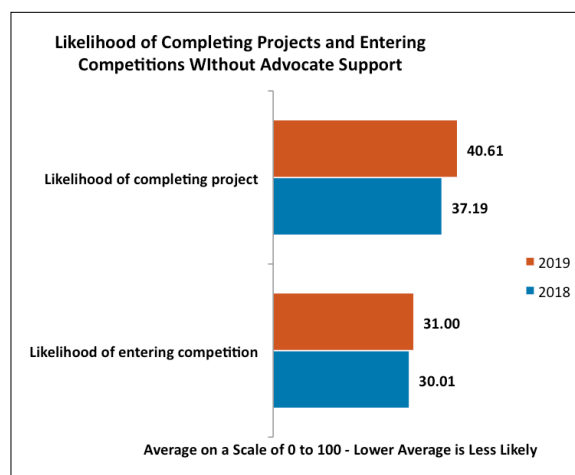
Figure 32. Likelihood of students completing projects and entering them into competitions without Advocate support

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Additional Findings

In this section, we explore and compare the perspectives of Advocates and their students on the benefits of doing the STEM projects and entering competitions.

Advocate and Student Perceptions on Why Students Enter Competitions Are Similar

Students who entered competitions were asked why they entered by rating the importance of each option on a scale of 1 (low) to 10 (high). Ratings show the wide variety of important reasons that students have for entering competitions. There were significant differences between the two cohorts for "Teacher Encouragement" and "Opportunity to Share my work with others" ($p < .001$) as well as "Passion for Science" and "Parent Encouragement" ($p < .05$). The differences may relate to differences in the cohorts, with more middle school students in 2019 where teacher and parent encouragement were rated higher and sharing their work and passion were rated lower.

"The Opportunity to Make Friends" was added on the 2019 survey. It's interesting to note that making friends and peer encouragement were the lowest-rated reasons, followed closely by parent encouragement.
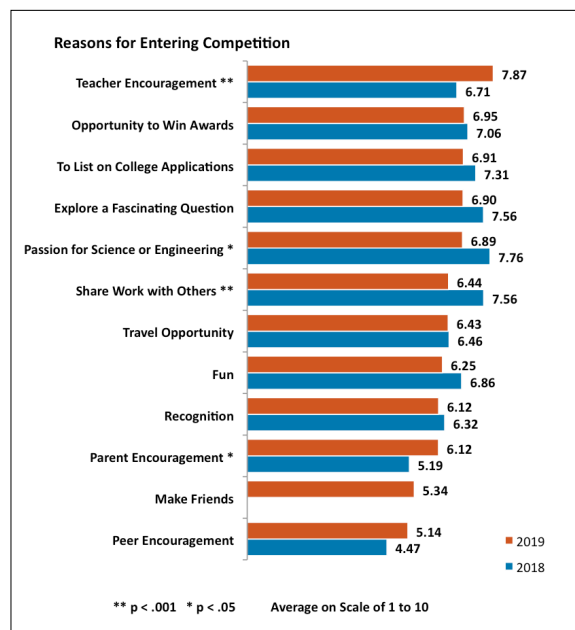
Figure 33. Student respondents' reasons for entering competitions by cohort

Advocates were asked what they thought motivated students to participate in competitions. Advocates could select up to three options from a list of options generated during the evaluation of the 2016-2017 program. This list, as seen in Figure 34, is similar but not identical to the list on the student survey (Figure 33).

High on both the Advocate and student lists were encouragement and the opportunity to win awards and scholarships.

(Two "other" motivations are listed in Appendix C.)
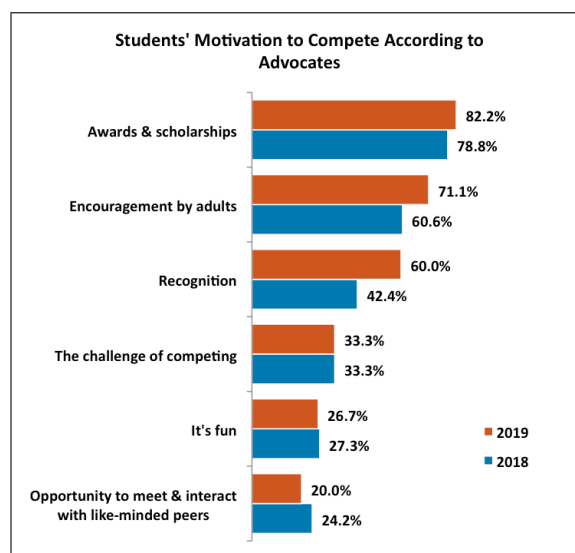
Figure 34. Advocate respondents' perceptions of student motivation to compete

Advocate and Student Perceptions on the Benefits of Research and Competition Vary

Advocates responded to the question, "What do you see as the benefits to students conducting research and design projects?" by selecting up to three items on a list of options, as seen in Figure 35. The two cohorts differed on "learning to think scientifically" and "building confidence," though both cohorts listed these benefits more than the other items. Only the difference on thinking scientifically was significant ($p < .05$) between the two cohorts, and could be related to a wide range of factors. "Understanding STEM concepts" was lowest on the list for both cohorts. It may be that conducting research helps more with the thinking process than understanding the concepts, which may be developed effectively through other avenues such as the classroom curriculum. (See Appendix C for other benefits.)

Benefits of Conducting Research According to Advocates

	2019	2018
Learning to think scientifically *	77.8%	48.5%
Building confidence	51.1%	69.7%
Developing or improving skills	44.4%	45.5%
Experiencing authentic STEM work	40.0%	30.3%
Improving their future (college, career, other options)	35.6%	42.4%
Increased exposure to STEM education & career options	28.9%	27.3%
Understanding STEM concepts	22.2%	15.2%

* p < .05

Figure 35. Advocate respondents' perceptions of the benefits of conducting research and design projects

Advocates and students were asked about the benefits of entering competitions, as seen in Figures 36 and 37.

Benefits of Entering Competitions According to Advocates

	2019	2018
Building confidence	71.1%	84.8%
Experiencing pride in their work	62.2%	45.5%
Improving their future (college, career, other options)	48.9%	33.3%
Receiving recognition for their work	37.8%	45.5%
Sharing ideas with others	31.1%	21.2%
Develop or improve skills	24.4%	33.3%
Making new friends & connections with peers	13.3%	12.1%
Making new friends & connections with adults	6.7%	12.1%

Student Perceptions of Competition Benefits by Students Who Entered

	2019	2018
Learn something new	50.4%	58.2%
Win awards and scholarships	42.1%	31.6%
Develop new skills	38.2%	50.0%
Build self-confidence	25.4%	38.8%
Increase potential to be accepted by the college of my choice	25.4%	20.4%
Gain a new experience	22.4%	29.6%
Share my work with others	11.0%	10.2%
Meet new people	9.2%	10.2%

Figures 36 & 37. Advocate and student perceptions of the benefits of entering competitions

Figures 36 and 37 compare the benefits of entering competitions from the perspectives of Advocates (Figure 36) and Students (Figure 37). On both surveys, respondents could select up to three benefits to students, but they were provided with different options. Building confidence was selected the most often by Advocates, and more often for entering competitions than for conducting projects (Figure 35). Thus, emotional benefits such as

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"Building Confidence" and "Experiencing pride in their work" were selected often by Advocates.

Figure 37 shows the results from only those students who entered competitions (n=85 in 2018, and n=189 in 2019). The most often selected benefit by students was "learn something new", which was not on the list of options for Advocates. However, while over 70% of Advocates selected building confidence as a benefit to students entering competitions, less than 40% of the students themselves selected this. Awards and scholarships along with developing new skills were selected often by students, while skills were selected by a third or fewer Advocates. Both students and Advocates seemed to agree that meeting new people was not a major benefit of entering competitions.

It is not surprising that Advocates and students differed some on perceptions of the benefits of entering competitions. The student respondents' selections may be helpful for Advocates to know as they nudge students toward entering competitions. The perspectives of the Advocates may be helpful for Lead Advocates and Society staff as they work to support Advocates and nudge them toward further engaging their students.

Advocates See Access to Resources and Awareness of Competitions as Program Benefits for Their Students

In addition to exploring the benefits of the Advocate Grant Program to the Advocates, we asked Advocates for their opinion on the benefits of the program to their students. Advocates could select up to three benefits. In 2018, we listed "financial support" as a general category, and 60.61% of Advocate respondents selected it. In 2019, this was clarified as "financial support for student research (supplies, equipment, etc.)" and "financial support for competitions (registration, transportation, etc.)" with 48.89% and 31.11% of Advocates selecting each respectively. None of the options that appeared on both the 2018 and 2019 Advocate surveys were significantly different.
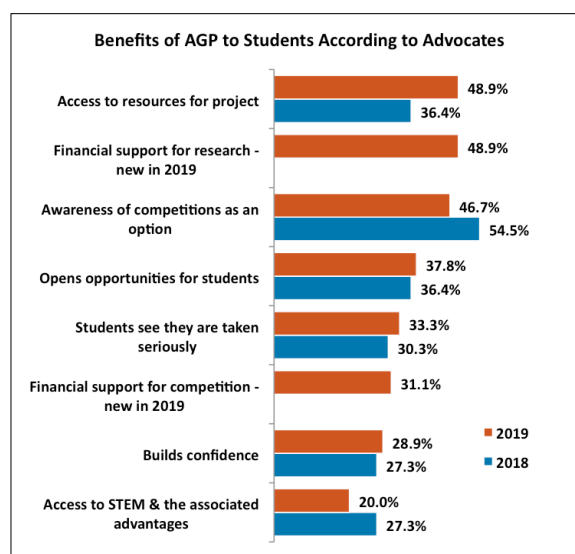
Figure 38 Advocate respondents' perceptions of the benefits of AGP for their students

It appears that resources for the research and design projects are a large program benefit for students, as is increased awareness of competitions as an option.

Differences Among Groups

To explore differences among groups of students and Advocates based on gender identity, ethnicity, grade in school, and setting, we used independent samples t-tests with the *Gain* scores. Due to the issue previously described with missing data from the 2018 student survey on *Before* and *After* scores, we only used scores for 2019 student respondents. To explore differences among groups of Advocates, we used all Advocate respondents in both cohorts.

Two years of data were available for group comparisons using Advocates' *Total Gain* scores. For the age range, we compared ages 44 and younger versus those 45 and over. Due to the small number of Advocates of color, we compared White/Caucasian versus all others. No significant differences were found for either Advocate cohort for age range, ethnicity, or school level (middle vs. high school). Student *Gain* score means did not significantly differ by gender identity or ethnicity. Significant differences for student and Advocate impacts are described below.

Student impacts differed by middle versus high school level

We defined Middle School as grades six, seven, and eight, and High School as grades nine, ten, eleven, and twelve. *Gain* scores on individual items reflect student respondents' perceptions of how much they had gained in specific areas. The mean *Total Gain* for Middle School student respondents was 30.35 compared to 47.08 for High School respondents ($p < .05$). High School students, with additional maturity, may have been better able to assess what they gained from the experience. Another explanation is that High School students gained more from the experience of conducting research and entering competitions, or perhaps they are closer to making decisions about college and career so the projects are relevant to them.
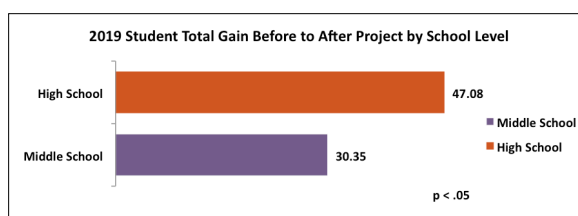
Figure 39. Total gain before and after by school level

To explore this difference further, we compared the means of individual items (see Figure 40). Note that High School respondents rated all items at a higher level than did Middle School students. Significant differences are indicated by asterisks after the item labels. Some of the items that are significantly different focus on decisions about college and careers that are more immediately relevant to High School respondents. Overall, it also appears that Middle School respondents simply did not rate their gains from the program as highly as did High School students.

2019 Student Item Gains Before to After Projects by School Level

Item	High School	Middle School
My STEM topic	3.57	2.88
Competitions could help you get accepted into the college or university	2.69	2.02
Competitions give prizes(scholarships/other monetary awards) *	2.63	1.50
Other STEM topics *	2.22	1.38
Writing a scientific journal article **	2.14	0.81
Ability to present my project to scientists or engineers **	2.13	1.00
The scientific process *	2.05	1.30
Ability to present my research to other students **	2.01	1.00
My confidence in handling STEM activities **	2.00	0.92
The engineering design process *	1.98	1.01
Ability to present my project to the general public *	1.97	1.00
My interest in participating in STEM activities *	1.95	1.10
How STEM supports my community **	1.91	0.70
Oral presentation skills	1.81	1.38
Options for STEM careers *	1.80	0.90
The value I place on scientific research **	1.80	0.86
My comfort in working with adults *	1.71	0.59
My confidence that I can be successful if I put my mind to something *	1.61	0.93
My confidence in serving as a role model to younger students **	1.57	0.67
Time management	1.39	1.17
Options for education after high school *	1.32	0.59
My interest in a STEM related career *	1.31	0.70
Writing skills	1.16	0.74
My interest in taking science and math classes in high school and beyond *	1.09	0.55
Meeting deadlines	1.04	0.70
My interest in going to college	0.76	0.33

* $p < .05$ ** $p < .001$

Figure 40. Student impact item gains before to after participation by school level

Student impacts differed by whether or not students won an award

We also compared *Total Gain* scores for student respondents entering competitions and not entering competitions as well as respondents who did and did not win awards. The mean differences among respondents entering and not entering competitions were not significant. However, the difference in *Total Gain* was significantly different ($p < .05$) among respondents who entered ($n=189$) and who won (*Total Gain* = 49.40) and did not win awards (*Total Gain* = 35.03). We are unable to say if this difference was due to the work students did to produce projects that won awards or the effect of receiving awards inflating some students' perceptions of what they had gained.

Student impact differences based on community setting could not be determined, though impact differences existed for Advocates

Data were unavailable to explore differences in student impact based on their community setting. In designing the evaluation surveys, we knew students would be unreliable sources of data for distinguishing their setting categories of urban, suburban, small town, and rural and did not include a community setting question. We anticipated using the setting of their Advocate. However, with the large numbers of students from a few Advocates (see Figures 7 and 8), we determined that statistical analysis of the difference in student impacts for community setting would not yield reliable results.

We did, however, explore differences in Advocate impact based on the community setting. The size of the subgroups for community setting was too small for comparison in the 2018 cohort. For the 2019 cohort, means comparisons were calculated for community setting categories by comparing each type to the other. The sample sizes were very small for such a comparison (Urban $n = 21$, Rural $n = 12$, Small Town $n = 5$, and Suburban $n = 7$), but some apparent differences are shown in Figure 41 that will be interesting to check as the program moves forward. The *Total Gain* for suburban Advocate respondents was low at 60.17 compared to other community settings with means in the high 70s and mid-80s.

2019 Advocate Total Gain Scores by Community Setting

84.20
84.17
79.89
60.71
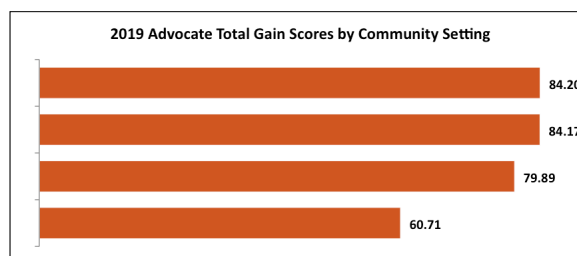
Figure 41. Comparison of Advocate total gain by community type

2019 Advocate impacts differed by gender identity

Comparisons were calculated for Advocate gender identity data. There was no significant difference for 2018 Advocate cohort. For the 2019 Advocate cohort, there was a large and significant difference ($p < .001$) of mean *Total Gain*. Females had a mean *Total Gain* of 91.40 ($n = 32$) and males a mean of 47.73 ($n = 12$). We checked to see if this could be due to different percentages of males in different Organizational or Community Settings, but this was not the case. Since male respondents are a minority among Advocates as a whole, this could be a factor. It would be interesting to explore differences in Advocate impacts by gender identity and other variables as data are collected for future cohorts.

RECOMMENDATIONS AND CONCLUSIONS

The goals of this program evaluation were to capture the results of two years of the Advocate Grant Program (2017-2018 and 2018-2019 cohorts), use the results to answer the evaluation questions on page 4, and offer insight and recommendations to help the Society for Science and the Public make decisions as they continue the program. We start this section by addressing the evaluation questions, then offer recommendations, and end with final thoughts on the program evaluation.

Conclusions – Answering the Evaluation Questions

The Program Accomplished Its Goals in Several Ways

In exploring the question, "To what extent did the program accomplish its goals? (i.e., implementation of program as designed, serving a specific number of youth, recruiting youth from the intended target audiences)," we found that the program accomplished the following outcomes. (References to page numbers within this report are provided.)

- The program reached a large number of students each year (p.3) that included a large percentage from low-income populations (p. 6) and from urban and rural communities that are often under-resourced (p. 6).
- Advocates responding to the survey reported that they served a total of 318 students in 2018 and 531 students in 2019 *who would not have entered competitions without the support of the Advocate*s (p. 9).
- Over 65% of the students responding to the survey were completing a research for the first time, indicating that Advocates were exposing students to new experiences; i.e., science research and engineering design projects (p.13).
- The Society recruited Advocates with experience in working with underserved youth, many of whom had no experience in supporting those students through competitions until they participated in the program (pp. 6-7).
- Advocate *Gain* scores showed that the Society recruited and selected many Advocates with little knowledge of the Society or its resources and brought them up to a high level of awareness (p. 19).
- The program helped Advocates gain an awareness of the range of competitions available for their students, along with the deadlines and requirements of competitions (p. 19). Related to this, Advocates reported that a benefit to students of the program was an increased awareness of competitions as an option (p. 35).
- The Society attracted Advocates who were motivated to work with underserved students on research and design projects and to move them toward competitions (p. 19).
- Most Advocates reported that they would continue the work of supporting underserved students with projects and competitions after the program (pp. 24-25), thus increasing the overall number of adults advocating for and mentoring underserved students in entering competitions.

Support for Advocates Influenced the Intended Impacts

In exploring the extent and ways in which the program experience influenced the intended impacts, we found that the support offered to the Advocates played a major role. Examples include the following.

- The Advocate Training Institute in DC was very helpful to Advocates (p. 22).
- The Society-sponsored Teacher Research Conference was not a part of the program, but the Advocates who were able to attend rated its helpfulness to their work as a ten on a scale of one to ten (p. 22).
- Stipends allowed most Advocates to support the work of the students, enabling them to conduct the research and design and to enter competitions (p. 23).
- According to Advocates, students gained access to resources for their work and an awareness of the competition options through the program (p. 35).
- Advocates' support of students led to at least 318 students in 2018 and 531 students in 2019 entering competitions who would not have entered without the support of their Advocates, according to Advocate survey responses (p. 8) which is backed up with data from the students (p. 32).

An Increase in Average Number of Students Supported is an Unintended Impact

Data summarized in Table 2, page 8, show that the average number of students supported by the Advocates who responded to the survey increased from the 2018 to the 2019 cohort. With recruitment of Advocates each year from different settings and with differing access to students, increasing the *average* number of students per Advocate each year is not a stated goal of the program nor is it to be expected. The increases between these two cohorts are an unanticipated program outcome.

Student impacts differed by school level (middle vs. high school) and whether or not they won an award

The section of findings titled "Differences Among Groups" was designed to explicitly answer the evaluation question: Were there differences among youth groups? We found two differences in student impact for the 2019 group of student survey respondents: differences between middle and high school students, and differences based on whether or not they won an award at a competition. No other differences in the tests we calculated were statistically significant.

Stipends and Direct Support to Advocates Influenced the Intended Impacts

In exploring the evaluation question, "Which program elements appear more or less successful in influencing intended impacts?" we found that the stipend paid to Advocates played a major role in allowing the Advocates to have the time and resources to support their students. Direct support to Advocates was also critical, through the initial face-to-face meeting in Washington DC, online meetings of smaller groups (cohorts) of Advocates with Lead Advocates and Society staff, and direct support by phone or email. The least successful element remains the Edmodo online platform.

A Few Differences Between the Characteristics of the 2017-2018 and 2018-2019 Cohorts Were Important

Throughout the descriptions of characteristics and findings in this report, we have noted differences between the two cohorts of Advocates and students, based on responses to the surveys. Many of these are not important, even if they are statistically different. The main difference between the cohorts was the difference in grade levels. The difference among Advocate respondents is seen on page 6, Figure 2, and the comparable difference among student respondents is seen on page 11, Figure 10. These differences likely contributed to many of the other differences noted between the two cohorts.

Recommendations

Recommendations for program improvement by the Advocates are described in this report on pages 26-28 and in the September 2018 report (many of which were already acted upon). Here, we provide brief recommendations for Society staff consideration moving forward.

Continue to Monitor Broad Program Outreach

Survey data self-reported by Advocates and students to the evaluators did not consistently match data provided to the Society through Advocate reports. Thus, the Society may want to look closely at the data annually to monitor program outreach. For example, survey data for urban and rural did not match Society staff members' knowledge of the Advocates' locations. In both years of the survey, large percentages of Advocates reported they served students in urban settings (54.55% in 2018 and 46.67% in 2019) compared to much smaller percentages in rural settings (9.09% in 2018 and 26.67% in 2019). Society staff may want to use NCES data to determine settings annually to better monitor outreach to these areas.

Gather Additional Information from Advocates to Determine, and Potentially Improve, Student Survey Response Rates

Responses from more students representing more Advocates would allow for more informed decisions. To determine if more incentives are needed for students or if Advocates need more nudging to share the survey links with their students to increase student survey response rates, consider asking Advocates to provide the number of students who received the link to the survey (those in the program and those not). This will allow you to determine a more accurate response rate. The act of asking for the number of links shared constitutes a nudge for Advocates as well.

Build in Time for Staff Reflection to Use Advocate Input and Survey Results to Continue Program Improvement

Carving out time for reflection and planning (away from email and phone calls) becomes critical since this program runs year-round with little time for staff reflection between supporting one cohort of Advocates, recruiting and selecting the next cohort, and bringing the new group together for the Advocate Training Institute. Over the past three years, evaluation data have been collected in the spring, analyzed in the summer, and results shared in early fall after a new cohort of Advocates has begun, none of which allows much time for reflection.

Beyond survey results, part of reflection and planning could involve Lead Advocates, particularly as the program grows, since they will have ideas and feedback to share from the Advocates in their cohorts. Possible strategies for reflection might include:

- A full-day retreat off-site for program staff just prior to recruitment of Advocates to be led by another Society staff member and to focus on key reflection questions
- An online meeting of program staff with Lead Advocates each year in late winter or early spring (avoiding peak Society competition times) to discuss areas of possible improvement
- Lead Advocates collecting ideas for program improvement from the Advocates in their cohort at one regular cohort meeting, then sharing those ideas with Society staff on a Lead Advocate group call (similar to focus group formats)

Even though we found the Advocate Grant Program to be a mature, stable program, there are always opportunities for improvement. For example, staff could take a closer look at the three lowest-rated program elements from the 2019 survey: Lead Advocate support, learning call/meetings, and Edmodo (see Figure 22, page 22). A few Advocates mentioned these when asked what could be improved (see pages 26-28). Based on these responses, improvements to consider include:

- Training for Lead Advocates
- Regular calls for Society staff with all Lead Advocates
- Revised structure for cohort and learning calls
- Revised Edmodo usage or replacement with an alternate platform

This last item, Edmodo, continues to generate comments by Advocates annually, with several saying they have difficulty finding things on this platform or noting that they did not find it useful. It may be time to find a new platform that would better serve the Advocates and the staff. Advocates are and continue to be spread out across the United States, and a user-friendly way to converse with each other and store information is a necessary element of a successful program. Finding ways to make a well-recognized meeting place may require reflection, input from Advocates, and input from alums. Training Advocates on how to use the platform and orienting them to its specific functions may be necessary. Communities of Practice could be developed on the program to focus on specific groups such as middle school Advocates, research lab Advocates, and those working in specific community types (e.g., urban and rural areas). Making a new platform an essential tool for Advocates may involve frequent reminders of information stored there (e.g. taped online meetings), developing a calendar of planned discussions, and assigning Advocates or Advocate alums to take leadership for specific areas or groups. Taking time to reflect on Advocate communication and resource sharing through Edmodo or another platform could benefit the program.

Consider Revisions to the Advocates' Goals Worksheet

Consider adding space on the Goals Worksheet that Advocates complete at the beginning of the program for identifying the resources and support they need to achieve their goals. This may help them to identify goals that are more achievable and to better achieve those goals. Additionally, one Advocate was unclear if goals were long-term or to be achieved by the end of the school year, so clarification might be needed as the worksheets are presented.

Continue to Add Support for Advocate Alums

As the Society looks for ways to provide ongoing support for the Advocates after they leave the program, consider new ways the Society can help Advocates continue their work by building on the needs identified in Figure 24, p. 25. The Society has already put in place many new elements to support program alums, and current Advocates may not yet be aware of them. Surveying the alums might yield an even better understanding of their needs and ideas.

Consider adding roles for Advocate alums to provide services requested by Advocates

Another way for Advocate alums to stay involved is to provide some services for the current Advocates. There are ongoing requests for information on topics such as raising funds for supplies (e.g., applying for grants or requesting donations), getting support from school administrators, and identifying examples or resources for engineering projects. Others have asked for help with connections to university professors to mentor students on particular topics. Advocate alums that have experience in responding to these challenges may have the expertise to contribute to the program. Their contributions could take the form of brief articles or online workshops that could be recorded and saved. Modest stipends could be considered for such support.

Program Evaluation into the Future

The Society for Science and the Public plans to continue the successful Advocate Grant Program into the future to continue to impact teachers and students positively. As part of the proposal for our summative evaluation of the 2017-2019 program, we included steps to build the Society's internal capacity to continue to collect and learn from survey data from Advocates and their students. The result is a Guide with step-by-step instructions for data preparation and simple analyses using Excel. An accompanying Excel template allows Society staff to easily drop in survey data and see summary results in automatically generated tables and charts.

The Guide and template will allow Society staff to see annual results that will help them make decisions and continue to improve the program. Collecting the data annually will also allow for eventual comparisons over time. Such analysis will go beyond the scope of the Guide and require additional evaluation skills. Building on the current two-year evaluation, we offer the following questions that data collected over time might answer.

- Are there greater impacts (e.g., *Gain* scores) for Advocates in certain settings, grades, middle or high school, or geographical areas?
- How is the impact different for Advocates who return for a second or third year versus new Advocates? And, is that dependent on whether they return as a Lead Advocate or not?
- How does student impact differ based on the number of students supported by their Advocate? Do Advocates with larger numbers of students and who are stretched to support so many yield similar student impacts as Advocates with a small group of students to support?

- Are there differences in student impact based on student ethnicity (beyond the minority/non-minority explored in this two-year project)?
- How does student impact differ based on the prior experience of their Advocate?
- How is the impact different for students who receive help in class versus outside of class or during the summer?
- How is student impact different for those required to complete a project?
- How is impact different for students who have prior experience with competitions and those who are entering for the first time?
- Are there increases or decreases in percentages of students who enter competitions by Advocate cohort over time? To what could differences be attributed?
- What is the effect of program changes on Advocate or student impact or other findings?

Answering these questions was beyond the scope of this evaluation and the data available. More survey data collected from more Advocates and over more than two years will aid in addressing these and other questions. Collapsing data over a larger number of cohorts of Advocates could support more robust findings. Going beyond the current surveys to include additional methods could yield even richer findings that could support the work of the Society.

APPENDIX A – 2019 Surveys

The two surveys that follow were developed using SurveyMonkey.com and distributed by links emailed to Advocates. Advocates provided links to the Student Survey to their students. Minor changes were made from the 2018 surveys.

Required items were marked with an asterisk. Response options with a circle ○ indicate only one option can be selected. Response options with a square ☐ indicate multiple options can be selected.

Advocate Survey

As part of your participation in the Advocate Grant Program, the evaluation team is asking each Advocate to complete this survey and to assist us in having your students complete an online survey.

This Advocate survey should take about 20 minutes to complete the 47 questions.

To protect your privacy, all data collected will be kept confidential. We ask for your name in this survey so we can be sure all Advocates have responded. The only people with access to the survey data are the external evaluators. Society staff will not have access. The evaluation results will be shared with the Society in formative and summative reports and may be shared with others in reports or articles. If direct quotes are used, they will remain anonymous. In all cases, the Advocates' identities will not be revealed.

If you have any questions about this survey or the AGP evaluation, please contact Christine Klein, Director, Insight for Learning Practices at 314-504-1465 or ckleinconsulting@gmail.com. Or, contact the Society's Chief Program Officer, Michele Glidden, at 202-785-2255.

Thank you for your participation.

* 1. Please enter your first name: _____
* 2. Please enter your last name: _____

* 3. How would you describe the community in which most of your students live?
    ○ Urban
    ○ Suburban
    ○ Small town
    ○ Rural

*4. What portion of your students attend a Title 1 school?
    ○ All
    ○ Most
    ○ Some
    ○ A few
    ○ None
    ○ I don't know

*5. In what type of organizational setting did you serve as an Advocate?
- ○ Classroom
- ○ Single School
- ○ School district wide
- ○ University or business lab
- ○ Community organization
- ○ Other (please specify)

*6. In what town or city is your organization located? _____

*7. In what state or U.S. territory is your organization currently located? (Pull-down menu)

*8. In what ZIP code was your program offered? (i.e. ZIP code of the primary location in which the program was offered) _____

*9. When did you provide support for students? (Check all that apply.)
- ☐ During class
- ☐ Before or after school
- ☐ In the evening
- ☐ On the weekend
- ☐ In the summer
- ☐ Other (please specify)

*10. Select all grade levels of the students you served. (Options grade 6 through 12, plus other)

Please respond to the following questions based on the impact the Advocate Grant Program (AGP) has had on you.

In the following items, please note that some items refer to supporting students in projects and others refer to competitions. By projects, we mean scientific research or engineering design projects. By competitions, we mean science research competitions or engineering design competitions rather than other types of general competitions.

11. Please rate **your awareness** of the following items prior to participating in AGP and after participation. (1 = not at all aware; 10 = aware a great deal)

	Before AGP Participation	After AGP Participation
The range of competitions available for my students	☐	☐
Eligibility requirements for competitions	☐	☐
Deadlines for competitions	☐	☐
How to support students in filling out competition entries	☐	☐
The role of competitions as a source of monetary awards for postsecondary education	☐	☐

	Before AGP Participation	After AGP Participation
The role of competition participation in boosting acceptance to the college or university of the student's choice	☐	☐
The Society as a resource For teachers	☐	☐

12. Please rate **the extent to which your peers and administrators recognize YOU as a source of information** about the following areas. (1 = not recognized at all; 10 = highly recognized)

	Before AGP Participation	After AGP Participation
Supporting students in projects	☐	☐
Supporting students in how to enter competitions	☐	☐

13. Please rate **your ability to support students** in the following areas. (1 = not at all; 10 = a great deal)

	Before AGP Participation	After AGP Participation
Conducting research And design projects	☐	☐
Entering competitions	☐	☐
Developing or improving their organizational skills	☐	☐
Developing or improving their time management skills	☐	☐
Organizing their research	☐	☐
Organizing their presentations	☐	☐
Preparing their competitive entries	☐	☐

14. Please rate **your attitude** in the following areas. (1 = not at all; 10 = a great deal)

	Before AGP Participation	After AGP Participation
Comfort with the application processes for a range of competitions	☐	☐
Feeling of camaraderie with others in the student research and competition community	☐	☐
Passion for getting students involved In scientific research or engineering design competitions	☐	☐

Confidence in guiding students Through competitions	☐	☐

15. Please rate **your motivation** in the following areas. (1 = not at all; 10 = a great deal)

	Before AGP Participation	After AGP Participation
Motivation to recruit underserved students to participate in research and design projects	☐	☐
Motivation to recruit underserved students to enter competitions	☐	☐

16. If you have comments on questions 11-15, please enter them here.

For each of the following, please provide numbers for last year (2017-2018) and this year (2018-2019). Enter zero if no students were served. (All boxes must contain a number.)[5]

Students supported in **CONDUCTING** PROJECTS

*17. How many **total** students did **you support in conducting** research or design projects? (Underserved plus not underserved)
Total Last Year:
Total This Year:

*18. How many **underserved** students did you support **conducting** research or design projects? (Underserved only)
Underserved Last Year:
Underserved This Year:

Students supported who **COMPLETED** PROJECTS

*19. How many **total** students did you support **who completed** research or design projects? (Underserved plus not underserved)
Total Last Year:
Total This Year:

*20. How many **underserved** students did you support **who completed** research or design projects? (Underserved only)
Underserved Last Year:
Underserved This Year:

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[5] We changed the wording on questions 17 through 24 in 2019 to clarify the questions.

*21. How many of your students (**total** underserved plus not underserved) **entered competitions**?
Total Last Year:
Total This Year:

*22. How many of your **underserved** students **entered competitions**? (Underserved only)
Underserved Last Year:
Underserved This Year:

*23. Of the number of the **UNDERSERVED** students entering competitions above, how many of those students **do you think would <u>not</u> have entered without your support**? Please provide the number for this year.
Underserved This Year:

24. If you have comments on questions 17-23 above, enter them here.

*25. What do you see as the benefits to students in **conducting** research and design projects? (Select up to THREE.)
☐ Learning to think scientifically
☐ Developing or improving skills
☐ Building confidence
☐ Learning or better understanding STEM concepts
☐ Improving their future (college, career, other options)
☐ Experiencing authentic STEM work
☐ Increased exposure to STEM education and career options

*26. What do you see as the benefits for students from **competition participation**? (Select up to THREE.)
☐ Developing or improving skills
☐ Building confidence
☐ Making new friends and connections with peers
☐ Making new friends and connections with adults
☐ Improving their future (college, career, other options)
☐ Sharing their ideas with others
☐ Receiving recognition for their work
☐ Experiencing pride in their work

*27. What do you think motivates students to participate in competitions? (Select up to THREE.)
☐ Awards and scholarships
☐ Encouragement by adults
☐ The challenge of competing
☐ It's fun
☐ Recognition
☐ Opportunity to meet & interact with like-minded peers

*28. What do you see as the biggest benefit **to your students** of you being part of the Advocate Grant Program? (Select up to THREE.)
☐ Awareness of competitions as an option
☐ Financial support for student research (supplies, equipment, etc)

☐ Financial support for competitions (registration, transportation, etc)
☐ Access to resources to produce a quality project
☐ Opens opportunities for student
☐ Builds confidence
☐ Provides access to STEM and the associated advantages
☐ Students see they are taken seriously

*29. What impact, if any, have you seen on your school (or institution) from the Advocate Grant Program? (Select up to THREE.)
☐ Provided me with the confidence or status to approach the administration for support
☐ Helped secure more funding for my institution (school/district/university/other)
☐ Increased admission of students as STEM majors to my university
☐ Increased support of the research program (eg. time, space, funding, equipment)
☐ Increased awareness of opportunities for students
☐ Increased awareness of opportunities for teachers
☐ Others recognized me as knowledgeable or as a leader
☐ Institution recognized or bragged about my students
☐ Our program will expand and grow
☐ I've seen no clear impact on my institution
☐ Other[6]

*30. What do you see as the biggest benefit of the Advocate Grant Program to you? (Select up to THREE.)
☐ Increased camaraderie with others in field of student research
☐ Support from other Advocates
☐ Support from Society staff
☐ Additional resources for students
☐ Able to support more students
☐ Knowing I'm making a difference in the lives of students
☐ Provides credibility for my work with administrators, peers, parents, and the community
☐ Provides visibility and recognition for my work with administrators and peers[7]

*31. Please indicate how helpful each of the following was to you and your ability to support your students using a scale of 1 (not helpful) to 10 (very helpful).[8]

AGP Kickoff meeting in DC in June	☐
Research Teachers Conference in DC	☐
Cohort calls/video conferencing	☐
Learning calls/video conferencing	☐
Individual support from Society staff	☐
Individual support from Lead Advocate	☐
Edmodo online community	☐

32. How could the Advocate Grant Program be improved?

33. Do you plan to continue to support underserved youth in entering competitions next year after the Advocate Grant Program?
○ Yes
○ No

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[6] Other was added in 2019 as an option to question 29.

[7] The last two options on question 30 were revised in 2019 for clarity. The last three options were reordered.

[8] Question 31 was added in 2019.

Why or why not? _____

34. If you plan to continue this work after your participation in the Advocate Grant Program ends, how best can the Society support you in doing so? (Check all that apply.)

☐ Create opportunities for me to meet other similar teachers in my geographic region in person
☐ Create opportunities for me to meet other similar teachers in an online community
☐ Help me to garner support for my research program with my administrators, school, or school district
☐ Help me to find funding for equipment
☐ Help me to recruit more teachers at my school to help
☐ I still need additional training on the science research competitions I didn't choose this year
☐ Other suggestions? (please specify) _____

*35. How did you receive the $3000 from the Society?
○ As payments directly to me
○ As payments to my institutions to distribute

*36. If you have used the $3000 for anything other than supporting your commitment of time, please explain how you have used it. (Select all that apply.)[9]
☐ Used stipend only for commitment of my time
☐ Clothes for students (to wear at competitions or for group identity)
☐ Entry fee for competitions
☐ Food for students during meetings or other group times
☐ Food/dinner for special occasion outside of group work
☐ Rewards or awards for students
☐ Supplies for student projects
☐ Student transportation to colleges, labs, etc
☐ Travel for Advocate to conferences and professional development
☐ Travel to competitions for students
☐ Substitute teacher for AGP related time out of class
☐ Other (please specify) _____

37. Was the $3000 adequate for the job at hand?[10]
○ Yes
○ No
○ If not, please explain. _____

*38. At the beginning of the program this year, you were asked to identify goals for the year. Did you achieve your goals?
○ Yes, I achieved all my goals.
○ I achieved some of my goals.
○ I made progress toward my goals.
○ I was unable to achieve or make progress toward my goals.
○ I don't remember the goals I listed.

39. How did the Lead Advocates or Society staff help you achieve your goals, if at all? _____

40. What additional support did you need to achieve your goals? _____

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[9] The wording of question 36 was changed in 2019 for clarity in addition to the wording of the first option.
[10] Questions 37 through 40 were added in 2019

41. In which of the following areas did you have experience prior to this year's Advocate program?

☐ Research teacher or mentor
☐ Science competition leader/mentor
☐ Engineering competition leader/mentor
☐ Other (please specify) _____

42. Have you worked with underserved students prior to your participation as an Advocate?[11]

○ No, this is the first time I have worked with underserved students.
○ Yes, I have worked with underserved students previously, but not on entering STEM research competitions.
○ Yes, I have mentored underserved students in entering STEM Research Competitions prior to participating in this program.

*43. In this year's program, what was your role?

○ Advocate
○ Lead Advocate

*44. Were you in the Advocate Grant Program last year?

○ Yes
○ No

*45. In what category does your age fall?

○ 18-24
○ 25-34
○ 35-44
○ 45-54
○ 55-64
○ 65+
○ Prefer not to answer

*46. With what gender do you most identify?

○ Male
○ Female
○ Non-binary
○ Prefer not to answer

*47. With which of the following do you most identify? (Select up to two.)

☐ White
☐ Hispanic or Latino/a
☐ Black or African-American
☐ American Indian or Alaskan Native
☐ Asian
☐ Native Hawaiian or other Pacific Islander
☐ Prefer not to answer

Thank you for your responses. Please press DONE to submit your responses.

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[11] New in 2019

Student Survey

Introduction

Thank you for taking this survey. This survey involves questions about science, technology, engineering, or math (STEM) projects and competitions. It will take you 15-20 minutes to complete.

We won't ask you about your own STEM project. None of the questions will test your knowledge. We will ask your opinion about things related to STEM projects.

There are no right or wrong answers on this survey. We just want your honest opinion.

We value your input on this survey. To thank you for your input, all completed surveys will be entered into a drawing for one of ten $50 gift cards. To be entered into the drawing you must answer at least 90% of the questions and provide your name so you can be notified if your name is drawn for one of the prizes. Not everyone will win, but everyone's input will help students and teachers in the future.

If you have any questions about this survey, please contact Christine Klein, Director, Insight for Learning Practices at 314-504-1465 or ckleinconsulting@gmail.com. Or, contact Michele Glidden, Chief Program Officer at the Society for Science and the Public, 202-785-2255.

Thank you for your participation.

About You

*1. Who gave you the link to this survey? We call this person your **Advocate** in this survey. (Note, your Advocate will not have access to your responses on this survey.)[12]

This page asks for information about you and your participation in STEM projects and competitions.

*2. What grade were you in February of this year?
- ○ Grade 6
- ○ Grade 7
- ○ Grade 8
- ○ Grade 9
- ○ Grade 10
- ○ Grade 11
- ○ Grade 12

*3. What is your age? _____

*4. With which gender do you most identify?
- ○ Male
- ○ Female
- ○ Non-binary
- ○ Prefer not to answer

*5. With which of the following do you most identify? (Select up to two.)

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[12] Question 1 was added in 2019.

☐ White
☐ Hispanic or Latino/a
☐ Black or African-American
☐ American Indian or Alaskan Native
☐ Asian
☐ Native Hawaiian or other Pacific Islander
☐ Prefer not to answer

*6. What is the name of your school? (If homeschooled, write "homeschooled.")

*7. In what city is your school (or homeschool) located?

*8. In what state is your school (or homeschool) located? (pull-down menu)

Projects

The following questions are about STEM projects. These include projects you might have done for a class, science fair, or other competitions.

*9. What kind of project did you work on during this school year?
○ Science research project
○ Engineering design project
○ Behavioral science research project
○ Other (please specify) _____

10. What is the status of your project?
○ Currently working on project
○ Project is completed

11. Have you entered your project into a competition?
○ Yes
○ No

Entering Competitions

12. Into which competition(s) have you entered your project this year? (Select all that apply)[13]
☐ School-wide Science Fair
☐ County-wide Science Fair
☐ Regional Science Fair
☐ Intel International Science and Engineering Fair (ISEF)
☐ BioGENIUS Challenge
☐ Broadcom MASTERS
☐ eCybermission
☐ FFA Agriscience Fair
☐ Junior Science and Humanities Symposium
☐ Regeneron Science Talent Search
☐ Other (please specify)

---

[13] The options on Question 12 changed in 2019 to reflect current competition options.

13. Did you win any awards for your project this year?
   ○ Yes
   ○ No
   ○ Too early to tell

14. Rate the importance of your reasons for entering a competition: (1 = low; 10 = high)[14]
   Opportunity to win prizes that included scholarships and other monetary awards
   List on applications to get you into the college or university of your choice
   Encouragement from parents/guardians
   Encouragement from teachers
   Encouragement from friends and peers
   Competitions are fun
   Passion for science or engineering
   Opportunity to travel to events
   Opportunity to gain recognition
   Opportunity to explore a fascinating question
   Opportunity to share my work with others
   Opportunity to make friends

Current and Previous Participation

The following questions ask about your participation in projects and competitions.

*15. Including this year, in how many years did you complete a STEM project? ____

*16. Including this year, in how many years were you required to complete a STEM project by a teacher, your school, or an adult other than your parent/guardian? ____

*17. Including this year, in how many years did you enter a STEM project in a competition? ____

BEFORE and AFTER your Project

The following questions ask you to rate areas **before** and **after** doing your STEM project, including participating in competitions. Please carefully consider each area individually. This helps us understand how working on your project affected you.

18. Please rate your skill in each of these areas BEFORE and AFTER working on your project. (1 = no level of skill; 10 = expert level of skill)

	Before Project	After Project
Writing skills	☐	☐
Oral presentation skills	☐	☐
Time management	☐	☐
Meeting deadlines	☐	☐
Writing a scientific journal article	☐	☐

---

[14] The last two options on Question 14 were added in 2019.

Ability to present my research to other students	☐	☐
Ability to present my project to scientists or engineers	☐	☐
Ability to present my project to the general public	☐	☐

19. Please rate your <u>knowledge</u> in each area BEFORE and AFTER working on your project. (1 = no knowledge or understanding; 10 = high level of knowledge or understanding)

	Before Project	After Project
My STEM topic	☐	☐
Other STEM topics	☐	☐
The scientific process	☐	☐
The engineering design process	☐	☐
Options for STEM careers	☐	☐
Options for education after high school	☐	☐
How STEM supports my community	☐	☐

20. Please rate your <u>awareness</u> on each of the following BEFORE and AFTER working on your project. (1 = no awareness; 10 = highly aware)

	Before Project	After Project
Competitions give prizes that include scholarships or other monetary awards	☐	☐
Competitions could help you get accepted into the college or university of your choice	☐	☐

21. Please rate the level of your <u>interest</u> or <u>attitude</u> BEFORE and AFTER working on your project. (1 = very low; 10 = very high)

	Before Project	After Project
My interest in participating in STEM activities	☐	☐
My confidence in handling STEM activities	☐	☐
My comfort in working		

with adults	☐	☐
My confidence that I can be successful if I put my mind to something	☐	☐
My confidence in serving as a role model to younger students	☐	☐
The value I place on scientific research	☐	☐
My interest in going to college	☐	☐
My interest in taking science and math classes in high school and beyond	☐	☐
My interest in a STEM related career (e.g. scientist, engineer, doctor, nurse, electrician, etc.)	☐	☐

Help and Support

We know most students complete their own projects, sometimes individually and sometimes as a team. Yet, most students or groups of students have important support or guidance from older students and adults. We are asking about this important support and guidance in the following questions.

22. Who helped or guided you in completing your project? (Select all that apply)[15]
☐ Advocate (the person who gave you the link to this survey)
☐ Teacher (other than Advocate)
☐ Club sponsor/After school program staff (other than Advocate)
☐ University professor
☐ Older student
☐ Family member
☐ No one helped me complete my project
☐ Other (please specify) _____

23. When did you get most of the help on your project? (Select the best possible response.)
○ During class
○ Before or after school
○ In the evening
○ On the weekend
○ In the summer

24. Where did you collect your data? (Select all that apply)
☐ My school
☐ University lab
☐ Business lab
☐ Hospital or veterinary lab
☐ A farm or ranch

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[15] Options were revised in 2019 for clarity.

☐ Park or other natural habitat
☐ Home
☐ Other (please specify) _____

25. Was your project this year part of an internship? (For example, a scheduled experience away from your school in a real workplace such as a research lab or robotics lab.)
○ Yes
○ No

26. Did you participate in any trips related to your project or the class/club where you did your project?[16]
○ Yes
○ No

27. If yes, how important was this trip to your overall experience? (Slide the dot to indicate how important.)

0 = Not at all important   Somewhat important   100 = Very important

Advocates

The following questions are related to the person who gave you the link to this survey. We call this person your Advocate in the questions.

28. How likely would you have been to complete a STEM project if your Advocate hadn't encouraged you?

0 = Unlikely   Neither likely or unlikely   100 = Highly likely

29. How likely would you have been to enter a STEM competition if your Advocate hadn't encouraged you to enter?

0 = Unlikely   Neither likely or unlikely   100 = Highly likely

30. Who helped you most with each of these aspects of your project?

	Person Giving Support
Selecting a STEM topic	☐
Finding references for topic	☐
Identifying procedures	☐
Explaining the research process	☐
Helping you get supplies & equipment	☐
Helping you find experts	☐
Helping you organize data	☐
Helping you write	☐
Helping you set and meet deadlines	☐

---

[16] Questions 26 and 27 were added in 2019.

	☐
Helping you identify competitions to enter	☐
Helping you interpret competition rules	☐
Helping you in fill out competition applications	☐
Providing/arranging transportation to competition(s)	☐

Give Us Your Thoughts

*31. Why did you do a STEM project? (Select up to three.)
☐ It was required
☐ I was interested in the topic
☐ I am interested in STEM
☐ I wanted to try something new
☐ I wanted the experience of working on a STEM project
☐ I was encouraged to do it by an adult

*32. What do you think are the benefits of entering a STEM competition? (Select up to three.)
☐ Learn something new
☐ Win awards and scholarships
☐ Develop new skills
☐ Build self-confidence
☐ Increase potential to be accepted by the college of my choice
☐ Meet new people
☐ Share my work with others
☐ Gain a new experience
☐ Other (please specify) _____

More About You

*33. Do you plan to attend college after high school?[17]
○ Yes
○ No
○ I'm not sure yet

The Society for Science and the Public is planning to contact you later to learn about your experiences beyond high school. Your responses to today's survey will help. We're asking for your name and date of birth to connect your experience now to your future experience. Also, we will need your name if you wish to be included in the drawing for the $50 gift cards. Your name and birthdate will be held confidentially in a secure file separate from your survey responses and will not be shared beyond the Society staff members in charge of the file.[18]

34. What is your name (first, middle, and last)?
First _____
Middle _____
Last _____

_____

[17] Question 33 was added in 2019.
[18] Questions 34 and 35 were added in 2019 when in the incentive was added and to enable long-term follow-up with individual students.

35. What is your date of birth, including the year you were born? (We may need this in case there are two people with your same name.) (MM/DD/YYYY)

Thank You

Thank you for completing this survey!

The drawing for the gift cards will be in mid-May. Teachers of the winners will be notified then.

Please press DONE below to submit your survey responses.

If you have any questions about this survey, please contact Christine Klein, Director, Insight for Learning Practices at 314-504-1465 or ckleinconsulting@gmail.com. Or, contact Michele Glidden at the Society for Science and the Public, 202-785-2255.

APPENDIX B – Methodology and Data Analysis

This appendix (along with Appendix C) adds detail to the summative evaluation report for those interested. These are not necessary for understanding the first 44 pages of the report, though some readers may want the added information.

Methodology

Insight for Learning Practices employed a mixed methods approach for this evaluation. The methods included: Advocate and students surveys, document analysis, and Society staff questionnaires.

Surveys were completed by Advocates and students. These included quantitative (multiple choice, ratings, etc.) and qualitative (open-ended) data, and were developed using SurveyMonkey. (See Appendix A on pages 45-60 for surveys.)

Incentives were offered to students to encourage participation in the student surveys. Links to the student survey were given to Advocates to forward to their students. Students were told they would complete an online survey that would take 10-15 minutes to complete. The survey asked about STEM projects and competitions as well as information about age, grade level, etc. The survey introduction explained that each student completing the survey would be entered into a drawing for one of ten $50 gift cards. Odds of winning were estimated at 1 in 80 or better. Students were told responses would be confidential.

Students were encouraged to provide their name and birth date so Society staff could reach out to them in the future for follow-up. Students were told they would need to include their name if they wanted to be included in the drawing. Not all students provided this information. After the May first deadline, the evaluators generated a list of random numbers between one and the total number of students. Using the case numbers assigned by SurveyMonkey that matched the ten random numbers, ten students were selected. Advocates of the ten students were contacted to determine an address for the gift card. In some cases, gift cards were sent to the Advocate to distribute, though some gave students' addresses to send the cards directly to the student. All contact information for students has been deleted or destroyed.

Document Analysis of program materials provided additional opportunities to guide data collection and provided additional information on the context of the program. Documents included the Advocate's goal sheets completed at the initial kickoff event for the 2018-2019 cohort and lists of students by their Advocates' names.

Questionnaires were completed by two key program staff, allowing the evaluators to collect additional information on changes to the program over time.

Retrospective Survey Design

With only one opportunity to survey students, it was impossible to use the standard pre-post survey design. Such a design can also result in a response-shift bias in which participants change their understanding of their own behaviors and attitudes over time in ways that can mask impact (Howard, 1980). For example, after entering a competition, a student might realize she was not as good at sharing project results with others as she originally thought (though she knows her skills have improved). On a typical pre-program

survey an Advocate might indicate a high awareness of the range of competitions available to students, though might realize just how many more are available throughout participation in the program. Typical pre-post design might show no change in awareness where the retrospective design would show positive change as the Advocate used the same frame of reference for rating before and after.

To avoid the response-shift bias and to capture data at one point in time, the retrospective design was used (Allen & Nimon, 2007). Advocates were asked to rate items before and after the program. Students were asked to rate items before and after they completed their project.

Data Analysis

This section provides additional information on the data analyses. The resulting data tables and figures are included in Appendix C. Statistical analyses using SPSS included basic descriptive statistics, independent samples t-tests, and contingency coefficient calculations. We used fairly basic inferential statistics useful to describe respondent characteristics and to explore which program elements could be improved. While more sophisticated statistics could have been used, we have found that these basic tests are often more interpretable and useful to evaluation audiences who have specific questions they want to be answered by a study. Contingency Coefficients were used to test comparisons of nominal variables, and independent sample t-tests used for rating items and continuous variables. While there are numerous tests in the totality of the analysis, which does open the possibility of spurious results, we only ran tests that were specifically connected to the overarching questions of the evaluation.

For qualitative items, codes were developed for the open-ended survey responses from the program impacts and themes that emerged from the response data. This design was devised based on a program logic model rather than overarching theoretical frameworks. Allowing the natural language of respondents to emerge through categories allows their perspectives to be communicated as input and feedback on the program.

References

Allen, J. M. & Nimon, K. (2007). Retrospective pretest: A practical technique for professional development evaluation. *Journal of Industrial Teacher Education, 44* (3), 27-42.

Howard, G. S. (1980). Response-Shift Bias: A Problem in Evaluating Interventions with Pre/Post Self-Reports. *Evaluation Review*, *4*(1), 93-106. https://doi.org/10.1177/0193841X8000400105

APPENDIX C – Data Details

Details of the data collected during the evaluation are presented in this appendix for reference and follow the sections of the report. Every attempt was made to keep tables and their corresponding figures together on the same page.

Evaluation Overview

Survey Response Rates

Table C1. Total Numbers of Advocates, Students, and Survey Respondents by Cohort

	2017-2018			2018-2019		
	Total	Survey Respondents	Response Rate	Total	Survey Respondents	Response Rate
Advocates	45	33	73.33%	50	45	90.00%
Students	717	98	13.63%	901	228	25.31%
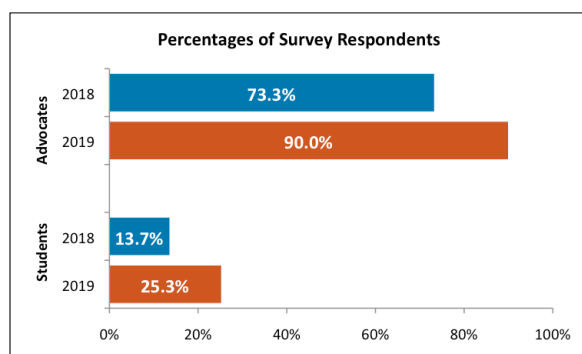
Figure C1. Response rates by cohort

Characteristics of Survey Respondents

Percentages were used to compare survey responses from the two cohorts of Advocates and their students. The tables below provide actual numbers and percentages, though the figures rely on percentages exclusively.

Demographic Characteristics of Advocate Respondents

Gender Identity of Advocates
Advocates not responding to the question are not reflected in the figure below.

Table C2. Gender Identity of Advocate Respondents by Cohort

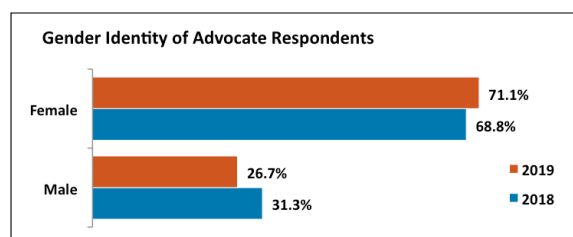| Gender Identity	2018		2019	
	n	%	n	%
Male	10	31.25%	12	26.67%
Female	22	68.75%	32	71.11%
Non-binary	0	0.00%	0	0.00%
Prefer not to answer	1	0.00%	1	2.22%
Total	33	100%	45	100%

Figure C2. Gender identity of Advocate respondents by cohort

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Race/Ethnicity of Advocates

Advocates could choose up to two responses for race/ethnicity, with one Advocate each year not providing a response. (Totals will not equal N.)

Table C3. Race/Ethnicity of Advocate Respondents by Cohort

Ethnicity	2018		2019	
	n	%	n	%
White/Caucasian	27	81.82%	31	68.89%
Black/African American	1	3.03%	6	13.33%
Asian	2	6.06%	5	11.11%
Hispanic/Latino/a	2	6.06%	4	8.89%
Pacific Islander or Hawaiian Native	1	3.03%	1	2.22%
Native American or Alaska Native	1	3.03%	1	2.22%
Prefer not to answer	1	3.03%	1	2.22%
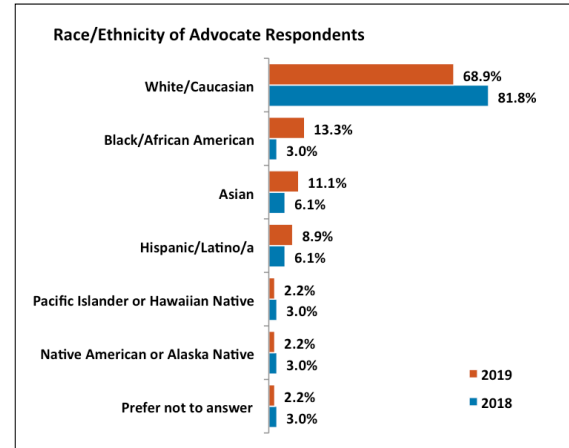
Figure C3. Race/ethnicity of Advocate respondents by cohort

Age Ranges of Advocates

Two Advocates in 2018 and one in 2019 did not provide an age range.

Table C4. Age Ranges of Advocate Respondents by Cohort

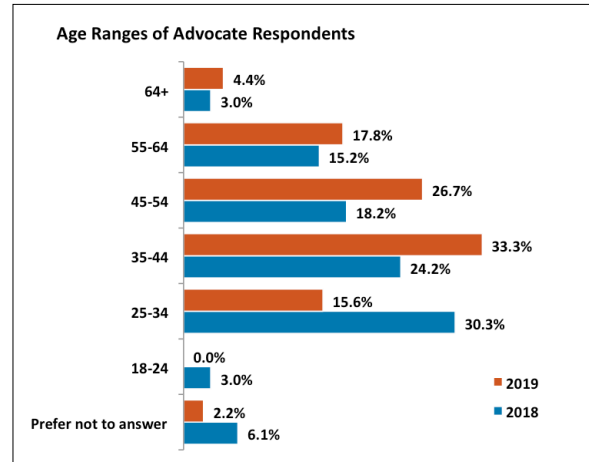| Age	2018		2019	
	n	%	n	%
18-24	1	3.03%	0	0.00%
25-34	10	30.30%	7	15.56%
35-44	8	24.24%	15	33.33%
45-54	6	18.18%	12	26.67%
55-64	5	15.15%	8	17.78%
64+	1	3.03%	2	4.44%
Prefer not to answer or blank	2	6.06%	1	2.22%

Figure C4. Age ranges of Advocate respondents

Context Characteristics of Advocate Respondents

Grade Levels Supported by Advocates
The majority of Advocates supported high school students. Advocates could list all grade levels that applied. (Totals will not equal N.)

Table C5. Grade Levels of Students Supported by Advocate Respondents by Cohort

Grade Level	2018		2019	
	n	%	n	%
6	3	9.09%	4	8.89%
7	6	18.18%	7	15.56%
8	7	21.21%	8	17.78%
9	14	42.42%	17	37.78%
10	19	57.58%	33	73.33%
11	21	63.64%	32	71.11%
12	17	51.52%	30	66.67%
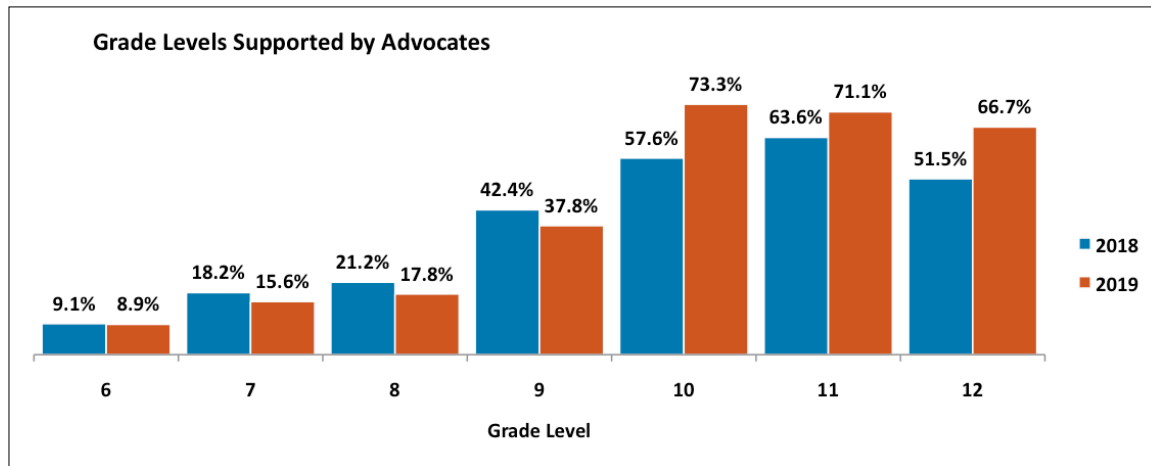
Figure C5. Grade levels of students supported by Advocate respondents by cohort

Community Settings of Advocates

About half of the Advocates in each group worked in an urban setting. There were more rural Advocates in 2019 than in 2018, though the differences in settings between the two cohorts were not significant.

Table C6. Community Settings of Advocate Respondents by Cohort

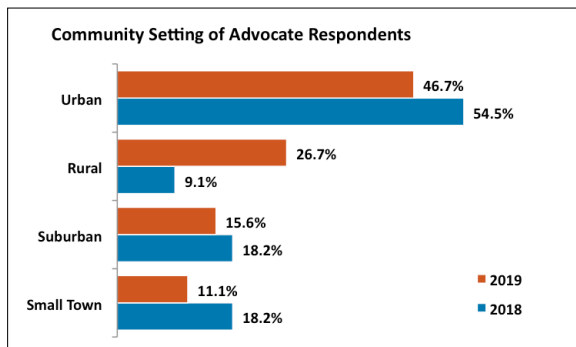| Community Setting	2018		2019	
	n	%	n	%
Urban	18	54.55%	21	46.67%
Suburban	6	18.18%	7	15.56%
Small Town	6	18.18%	5	11.11%
Rural	3	9.09%	12	26.67%
Total	33	100%	45	100%

Figure C6. Community settings of Advocate respondents by cohort

Portion of Students in Title 1 Schools
Over half the Advocates in both cohorts supported students attending Title 1 schools.

Table C7. Portion of Advocate Respondents Students in Title 1 Schools by Cohort

Portion in Title 1 Schools	2018		2019	
	n	%	n	%
All	17	51.52%	25	55.56%
Most	8	24.24%	7	15.56%
Some	1	3.03%	4	8.89%
A few	0	0.00%	2	4.44%
None	5	15.15%	5	11.11%
I don't Know	2	6.06%	2	4.44%
Total	33	100%	45	100%
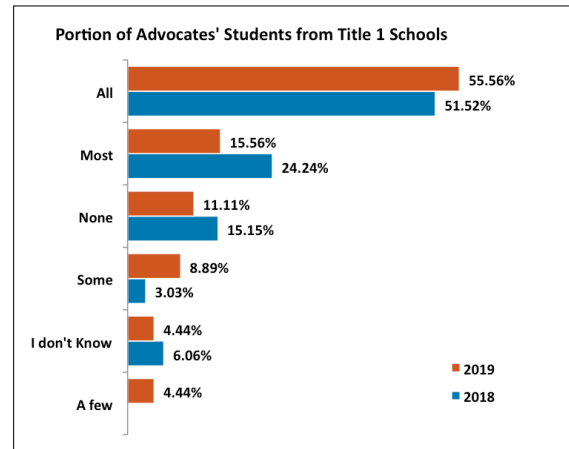
Figure C7. Portion of Advocate respondents' students in Title 1 schools by cohort

Organizational Settings of Advocate
About 40% of Advocate respondents in 2018 and 2019 reported that they served in a Single School and about one-third served in a Classroom. The two in each cohort that reported an "Other" setting listed an afterschool club, which could have been in a single school, district-wide, or community organization.

Table C8. Organizational Settings of Advocate Respondents by Cohort

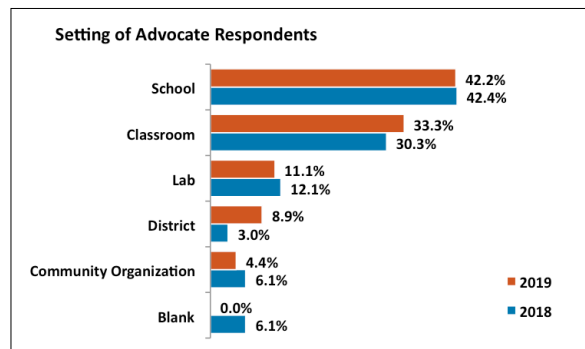| Organizational Setting	2018		2019	
	n	%	n	%
Classroom	10	30.30%	15	33.33%
School	14	42.42%	19	42.22%
District	1	3.03%	4	8.89%
Lab	4	12.12%	5	11.11%
Community Organization	2	6.06%	2	4.44%
Other	0	0.00%	0	0.00%
Blank	2	6.06%	0	0.00%
Total	33	100%	45	100%

Figure C8. Organizational settings of Advocate respondents by cohort

Prior Experience of Advocate Respondents

Advocates were asked if they had prior experience (prior to their participation in the Advocate Grant Program) as a research teacher/mentor, science competition leader/mentor, engineering competition leader/mentor, or other experience. Figure 3 on page 7 of the report summarizes the data in the tables and figures below.

Table C9. Advocate Respondents' Prior Experience as Research Teacher or Mentor by Cohort

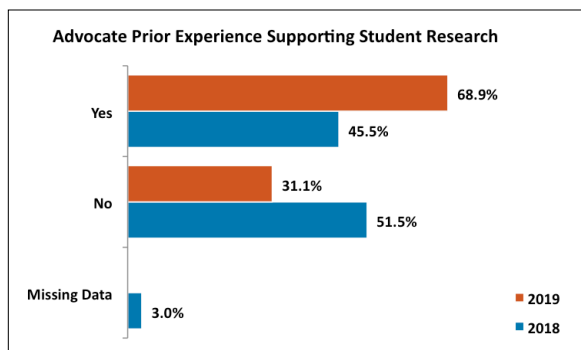| Experience?	2018		2019	
	n	%	n	%
Yes	15	45.45%	31	68.89%
No	17	51.52%	14	31.11%
Missing Data	1	3.03%	0	0.00%
Total	33	100%	45	100%

Figure C9. Experience supporting research

Table C10. Advocate Respondents' Prior Experience as Competition Mentor

Experience?	2018		2019	
	n	%	n	%
Yes	16	57.58%	27	60.00%
No	13	39.39%	18	40.00%
Missing Data	1	3.03%	0	0.00%
Total	33	100%	45	100%
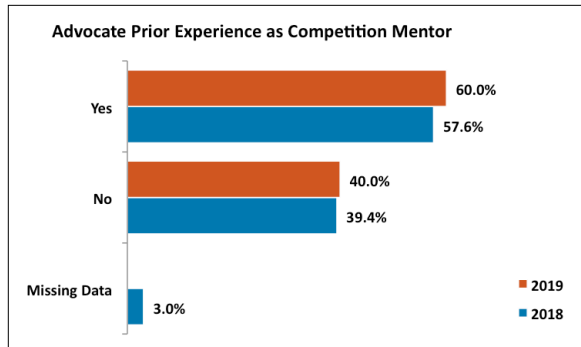
Figure C10. Experience as competition mentor

Table C11. Advocate Respondents' Prior Experience as Engineering Mentor

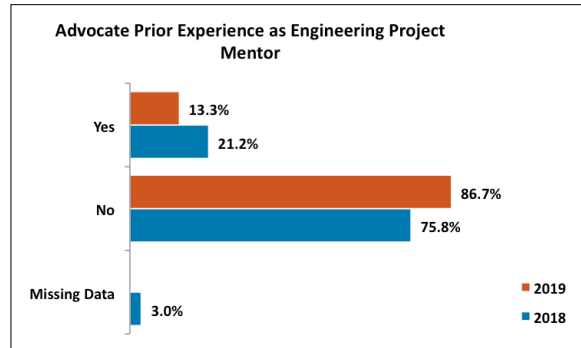| Experience?	2018		2019	
	n	%	n	%
Yes	7	21.21%	6	13.33%
No	25	75.76%	39	86.67%
Missing Data	1	3.03%	0	0.00%
Total	33	100%	45	100%

Figure C11. Experience as an engineering mentor

Advocates were given the opportunity to list other experiences and provided the following.
2018
- Science Olympiad Regional Director
- Science Fair coordinator
- Independent study teacher for one year
- STEAM teacher

2019
- District mentor for other teachers in our city
- I have assisted students in entering a Crystallography contest at [university] and they won second place
- I was an advocate last year as well.

Experience Working with Underserved Students

Beginning with the 2019 survey, Advocates were asked if they had worked with underserved students prior to participating in the Advocate Grant Program, and all had.

Table C12. Advocate Respondents' Prior Experience supporting underserved students

Experience with underserved students?	2019	
	n	%
Yes, with competitions	23	51.11%
Yes, but not with competitions	22	48.89%
No, this is first time	0	0.00%
Total	45	100%
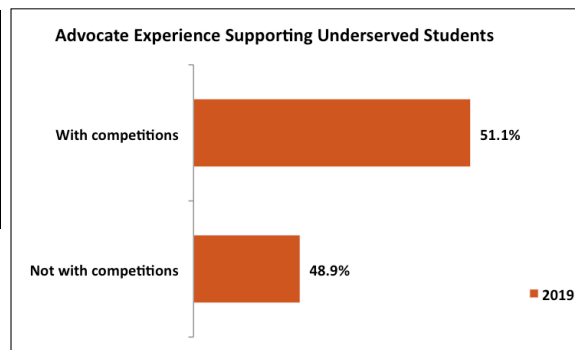
Figure C12. Experience supporting underserved students

Advocates' Roles

Table C13. Advocate Respondents' Roles

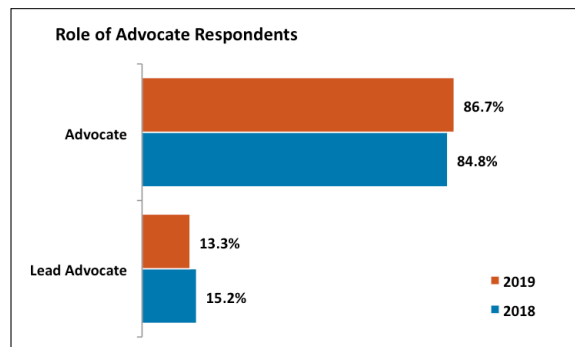| Role	2018		2019	
	n	%	n	%
Advocate	28	84.85%	39	86.67%
Lead Advocate	5	15.15%	6	13.33%
Total	33	100%	45	100%

Figure C13. Role of Advocate respondents

Returning Advocates

Table C14. Advocate Respondents Returning from Previous Year

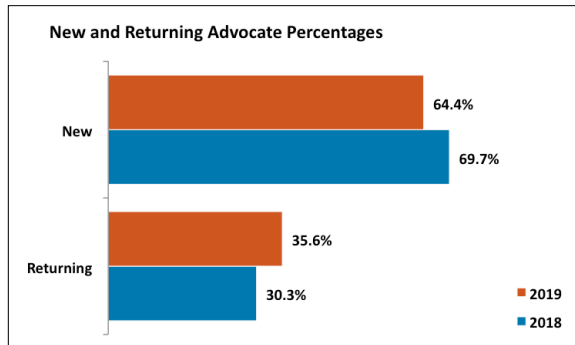| Returning Advocates	2018		2019	
	n	%	n	%
New	23	69.70%	29	64.44%
Returning	10	30.30%	16	35.56%
Total	33	100%	45	100%

Figure C14. Advocate respondents returning

Number of Students Supported of Advocate Respondents

All data for the number of students supported by Advocates for each cohort is given in Table 2 on page 8 of the report. Figures 4 – 6 graphically depict the results.

Demographic Characteristics of Student Respondents

Gender Identity of Students

Table C15. Student Respondent Gender Identity

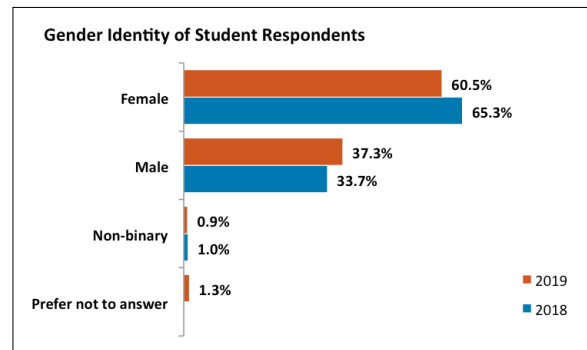| Gender Identity	2018		2019	
	n	%	n	%
Female	64	65.3%	138	60.5%
Male	33	33.7%	85	37.3%
Non-binary	1	1.0%	2	0.9%
Prefer not to answer	0	0.0%	3	1.3%
Total	98	100%	228	100%

Figure C15. Student respondents' gender of students

Students could select up to two option, so numbers will not total N.

C16. Student Respondent Race/Ethnic Identity

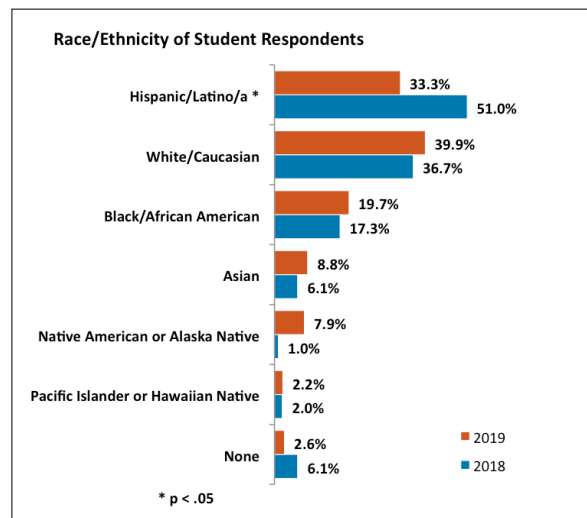| Race/Ethnicity	2018		2019	
	n	%	n	%
Hispanic/ Latino/a *	50	51.02%	76	33.33%
White/Caucasian	36	36.73%	91	39.91%
Black/African American	17	17.35%	45	19.74%
Asian	6	6.12%	20	8.77%
Native American or Alaska Native	1	1.02%	18	7.89%
Pacific Islander or Hawaiian Native	2	2.04%	5	2.19%
None	6	6.12%	6	2.63%

Figure C16. Student respondents' race/ethnicity by cohort

Grade Level of Students

A comparison on of the grade level distributions for the 2018 and 2019 samples is significantly different at $p < .001$.

Table C17. Student Respondent Grade Level

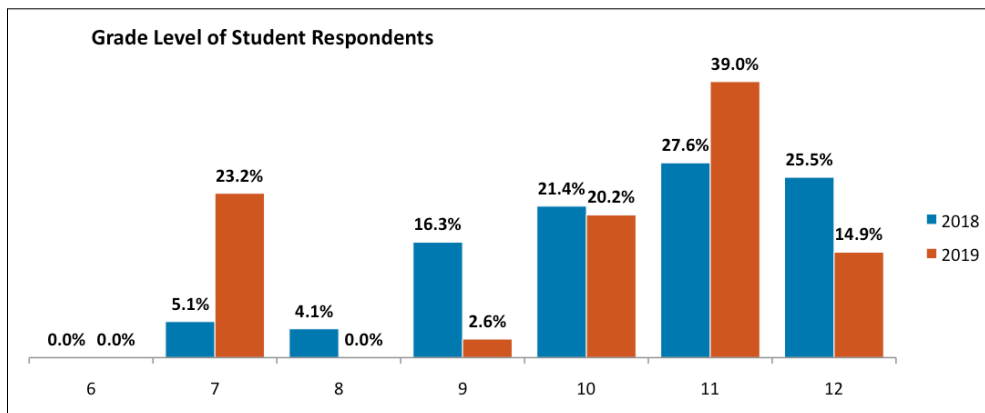| Grade Level	2018		2019	
	n	%	n	%
6	0	0.00%	0	0.00%
7	5	5.10%	53	23.25%
8	4	4.08%	0	0.00%
9	16	16.33%	6	2.63%
10	21	21.43%	46	20.18%
11	27	27.55%	89	39.04%
12	25	25.51%	34	14.91%
Total	98	100%	228	100%

Figure C17. Student respondents' grade level (same as Figure 10, p. 11)

Project Characteristics of Student Respondents

Students Required to Complete Projects

The difference between the two cohorts for whether or not students were required to complete a project was significant at $p < .001$.

Table C18. Student Respondents Required Projects

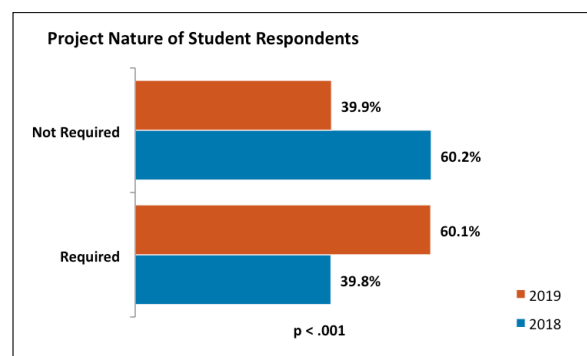| Required	2018		2019	
	n	%	n	%
Required	39	39.80%	137	60.09%
Not Required	59	60.20%	91	39.91%
Total	98	100%	228	100%

Figure C18. Student respondents required to complete projects or not by cohort

70

Student Project Types

The difference between the two cohorts for project types was significant at *p* < .001.

Table C19. Student Respondents' Project Types

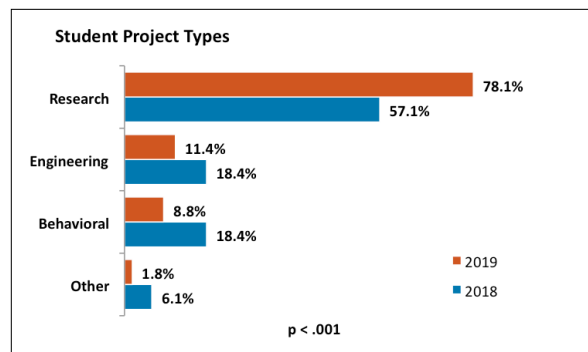| Project Type	2018		2019	
	n	%	n	%
Research	56	57.14%	178	78.07%
Engineering	18	18.37%	26	11.40%
Behavioral	18	18.37%	20	8.77%
Other	6	6.12%	4	1.75%
Total	98	100%	228	100%

Figure C19. Student respondents' project types

Students were given the option to describe other project types. The following are the "other" responses.

Other:
2018:
• Advertising
• Building an outdoor classroom
• Creating a bilingual brochure for our club
• Environmental Engineering
• The Outdoor Classroom
• Urban Barcode Project
2019:
• Chemistry
• "I wouldn't really call it an engineering design project but we basically took two different sequences of a gene, one mutated with sickle cell and another (same exact one) but not mutated since sickle cell is just a single cell mutation. Then we created a music box that was able to play out both strands so you could hear the mutation."
• Material Science
• Recording data

Student Project Status

Table C20. Student Respondents' Project Status

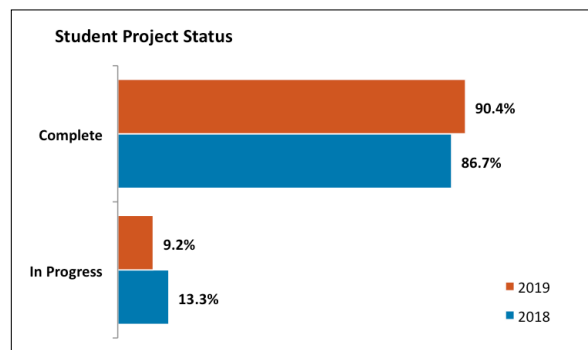| Project Status	2018		2019	
	n	%	n	%
Complete	85	86.73%	206	90.35%
In Progress	13	13.27%	21	9.21%
No Answer	0	0.00%	1	0.44%
Total	98	100%	228	100%

Figure C20. Student respondents' project types

Student Respondents' Reasons for Doing Projects

Students could select up to three reasons from the options in Figure C21, with an "other" option. The differences between the two cohorts on three items were significant.

Table C21. Student Respondents' Reasons for Doing Projects

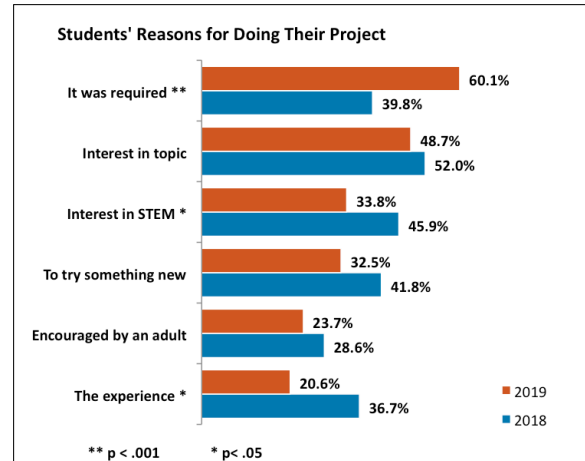| Reason for Doing Project	2018		2019	
	n	%	n	%
It was required **	39	39.80%	137	60.09%
Interest in Topic	51	52.04%	111	48.68%
Interest in STEM *	45	45.92%	77	33.77%
To try something new	41	41.84%	74	32.46%
The experience *	36	36.73%	47	20.61%
Encouraged by an adult	28	28.57%	54	23.68%

Figure C21. Student respondents' reasons for doing projects (same as Figure 13 on page 13)

The following are the "other" reasons students described.

2018:
- As a kid my sister entered competitions and I thought it looked fun so I decided to do it in high school as well.
- I thought it was fun last year
- It sounded like fun to me.
- It was for a grade
- it was required to get a class credit

2019:
- Because I can
- College application
- I don't know
- Marine biology
- [Advocate] made it seem like it was going to be so much fun and I had a blast!!!
- Wanted to enter competitions for scholarships

Student Respondents' Experience With Projects and Competitions

Students were asked for the number of years they had experience with completing projects, being required to complete a project, and entering a competition. On Figures C21 – C23, only responses with more than 5% of student respondents in a cohort are included. Tables include all data.

Table C22. Student Respondents' Number of Years Completing Projects

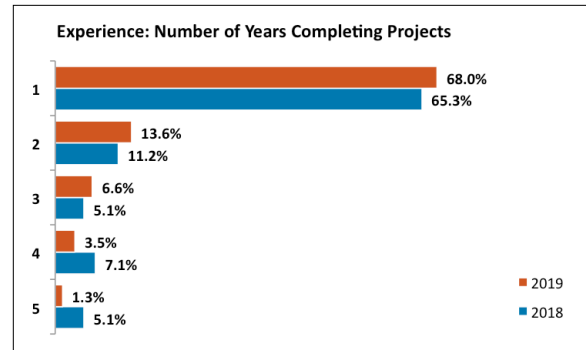| Years	2018		2019	
	n	%	n	%
1	64	65.31%	155	67.98%
2	11	11.22%	31	13.60%
3	5	5.10%	15	6.58%
4	7	7.14%	8	3.51%
5	5	5.10%	3	1.32%
6	3	3.06%	3	1.32%
7	1	1.02%	1	0.44%
8	1	1.02%	0	0.00%
9	0	0.00%	1	0.44%
10	1	1.02%	0	0.00%
11	0	0.00%	1	0.44%
0	0	0.00%	10	4.39%
Total	98	100%	228	100%

Figure C22. Student respondents' number of years of experiences with completing projects

Table C23. Student Respondents' Number of Years Required to Complete a Project

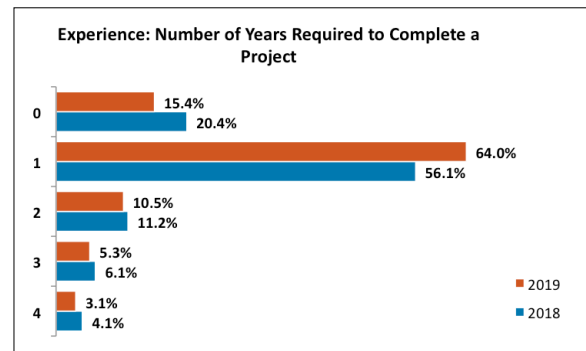| Years	2018		2019	
	n	%	n	%
1	55	56.12%	146	64.04%
2	11	11.22%	24	10.53%
3	6	6.12%	12	5.26%
4	4	4.08%	7	3.07%
5	1	1.02%	4	1.75%
6	0	0.00%	0	0.00%
7	1	1.02%	0	0.00%
0	20	20.41%	35	15.35%
Total	98	100%	228	100%

Figure C23. Student respondents' number of years of experiences with completing required projects

Table C24. Student Respondents' Number of Years Entering a Competition

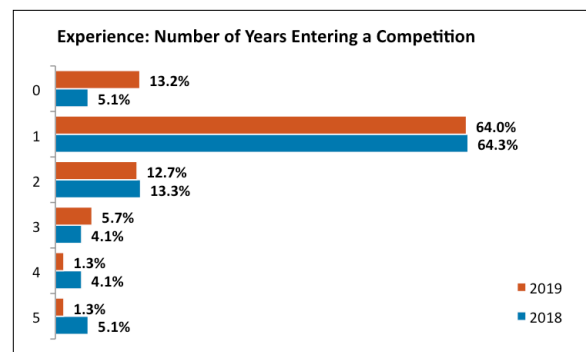| Years	2018		2019	
	n	%	n	%
1	63	64.29%	146	64.04%
2	13	13.27%	29	12.72%
3	4	4.08%	13	5.70%
4	4	4.08%	3	1.32%
5	5	5.10%	3	1.32%
6	3	3.06%	1	1.32%
7	1	1.02%	0	0.44%
0	5	5.10%	30	13.16%
Total	98	100%	228	100%

Figure C24. Student respondents' number of years of experience entering a competition

Where Students Collected Data

Students were asked where they collected their data and could select all that applied, including and option for "other". Only the options selected by at least 5% of student respondents are included in the Figure 25.

Table C25. Where Student Respondents Collected Data

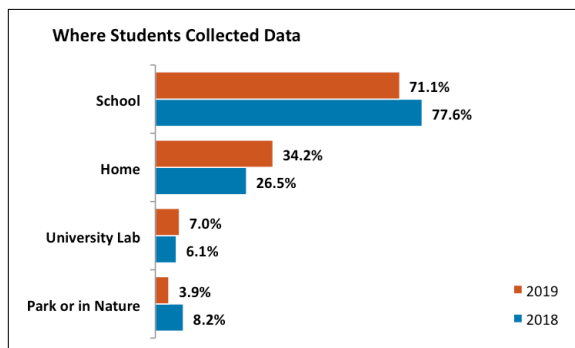| Where Students Collect Data	2018		2019	
	n	%	n	%
School	76	77.55%	162	71.05%
Home	26	26.53%	78	34.21%
University Lab	6	6.12%	16	7.02%
Park/Nature	8	8.16%	9	3.95%
Business Lab	0	0.00%	2	0.88%
Hospital or Vet	0	0.00%	2	0.88%
Farm or Ranch	0	0.00%	1	0.44%

Figure C25. Where student respondents collected data

"Other" data collection locations included the following.

2018:
- A Gym at a Church
- Beaches and Harbors (2 Students from the same Advocate)
- Club lab (5 Students from the same Advocate)
- Internet/Online (3 Students)
- Public Lab (3 Students from the same Advocate)
- Through a survey outside of school

2019:
- A warehouse
- Books/Library (2 Students)
- Gym
- In the middle of nowhere
- Internet/Online (6 Students)
- Local store
- My church
- No data was collected just engineered not in time.
- Parts of D.C (5 Students from the same Advocate)
- Police Department
- Public Places
- Restaurants
- Social media
- USGS lab

When Students Received Help With Projects

Students were asked to select the best possible response to the question of when they received help on their project.

Table C26. When Student Respondents Received Help

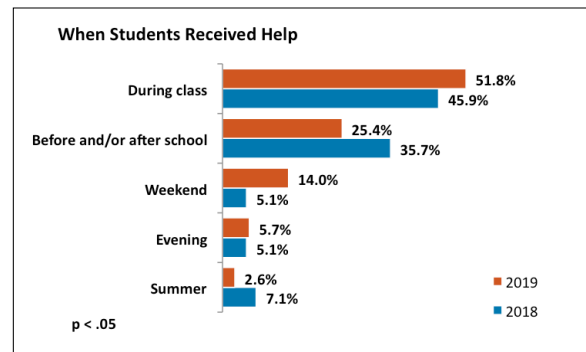| Help	2018		2019	
	n	%	n	%
During class	45	45.92%	118	51.75%
Before and/or after school	35	35.71%	58	25.44%
Evening	5	5.10%	13	5.70%
Weekend	5	5.10%	32	14.04%
Summer	7	7.14%	6	2.63%
Blank	1	1.02%	1	0.44%
Total	98	100%	228	100%

Figure C26. When student respondents received help

Internships

Table C27. Whether or Not Student Respondents Took Part in an Internship

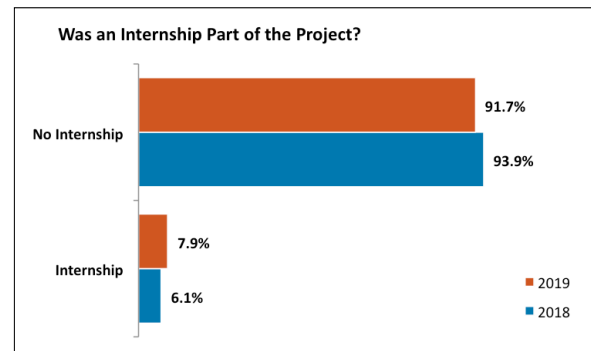| Internship?	2018		2019	
	n	%	n	%
Internship	6	6.12%	18	7.89%
No Internship	92	93.88%	209	91.67%
Blank	0	0.00%	1	0.44%
Total	98	100%	228	100%

Figure C27. Percentage of students with internships as part of project

Trips as Part of Program

In 2019, we asked students if a trip was part of their project or the class or club where they did their project. If they did, we asked how important it was on a scale of one to 100. The average for how important (for just those student respondents who said trips were included) was 79.26 in 2019.

Table C28. Whether or Not a Trip Was Part of Their Projects

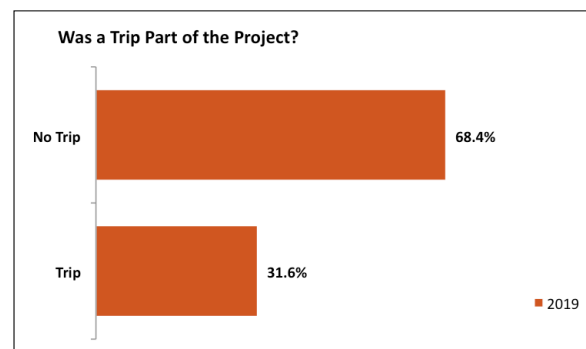| Trip?	2019	
	n	%
Trip	72	31.58%
No Trip	156	68.42%
Blank	0	0.00%
Total	228	100%

Figure C28. Percentage of student respondents with trips as part of project

Competition Experience of Student Respondents

Students were asked if they entered a competition this year (year of the survey). They were then asked what competitions they entered, including an "other" option. Students could select all competitions that applied.

Table C29. Student Respondents Entering Competitions This Year

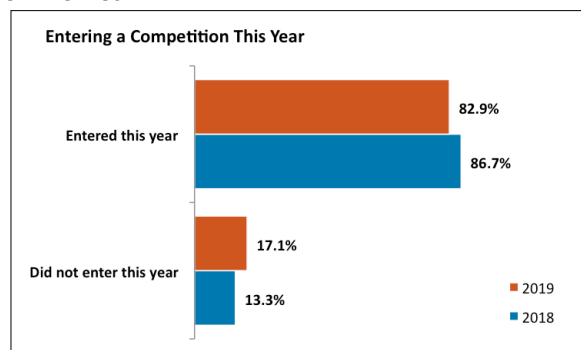| Entered Competition?	2018		2019	
	n	%	n	%
Entered this year	85	86.73%	189	82.89%
Did not enter this year	13	13.27%	39	17.11%
Total	98	100%	228	100%

Figure C29. Percentage of student respondents entering a competition this year (year of survey)

Table C30. Competitions Entered by Student Respondents

| Competitions Entered	2018		2019	
	n	%	n	%
Regional Science Fair	41	41.84%	122	53.51%
School-wide Science Fair *	44	44.90%	106	46.49%
County-wide Science Fair *	26	26.53%	35	15.35%
Junior Science & Humanities Symposium (JSHS)	5	5.10%	18	7.89%
Intel ISEF	8	8.16%	13	5.70%
Regeneron STS	2	2.04%	8	3.51%
BioGENIUS	0	0.00%	7	3.07%
Broadcom MASTERS	0	0.00%	5	2.19%
FFA Agriscience Fair	0	0.00%	2	0.88%
eCybermission *	5	5.10%	1	0.44%
Other Competition	20	20.41%	26	11.40%
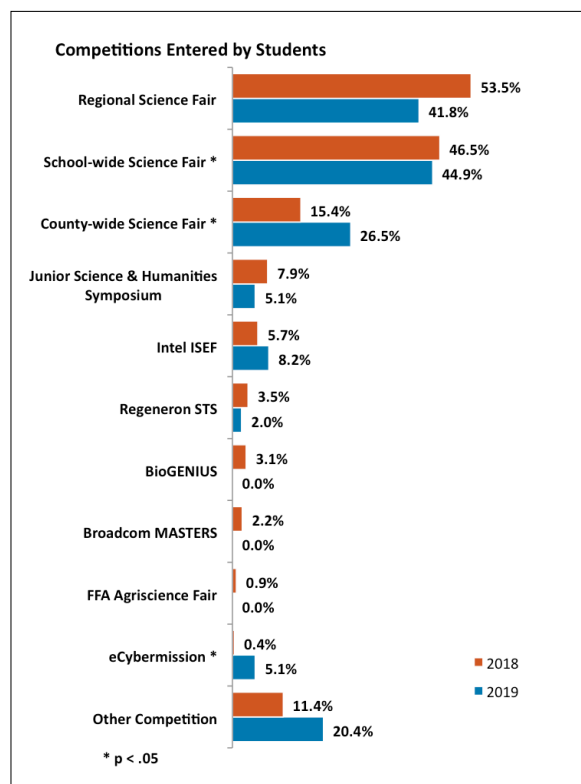
Figure C30. Percentage of student respondents entering each competition by cohort

Students listed the following other competitions:

2018:
- Herndon Science Competition
- Junior Breakthourgh Challenge

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- Sciencepalooza (2 Students from the same Advocate)
- Siemens Competition (4 Students from the same Advocate)
- Southern Utah Science and Engineering Fair (SUSEF) (2 Students from the same Advocate)
- Synopsys Championship (3 Students from the same Advocate)
- Tech Challenge (2 Students from the same Advocate)
- Urban Barcode Project (3 Students from the same Advocate)

2019:
- ACS Research Poster Competition
- Google Science Fair (5 Students from different Advocates)
- Missouri Junior Academy of Science (2 Students from the same Advocate)
- Ozark Science and Engineering Fair (2 Students from the same Advocate)
- Southern Utah Science and Engineering Fair (SUSEF) (2 Students from the same Advocate)
- Urban Barcode Project

Student Respondents Winning Awards

Students were asked if they had won an award this year (the year of the survey). Table C31 and Figure C31 provide the numbers and percentages of students who entered competitions by whether they did or did not win an award. (Totals are for those who entered this year, and percentage is based on the total number of students who entered.)

Table C31. Student Respondents Who Did and Did Not Win Awards This Year

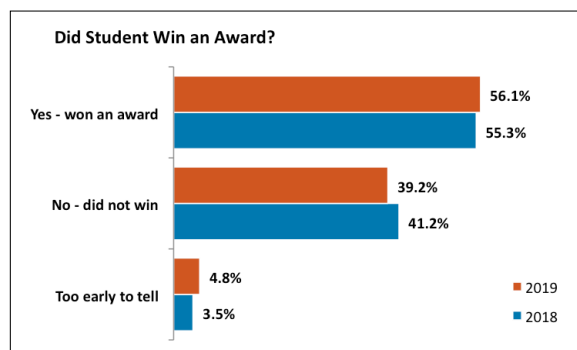| Win Award?	2018		2019	
	n	%	n	%
Yes – won an award	47	55.29%	106	56.08%
No – did not win	35	41.18%	74	39.15%
Too early to tell	3	3.53%	9	4.76%
Total	85	100%	189	100%

Figure C31. Percentage of student respondents who entered a competition this year and won an award

College Plans of Student Respondents

Table C32. Student Respondents' College Plans

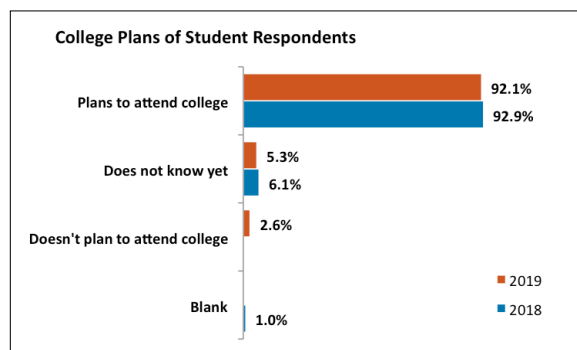| College Plans	2018		2019	
	n	%	n	%
Plans to attend college	91	92.86%	210	92.11%
Does not know yet	6	6.12%	12	5.26%
Doesn't plan to attend college	0	0.00%	6	2.63%
Blank	1	1.02%	0	0.00%
Total	98	100%	228	100%

Figure C32. Percentage of student respondents who plan to attend college

Discussion of Findings

This section follows the findings presented in the report beginning on page 15 for Advocates and their students.

Advocate Findings

Advocate Gain Scores as a Measure of Impact

Advocates rated a series of statements on a scale of 1 (lowest) to 10 (highest) for before and after their participation in the Advocate Grant Program. The results in Figures 16 (page 16), 17 (page 17) and 18 (page 18) are not repeated here. The tables below provide the means and standard deviations (SD) on the *Before*, *After*, and *Gain* scores for each cohort.

Table C33. Advocate respondents' means for the 2017-2018 cohort (*N*=33)

2018	BEFORE		AFTER		GAIN	
	Mean	SD	Mean	SD	Mean	SD
Awareness of the Society as resource for teachers	3.39	2.82	9.24	1.39	5.85	3.06
Awareness of deadlines for competitions	4.06	2.98	8.48	1.58	4.42	2.73
Awareness of competition eligibility requirements	3.91	2.53	8.27	1.44	4.36	2.41
Feeling of camaraderie in student research community	3.73	2.36	7.94	1.73	4.21	2.39
Awareness of range of competitions available	4.88	2.78	9.06	0.97	4.18	2.53
Awareness of how to support students in filling out entry forms	4.42	2.88	8.52	1.82	4.09	2.72
Comfort with competition application process	3.91	2.51	7.85	1.75	3.94	2.29
Awareness of competitions as source of monetary awards	5.06	3.54	8.94	1.32	3.88	3.06
Confidence in guiding students through competitions	4.55	2.40	8.39	1.35	3.85	2.14
Peers recognize expertise in supporting students to enter competitions	4.94	3.08	8.63	1.73	3.70	2.79
Ability to support students in entering competitions	4.85	2.72	8.34	1.36	3.50	2.21
Motivation to recruit underserved students to participate in projects	5.91	3.10	9.41	1.03	3.50	2.97
Passion for getting students involved in competitions	5.58	3.02	9.06	1.30	3.48	2.62
Peers recognize expertise in supporting students projects	5.44	2.84	8.91	1.21	3.47	2.59
Ability to support students in preparing competitive entries	4.94	2.70	8.33	1.83	3.39	2.38
Motivation to recruit underserved students to enter comp	6.70	2.89	9.52	0.87	2.82	2.94
Ability to support students in conducting projects	5.79	2.25	8.50	1.32	2.71	1.45
Awareness of role of competitions in boosting college acceptance	6.30	3.26	8.67	1.88	2.36	2.87
Ability to support students in organizing their research	5.70	2.49	8.00	1.41	2.30	1.88
Ability to support students in developing or improving organizational skills	6.18	1.78	8.48	1.28	2.30	1.51
Ability to support students in organizing presentations	6.06	2.33	8.18	1.61	2.12	1.76
Ability to support students in developing or improving time management skills	6.00	1.94	7.91	1.68	1.91	1.55

Table C3[5]. Advocate respondents' means for the 2018-2019 cohort (*N*=45)

2019	BEFORE		AFTER		GAIN	
	Mean	SD	Mean	SD	Mean	SD
Awareness of the Society as resource for teachers	3.67	2.92	9.50	0.81	5.83	3.12
Feeling of camaraderie in student research community	4.29	2.36	8.91	1.44	4.62	2.44
Peers recognize expertise in supporting students to enter competitions	4.67	2.65	9.11	1.19	4.44	2.55
Awareness of deadlines for competitions	4.46	2.76	8.63	1.45	4.17	2.77
Awareness of how to support students in filling out entry forms	4.98	2.63	9.09	1.04	4.11	2.67
Awareness of range of competitions available	4.64	2.66	8.71	1.49	4.07	2.47
Comfort with competition application process	4.56	2.46	8.58	1.34	4.02	2.35
Awareness of competition eligibility requirements	4.78	2.70	8.69	1.26	3.91	2.57
Peers recognize expertise in supporting students projects	5.38	2.47	9.22	1.09	3.84	2.20
Ability to support students in entering competitions	5.13	2.57	8.87	1.06	3.73	2.37
Motivation to recruit underserved students to enter comp	5.69	2.71	9.42	1.14	3.73	2.42
Confidence in guiding students through competitions	5.36	2.50	8.82	1.51	3.47	2.15
Awareness of competitions as source of monetary awards	5.45	2.90	8.91	1.36	3.45	2.73
Passion for getting students involved in competitions	6.16	2.51	9.53	1.01	3.38	2.16
Motivation to recruit underserved students to participate in projects	6.27	2.60	9.62	0.72	3.36	2.52
Ability to support students in preparing competitive entries	5.58	2.60	8.80	1.18	3.22	2.21
Awareness of role of competitions in boosting college acceptance	5.76	2.96	8.89	1.35	3.13	2.72
Ability to support students in organizing presentations	6.02	2.37	8.89	1.09	2.87	2.20
Ability to support students in organizing their research	5.84	2.50	8.69	1.18	2.84	2.04
Ability to support students in conducting projects	6.24	2.40	8.96	1.11	2.71	1.98
Ability to support students in developing or improving time management skills	5.84	2.25	8.49	1.27	2.64	2.20
Ability to support students in developing of or improving organizational skills	6.07	2.09	8.56	1.14	2.49	1.88

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[5] There is no Figure C33 or C34. To keep table and accompanying figure numbers the same, these figure numbers are skipped

Program Benefits to Advocates

Advocates could select up to three program benefits to themselves and their school or organization. One 2019 Advocate provided another benefit, "funding for time spent with students."

Table C35. Advocate Grant Program Benefits According to Advocate Respondents

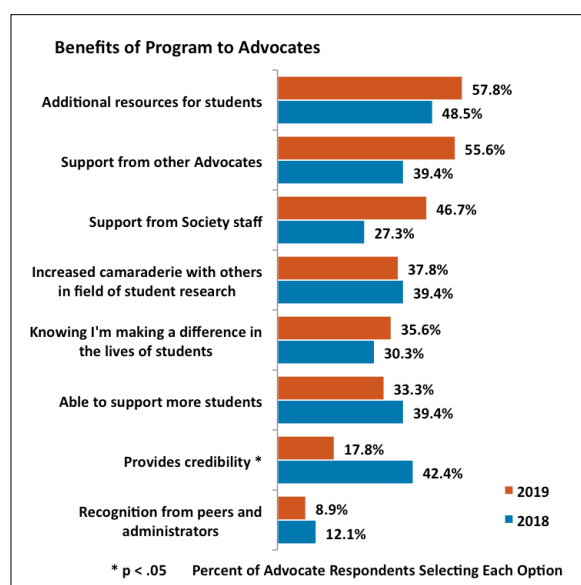| Benefits to Advocates	2018		2019	
	n	%	n	%
Additional resources for students	16	48.48%	26	57.78%
Support from other Advocates	13	39.39%	25	55.56%
Support from Society staff	9	27.27%	21	46.67%
Increased camaraderie with others in field of student research	13	39.39%	17	37.78%
Knowing I'm making a difference in the lives of students	10	30.30%	16	35.56%
Able to support more students	13	39.39%	15	33.33%
Provides credibility *	14	42.42%	8	17.78%
Recognition from peers & administrators	4	12.12%	4	8.89%

Figure C35. Program benefits to Advocate respondents (Figure 19, page 20)

Table C36. Advocate Grant Program Benefits to Schools and Organizations of Advocates

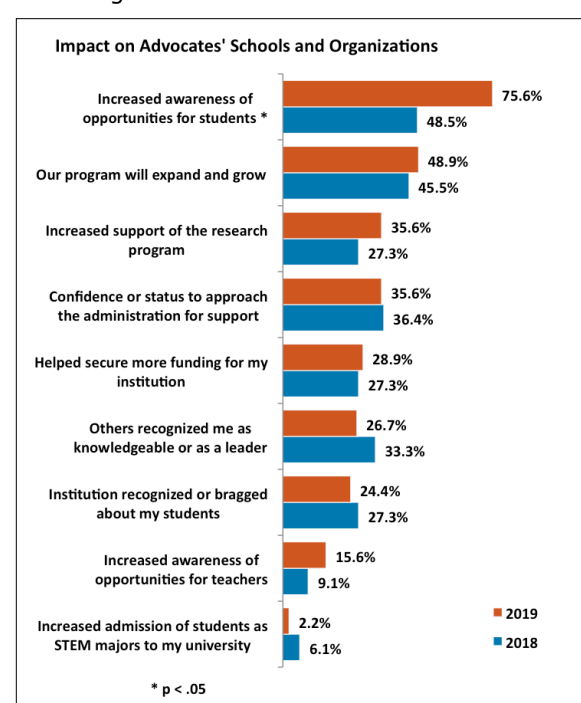| Benefits to Schools/Organizations	2018		2019	
	n	%	n	%
Confidence or status to approach administration for support	12	36.36%	16	35.56%
Helped secure more funding for my institution	9	27.27%	13	28.89%
Increased admission of students as STEM majors to university	2	6.06%	1	2.22%
Increased support of the research program	9	27.27%	16	35.56%
Inc. awareness of opportunities for students *	16	48.48%	34	75.56%
Inc. awareness of opportunities for teachers	3	9.09%	7	15.56%
Others recognized me as knowledge-able or as a leader	11	33.33%	12	26.67%
Institution recognized or bragged about my students	9	27.27%	11	24.44%
Our program will expand and grow	15	45.45%	22	48.89%
I've seen no clear impact on my institution	0	0.00%	0	0.00%

Figure C36. Program benefits to Advocates' schools and organizations (Figure 20, page 21)

In addition to the options listed in Table C36, one Advocate added, "Provided me with the confidence and status to provide this opportunity for students regardless of whether administration support science research financially or not."

Advocate Respondents' Work Toward Goals

Beginning with the 2019 survey, Advocates were asked about their progress on achieving the goals they set at the beginning of the program.

Table C37. 2019 Advocate Respondents Goal Attainment

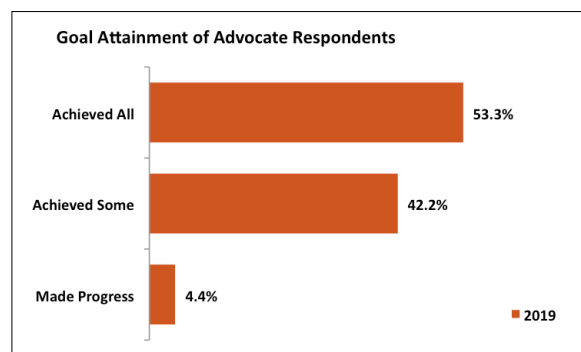| Goal Attainment	2019	
	n	%
Achieved All	24	53.33%
Achieved Some	19	42.22%
Made Progress	2	4.44%
Unable to Achieve Goal	0	0.00%
Don't Remember Goals	0	0.00%
Total	45	100%

Figure C37. 2019 Advocate respondents' goal attainment (Figure 21, page 21)

Helpful Program Elements

Beginning with the 2019 survey, Advocate respondents rated the helpfulness of various program elements using a scale of one (not helpful) to ten (very helpful).

Table C38. 2019 Advocate Respondents' Average Ratings of Program Element Helpfulness

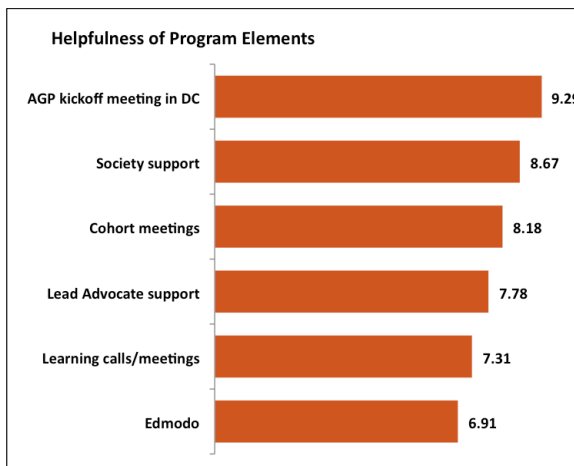| Program Elements	Mean	N	SD	SE[6]
AGP kickoff meeting in DC in June	9.29	45	2.12	0.32
Individual support from Society staff	8.67	45	2.07	0.31
Cohort calls/video conferencing	8.18	45	1.98	0.30
Individual support from Lead Advocates	7.78	45	3.36	0.50
Learning calls/meetings	7.31	45	3.01	0.45
Edmodo online community	6.91	45	3.22	0.48

Figure C38. 2019 Average ratings of program element helpfulness (Figure 22, page 22)

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[6] Standard error

Program Stipends

Table C39. How Stipends Were Received by Advocates

How Stipends Received	2018		2019	
	n	%	n	%
Directly to Me	29	87.88%	40	88.89%
To My Institution	3	9.09%	5	11.11%
Missing Data	1	3.03%	0	0.00%
Total	33	100%	45	100%

How Advocate Respondents Received Stipend

Figure C39. How Advocate respondents received their stipends
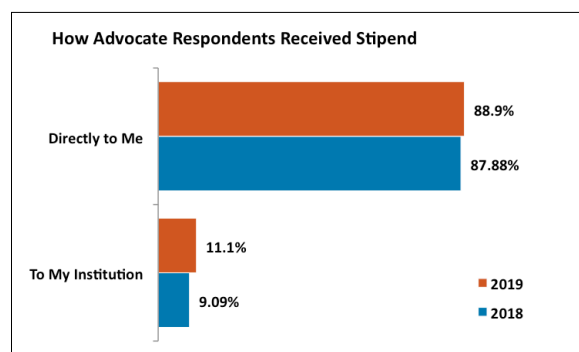
Table C40. 2019 Advocate Respondents' Opinion on Whether Stipend Was Enough

Enough?	2019	
	n	%
Yes	42	93.33%
No	3	6.67%
Total	45	100%

Did Advocate Respondents Think Stipend Enough?

Figure C40. Stipend enough?
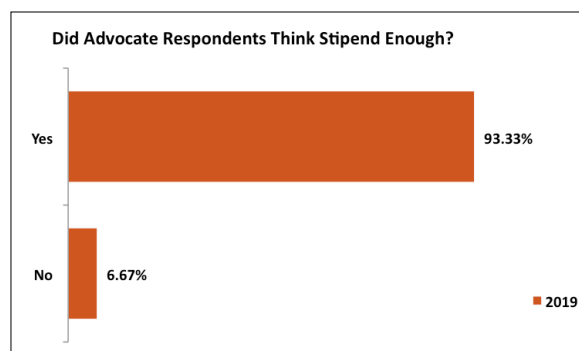
Advocates could select all options for how they used their stipends. Additional comments on how they used their stipends are listed below.

Table C41. How Advocate Respondents' Used Their Stipends

How Stipend Used	2018		2019	
	n	%	n	%
Food for students during meetings or other group times	20	60.61%	33	73.33%
Supplies for student projects *	12	36.36%	28	62.22%
Rewards or awards for students *	8	24.24%	21	46.67%
Travel to competitions for students	9	27.27%	13	28.89%
Entry fee for competitions	8	24.24%	13	28.89%
Clothes for students (for competitions or group identity)	6	18.18%	13	28.89%
Student transportation to colleges, labs, etc *	3	9.09%	13	28.89%
Food/dinner for special occasion outside group work	5	15.15%	12	26.67%
Used stipend only for myself	6	18.18%	7	15.56%
Advocate travel to conferences and PD	1	3.03%	3	6.67%
Substitute teacher for AGP related time	0	0.00%	1	2.22%

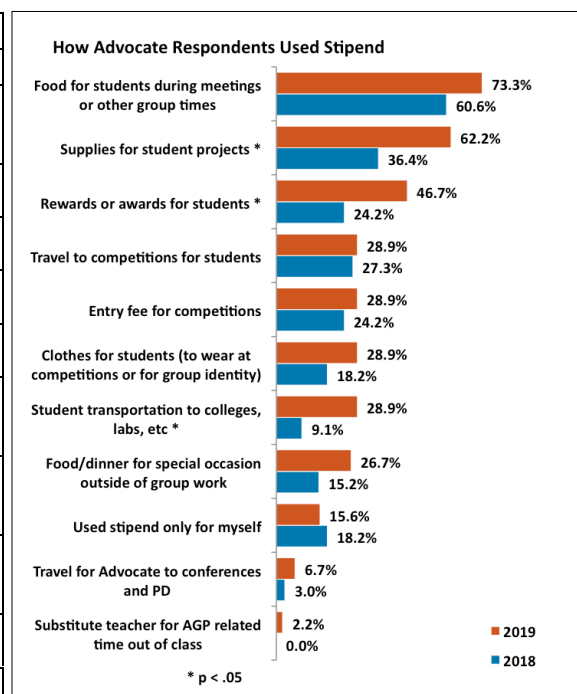**How Advocate Respondents Used Stipend**

* p < .05

Figure C41. How Advocate respondents used their stipends (same as Figure 23, p. 23)

2018:
- Donated to school to cover some of the costs that school already has done for the STEM research competitions.
- summer wage for me. I opened my lab in the afternoons.
- hotel rooms for families of students to attend competition
- I also used it for supplies and travel to competitions.
- I am still waiting for my final payment and received no response to my e-mails.
- Purchased graduation stoles for alumni of the science research cohort to wear at their graduation ceremony

2019:
- I have yet to receive any money.
- Equipment

Advocate Plans to Continue Supporting Underserved Students

Table C42. Advocate Respondents' Plan to Continue to Support Underserved Students or Not

Plan to Continue	2018		2019	
	n	%	n	%
Yes	29	87.88%	42	93.33%
No	3	9.09%	3	6.67%
Missing Data	1	3.03%	0	0.00%
Total	33	100%	45	100%

Figure C42. Advocate plans to continue supporting underserved students
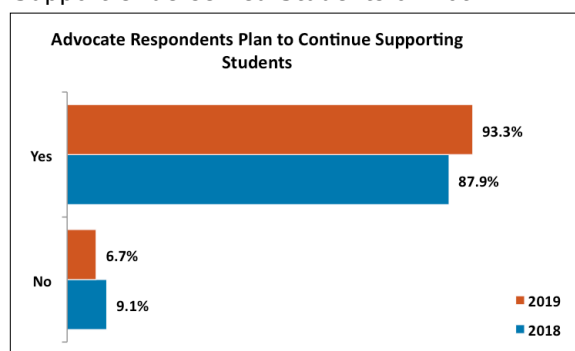
How the Society Could Help Advocates Continue Supporting Underserved Students

Advocates could select all options for ways the Society could help them continue to support underserved students.

Table C43. Ways the Society Could Help Advocates Continue Supporting Underserved Students

| Society Help	2018		2019	
	n	%	n	%
Help me to find funding for equipment	19	65.52%	30	71.43%
Opportunities to meet other similar teachers in region in person	16	55.17%	27	64.29%
Opportunities to meet other similar teachers in an online community	12	41.38%	24	57.14%
Help me garner support for my program with administrators	10	34.48%	17	40.48%
Additional training on the competitions I didn't choose this year	8	27.59%	11	26.19%
Help me to recruit more teachers at my school to help	8	27.59%	11	26.19%
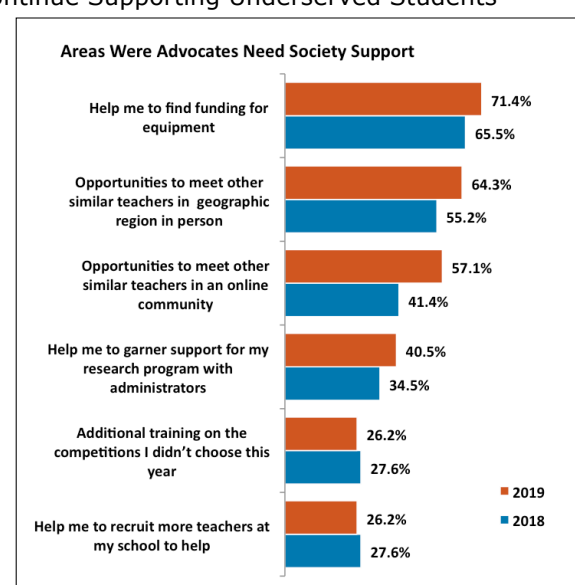
Figure C43. Ways the Society can help Advocates continue supporting underserved students (Same as Figure 24, p. 25)

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Advocates provided other ways the Society could help.

2018:
- You are welcome to my school site for a local meeting
- Be ready to advocate for the students with organizations that prevent them from competing.
- I didn't submit an application to be an Advocate again, because I don't agree with the support of Regeneron, due to their use of embryonic stem cells.
- I would like to be involved in building an online community promoting science fairs and reaching out to educators in countries I have lived in/ worked in such as Canada, the UK, India, Kenya etc. and possibly doing some grant writing to help fund their participation.
- Continue sending email about awesome ideas and opportunities every once in a while. I love getting the science news emails. Maybe a listserve like that.
- Send additional surveys to learn from our applications of what we learned or when we plan to re-engage in the advocate program.

2019:
- Help create a network of college professors who are interested in helping high school students or allowing them in their labs.

Student Findings

Where Students Turned for Help

Students were asked where they turned for help on a variety of project aspects. The following tables and figures provide the details behind Figures 25 and 26 on page 29 of the report. Figures include only items with over 5% of responses, sorted by 2019 percentages. Tables include all data, in order of options on the survey.

Table C44. Where Students Turned for Help With Projects

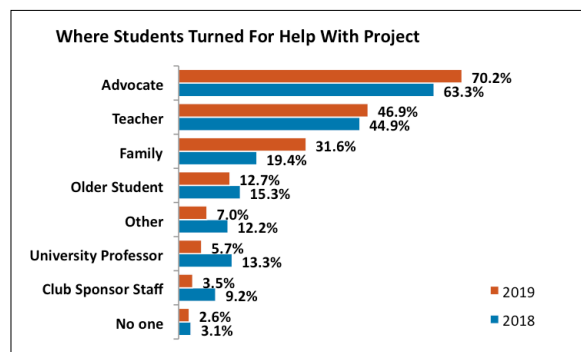| Project	2018		2019	
	n	%	n	%
Advocate	62	63.27%	160	70.18%
Teacher	44	44.90%	107	46.93%
Club Staff	9	9.18%	8	3.51%
Professor	13	13.27%	13	5.70%
Older Student	15	15.31%	29	12.72%
Family	19	19.39%	72	31.58%
No one	3	3.06%	6	2.63%
Other	12	12.24%	16	7.02%

Figure C44. Where students turned for help with their projects in general

Responses to the "Other" category include the following.

2018:
- College Students (2 Students from the same Advocate)
- Friends/Peers (2 Students)
- Me
- Scientific Researcher (3 Students)
- Teammates (4 Students from the same Advocate)

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2019:
- A student in the same grade
- Friend/Peers (7 Students)
- My partner(s) (5 Students)
- Police Officers
- Qualified Scientist
- Sponsor

Table C45. Where Students Turned for Help Selecting a STEM Topic

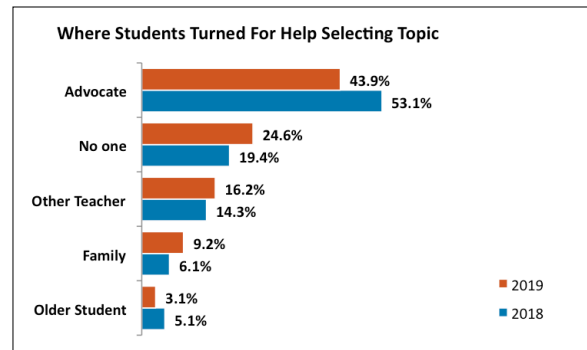| Selecting Topic	2018		2019	
	n	%	n	%
Advocate	52	53.06%	100	43.86%
Teacher	14	14.29%	37	16.23%
Club Staff	1	1.02%	2	0.88%
Professor	1	1.02%	4	1.75%
Older Student	5	5.10%	7	3.07%
Family	6	6.12%	21	9.21%
No one	19	19.39%	56	24.56%
Blank	0	0.00%	1	0.44%
Total	98	100%	228	100%

Figure C45. Where students turned for help with selecting a topic

Table C46. Where Students Turned for Help With References

References	2018		2019	
	n	%	n	%
Advocate	53	54.08%	100	43.86%
Teacher	20	20.41%	33	14.47%
Club Staff	2	2.04%	0	0.00%
Professor	5	5.10%	5	2.19%
Older Student	2	2.04%	9	3.95%
Family	1	1.02%	12	5.26%
No one	15	15.31%	66	28.95%
Blank	0	0.00%	3	1.32%
Total	98	100%	228	100%

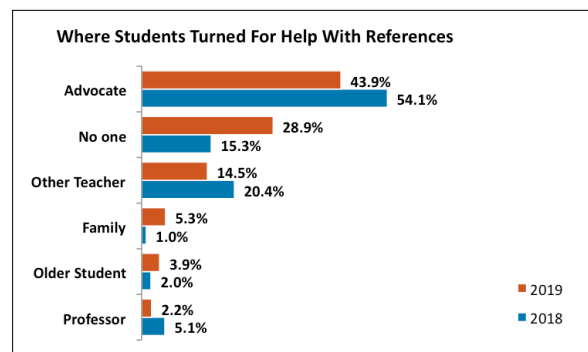*Figure C46.* Where students turned for help with references

Table C47. Where Students Turned for Help With Procedures

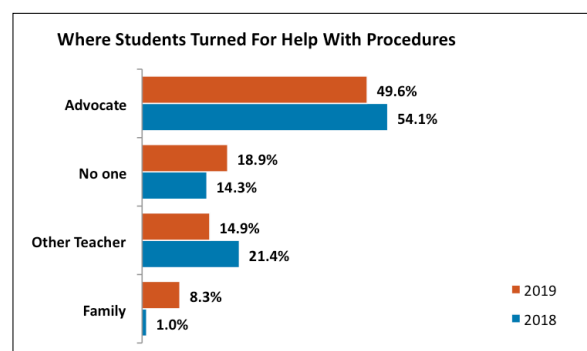| Procedures	2018		2019	
	n	%	n	%
Advocate	53	54.08%	113	49.56%
Teacher	21	21.43%	34	14.91%
Club Staff	2	2.04%	1	0.44%
Professor	4	4.08%	7	3.07%
Older Student	2	2.04%	8	3.51%
Family	1	1.02%	19	8.33%
No one	14	14.29%	43	18.86%
Blank	1	1.02%	3	1.32%
Total	98	100%	228	100%

Figure C47. Where students turned for help with procedures

Table C48. Where Students Turned for Help With Process

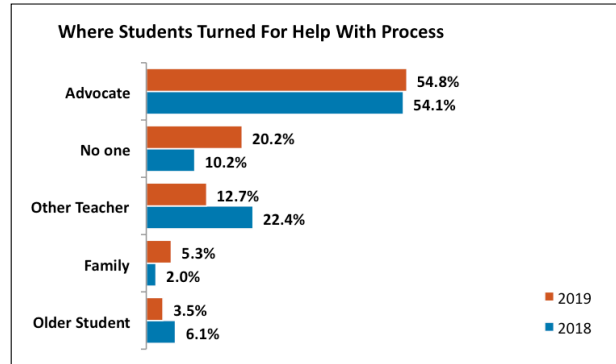| Process	2018		2019	
	n	%	n	%
Advocate	53	54.08%	125	54.82%
Teacher	22	22.45%	29	12.72%
Club Staff	2	2.04%	1	0.44%
Professor	3	3.06%	2	0.88%
Older Student	6	6.12%	8	3.51%
Family	2	2.04%	12	5.26%
No one	10	10.20%	46	20.18%
Blank	0	0.00%	5	2.19%
Total	98	100%	228	100%

Figure C48. Where students turned for help with process

Table C49. Where Students Turned for Help With Equipment

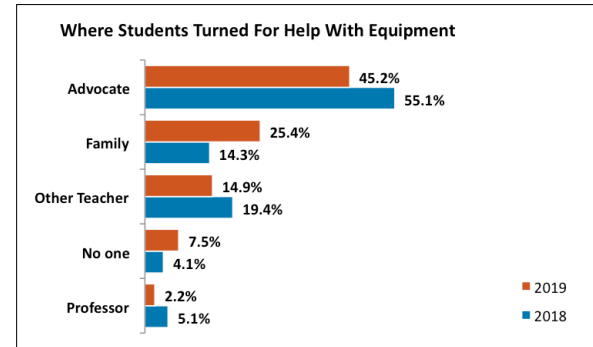| Equipment	2018		2019	
	n	%	n	%
Advocate	54	55.10%	103	45.18%
Teacher	19	19.39%	34	14.91%
Club Staff	1	1.02%	3	1.32%
Professor	5	5.10%	5	2.19%
Older Student	1	1.02%	3	1.32%
Family	14	14.29%	58	25.44%
No one	4	4.08%	17	7.46%
Blank	0	0.00%	5	2.19%
Total	98	100%	228	100%

Figure C49. Where students turned for help with equipment

Table C50. Where Students Turned for Help Finding Experts

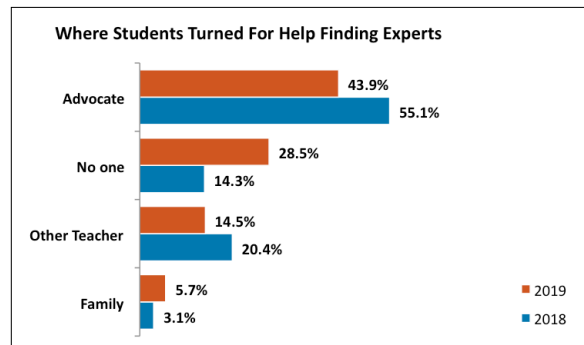| Experts	2018		2019	
	n	%	n	%
Advocate	54	55.10%	100	43.86%
Teacher	20	20.41%	33	14.47%
Club Staff	2	2.04%	3	1.32%
Professor	4	4.08%	4	1.75%
Older Student	1	1.02%	3	1.32%
Family	3	3.06%	13	5.70%
No one	14	14.29%	65	28.51%
Blank	0	0.00%	7	3.07%
Total	98	100%	228	100%

Figure C50. Where students turned for help finding experts

Table C51. Where Students Turned for Help Organizing Data

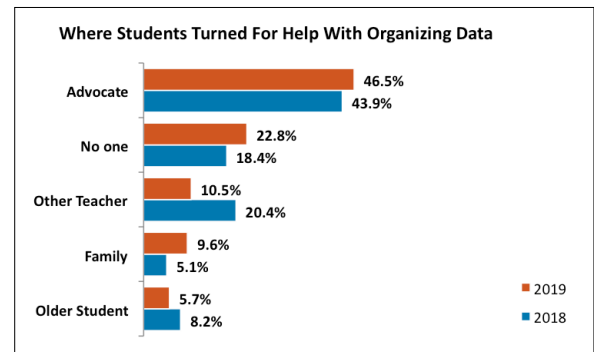| Organizing Data	2018		2019	
	n	%	n	%
Advocate	43	43.88%	106	46.49%
Teacher	20	20.41%	24	10.53%
Club Staff	1	1.02%	2	0.88%
Professor	3	3.06%	4	1.75%
Older Student	8	8.16%	13	5.70%
Family	5	5.10%	22	9.65%
No one	18	18.37%	52	22.81%
Blank	0	0.00%	5	2.19%
Total	98	100%	228	100%

Figure C51. Where students turned for help organizing data

Table C52. Where Students Turned for Help Writing

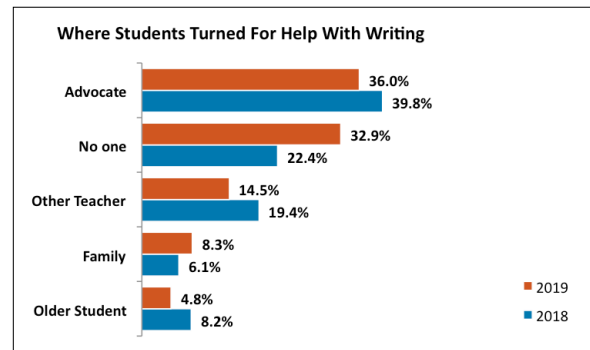| Writing	2018		2019	
	n	%	n	%
Advocate	39	39.80%	82	35.96%
Teacher	19	19.39%	33	14.47%
Club Staff	1	1.02%	2	0.88%
Professor	3	3.06%	2	0.88%
Older Student	8	8.16%	11	4.82%
Family	6	6.12%	19	8.33%
No one	22	22.45%	75	32.89%
Blank	0	0.00%	4	1.75%
Total	98	100%	228	100%

Figure C52. Where students turned for help writing

Table C53. Where Students Turned for Help With Deadlines

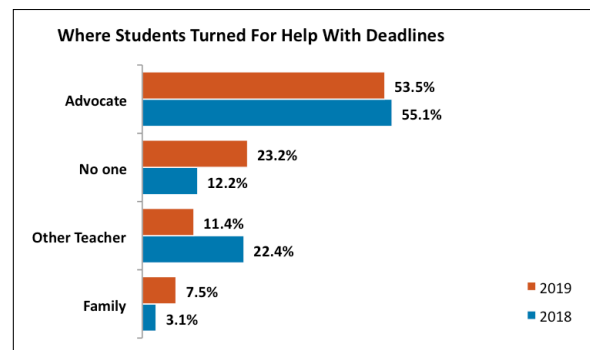| Deadlines	2018		2019	
	n	%	n	%
Advocate	54	55.10%	122	53.51%
Teacher	22	22.45%	26	11.40%
Club Staff	1	1.02%	1	0.44%
Professor	2	2.04%	2	0.88%
Older Student	3	3.06%	3	1.32%
Family	3	3.06%	17	7.46%
No one	12	12.24%	53	23.25%
Blank	1	1.02%	4	1.75%
Total	98	100%	228	100%

Figure C53. Where students turned for help with meeting deadlines

Table C54. Where Students Turned for Help Identifying Competitions to Enter

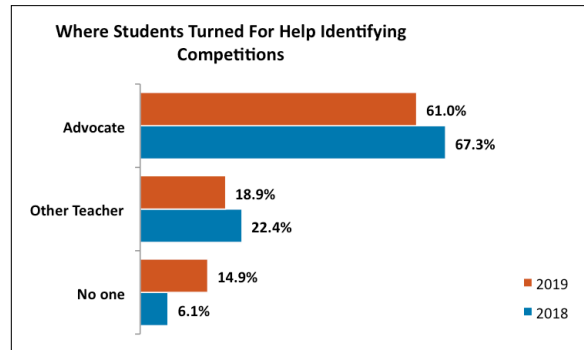| Identifying Competitions	2018		2019	
	n	%	n	%
Advocate	66	67.35%	139	60.96%
Teacher	22	22.45%	43	18.86%
Club Staff	2	2.04%	1	0.44%
Professor	1	1.02%	1	0.44%
Older Student	1	1.02%	1	0.44%
Family	0	0.00%	5	2.19%
No one	6	6.12%	34	14.91%
Blank	0	0.00%	4	1.75%
Total	98	100%	228	100%

Figure C54. Where students turned for help identifying competitions to enter

Table C55. Where Students Turned for Help With Competition Rules

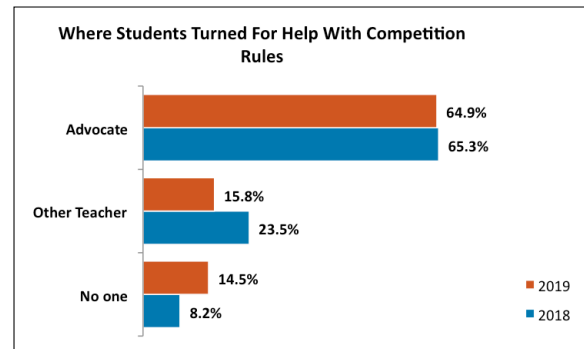| Competition Rules	2018		2019	
	n	%	n	%
Advocate	64	65.31%	148	64.91%
Teacher	23	23.47%	36	15.79%
Club Staff	1	1.02%	0	0.00%
Professor	0	0.00%	1	0.44%
Older Student	2	2.04%	1	0.44%
Family	0	0.00%	3	1.32%
No one	8	8.16%	33	14.47%
Blank	0	0.00%	6	2.63%
Total	98	100%	228	100%

Figure C55. Where students turned for help with competition rules

Table C56. Where Students Turned for Help Entering Competitions

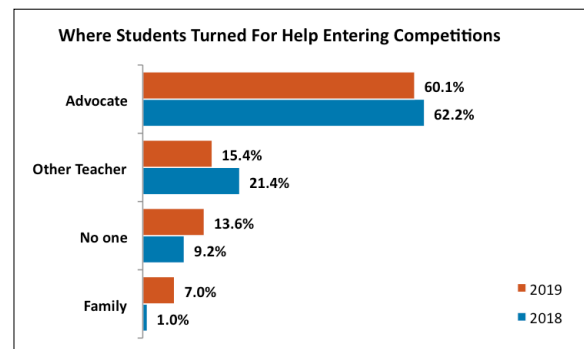| Entering Competitions	2018		2019	
	n	%	n	%
Advocate	61	62.24%	137	60.09%
Teacher	21	21.43%	35	15.35%
Club Staff	2	2.04%	0	0.00%
Professor	1	1.02%	1	0.44%
Older Student	3	3.06%	1	0.44%
Family	1	1.02%	16	7.02%
No one	9	9.18%	31	13.60%
Blank	0	0.00%	7	3.07%
Total	98	100%	228	100%

Figure C56. Where students turned for help entering competitions

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Table C57. Where Students Turned for Help With Transportation

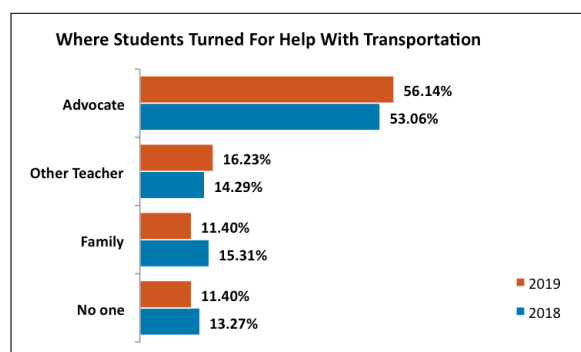| Transportation	2018		2019	
	n	%	n	%
Advocate	52	53.06%	128	56.14%
Teacher	14	14.29%	37	16.23%
Club Staff	2	2.04%	1	0.44%
Professor	0	0.00%	1	0.44%
Older Student	1	1.02%	1	0.44%
Family	15	15.31%	26	11.40%
No one	13	13.27%	26	11.40%
Blank	1	1.02%	8	3.51%
Total	98	100%	228	100%

Figure C57. Where students turned for help with transportation

Student Gain Scores as a Measure of Impact

Students rated a series of statements on a scale of 1 (lowest) to 10 (highest) for before and after their projects. Only scores from the 2019 survey are reported. Missing data from 2018 respondents for *Before* and *After* scores did not allow for meaningful results for this cohort. Figures 27 - 31 (pages 30-32) are not repeated here. Table C58 provides the *Before*, *After*, and *Gain* scores for the 2019 cohort of students depicted in those figures (data sorted in the order in Figures 28-30; i.e., from highest *Gain* to lowest within each category). (To keep table and accompanying figure numbers the same, there is no Figure C58.)

Table C58. Student respondents' means for the 2018-2019 cohort (*N*=228)

Mean Responses for 2018-2019 Cohort	BEFORE		AFTER		GAIN	
	Mean	SD	Mean	SD	Mean	SD
Knowledge						
My STEM topic	4.29	2.31	7.70	2.04	3.41	2.59
Other STEM topics	4.01	2.24	6.03	2.35	2.02	1.99
The scientific process	5.61	2.40	7.48	2.05	1.87	2.03
The engineering design process	4.76	2.48	6.52	2.39	1.75	2.03
How STEM supports my community	5.11	2.66	6.74	2.70	1.63	2.24
Options for STEM careers	4.99	2.70	6.59	2.51	1.59	2.00
Options for education after high school	6.25	2.67	7.40	2.49	1.15	1.67
Confidence and Interest						
My interest in participating in STEM activities	5.52	2.86	7.27	2.58	1.76	2.06
My confidence in handling STEM activities	5.46	2.57	7.21	2.19	1.75	1.89
The value I place on scientific research	5.91	2.49	7.48	2.31	1.58	1.93
My confidence that I can be successful if I put my mind to something	6.59	2.68	8.04	2.02	1.45	1.81
My comfort in working with adults	6.14	2.57	7.59	2.21	1.45	1.86
My confidence in serving as a role model to younger students	6.36	2.61	7.72	2.26	1.36	1.66
My interest in a STEM related career	6.65	3.16	7.81	2.68	1.17	1.92
My interest in taking science and math classes in high school and beyond	6.90	2.87	7.86	2.53	0.96	1.59
My interest in going to college	8.36	2.62	9.02	1.96	0.66	1.60

Awareness						
Competitions help you get accepted into the college or university	5.61	3.13	8.15	2.29	2.54	2.94
Competitions give prizes (scholarships or monetary awards)	5.60	3.18	7.97	2.35	2.37	2.73
Skills						
Ability to present my project to scientists or engineers	5.06	2.42	6.93	2.23	1.87	2.06
Writing a scientific journal article	4.53	2.38	6.36	2.25	1.83	1.97
Ability to present my research to other students	5.93	2.38	7.71	1.82	1.78	1.90
Ability to present my project to the general public	5.27	2.56	7.01	2.26	1.74	2.11
Oral presentation skills	5.61	2.07	7.32	1.82	1.71	1.76
Time management	5.76	1.97	7.10	1.86	1.34	1.75
Writing skills	6.34	1.81	7.40	1.62	1.06	1.55
Meeting deadlines	6.72	2.39	7.68	2.18	0.96	1.79

Percentages of Students Unlikely to Complete Projects or Enter Competitions Without Advocate Support

Students rated their likelihood of completing projects and entering competitions without their Advocate's support on a scale of 0 (unlikely) to 100 (likely). Averages are presented below. The lower the average, the less likely the students were to complete or enter projects without Advocate support; i.e., low averages reflect a high need for Advocate support.

Table C59. Average Likelihood of Students Completing and Entering Projects Without Advocate Support

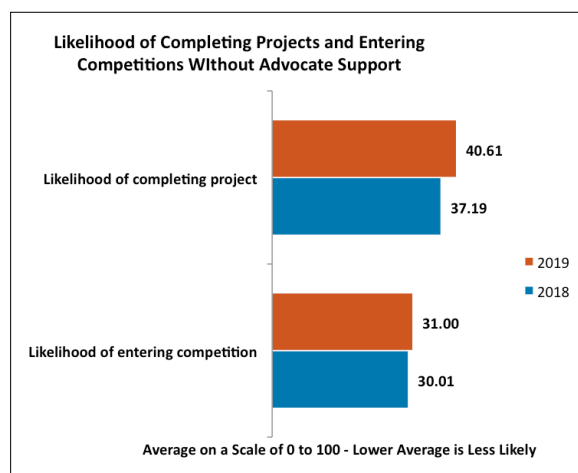| Likelihood	2018	2019
Likelihood of completing project	37.19	40.61
Likelihood of entering competition	30.01	31.00

Figure C59. Average likelihood of students completing and entering projects without Advocate support (same as *Figure 32*, p. 32)

Additional Findings

Why Students Enter Competitions

Table C60. Reasons Students Who Entered a Competition Gave for Entering Competitions

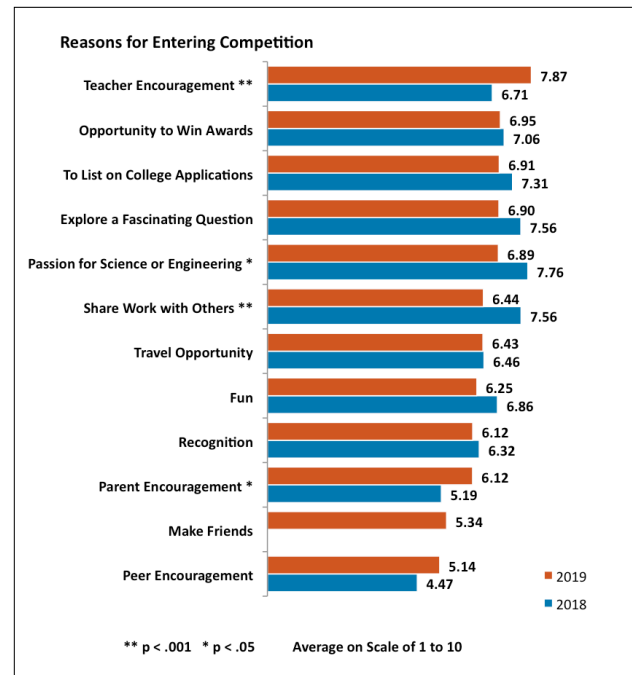|	2018		2019	
	Mean	SD	Mean	SD
Win awards	7.06	3.07	6.95	3.01
College application	7.31	2.74	6.91	3.04
Parent encouragement	5.19	2.95	6.12	3.20
Teacher encouragement **	6.71	3.04	7.87	2.44
Peer encouragement *	4.47	2.99	5.14	3.16
Fun	6.86	2.74	6.25	2.93
Passion	7.76	2.57	6.89	2.97
Travel opportunity	6.46	3.18	6.43	3.02
Recognition	6.32	2.90	6.12	3.08
Explore	7.56	2.42	6.9	2.67
Share *	7.56	2.56	6.44	2.91
Friends			5.34	3.30

Figure C60. Reasons for entering competitions according to student respondents (same as Figure 33, p. 33)

Advocates selected up to three things they thought motivated students to enter competitions (below), which can be compared to the students' reasons above.

Table C61. Student Motivation to Enter Competitions According To Advocate Respondents

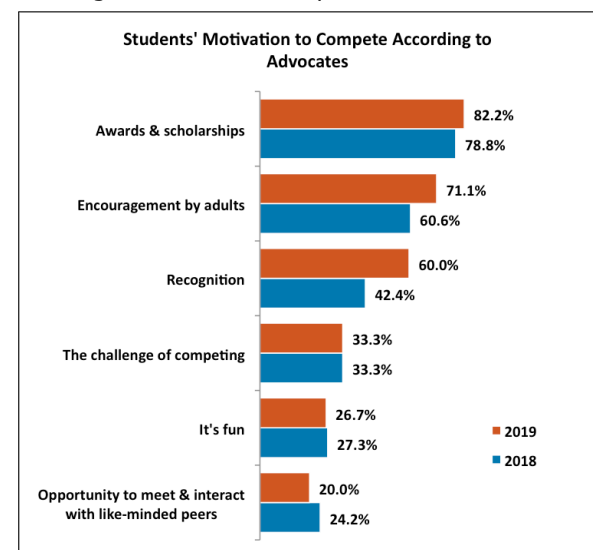| Student Motivation to Enter	2018		2019	
	n	%	n	%
Awards & scholarships	26	78.79%	37	82.22%
Encouragement by adults	20	60.61%	32	71.11%
Recognition	14	42.42%	27	60.00%
The challenge of competing	11	33.33%	15	33.33%
It's fun	9	27.27%	12	26.67%
Opportunity to meet & interact with like-minded peers	8	24.24%	9	20.00%

Figure C61. Advocates perceptions of student motivation to enter competitions (same as Figure 34, p. 34)

Two Advocates offered comments for "other" student motivations to compete.

2018:
- During the process of science research, none of my students really call it fun. However, at the end of the year/competition season, I overhear them talking it up to their friends and my students who have not yet graduated will re-enroll or continue with further research projects.

2019:
- The experience is different from anything they've ever done.

Benefits of Competitions According to Students and Advocates

Table C62. Student Benefits of Conducting Research According To Advocate Respondents

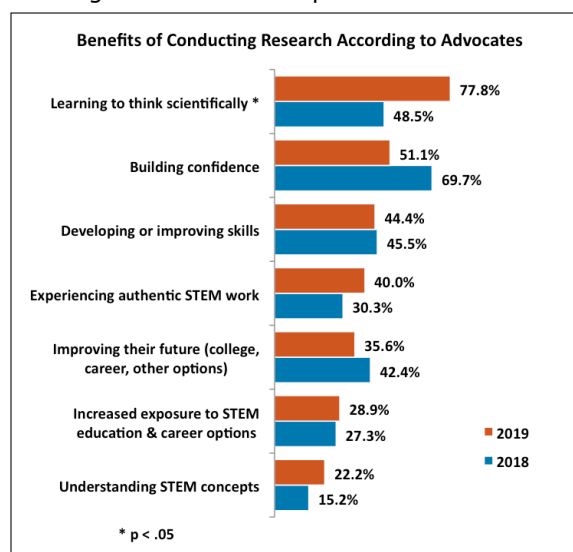| Student Benefits of Conducting Research	2018		2019	
	n	%	n	%
Learning to think scientifically *	16	48.48%	35	77.78%
Developing or improving skills	15	45.45%	20	44.44%
Building confidence	23	69.70%	23	51.11%
Understanding STEM concepts	5	15.15%	10	22.22%
Improving their future (college, career, other options)	14	42.42%	16	35.56%
Experiencing authentic STEM work	10	30.30%	18	40.00%
Increased exposure to STEM education & career options	9	27.27%	13	28.89%

Figure C62. Benefits of student research according to Advocate respondents (same as Figure 35 p. 34)

Advocates offered these "other" benefits to conducting research.

2018:
- ownership of their work
- Conducting research and design projects earns independence from the parents of some of my students who have traditionally wanted to please their parents with career choices, but after science research, they find that they are able to convince their parents to allow them to do what they really want to do.

Table C63. Student Benefits of Entering Competitions According to Advocate Respondents

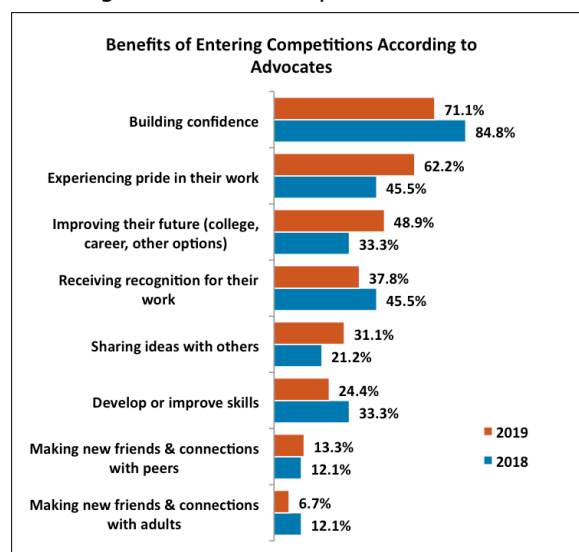| Benefits Entering Competitions	2018		2019	
	n	%	n	%
Building confidence	28	84.85%	32	71.11%
Experiencing pride in their work	15	45.45%	28	62.22%
Improving their future	11	33.33%	22	48.89%
Receiving recognition for their work	15	45.45%	17	37.78%
Sharing ideas with others	7	21.21%	14	31.11%
Develop or improve skills	11	33.33%	11	24.44%
Making new friends & connections with peers	4	12.12%	6	13.33%
Making new friends & connections with adults	4	12.12%	3	6.67%

Figure C63. Benefits of students entering competitions according to Advocate respondents (Same as Figure 36, p. 35)

Two Advocates offered these "other" benefits to competing:
2018:
- communication skills
2019:
- practice being a professional researcher

Table C64. Student Benefits of Entering Competitions According to Students Who Entered

| Student Perceptions	2018		2019	
	n	%	n	%
Learn something new	57	58.16%	115	50.44%
Win awards and scholarships	31	31.63%	96	42.11%
Develop new skills	49	50.00%	87	38.16%
Build self-confidence	38	38.78%	58	25.44%
Increase potential to be accepted by the college of my choice	20	20.41%	58	25.44%
Meet new people	10	10.20%	21	9.21%
Share my work with others	10	10.20%	25	10.96%
Gain a new experience	29	29.59%	51	22.37%
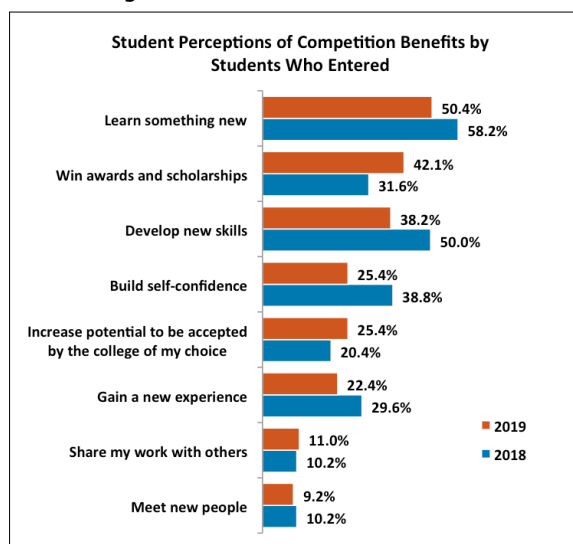
Figure C64. Benefits of students entering competitions according to student respondents (same as Figure 38, p. 35)

Two 2019 students added these "other" benefits to entering competitions.
- being able to improve leadership skills
- For a grade

Benefits of AGP for Students According to Advocates

Table C65. Student Benefits of the Advocate Grant Program According to Advocate Respondents

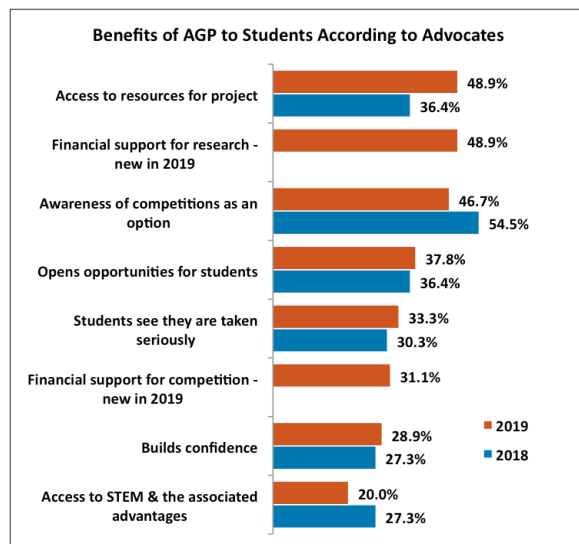| Student Benefits of AGP According to Advocates	2018		2019	
	n	%	n	%
Access to resources for project	12	36.36%	22	48.89%
Financial support for research (2019)			22	48.89%
Awareness of competitions as an option	18	54.55%	21	46.67%
Opens opportunities for students	12	36.36%	17	37.78%
Students see they are taken seriously	10	30.30%	15	33.33%
Financial support for competition (2019)			14	31.11%
Builds confidence	9	27.27%	13	28.89%
Access to STEM & the associated advantages	9	27.27%	9	20.00%
Financial support, general (2018)	20	60.61%		

Figure C65. Benefits of AGP to students according to Advocates (Figure 38, p. 35)

Three Advocates offered these "other" benefits of the program to their students.

2018:
- Experience to learn for future competitions. The most successful students were the ones with previous experience
- Inspiring nontraditional students to get involved with STEM
- They feel they are apart of something bigger than just their school.

Differences Among Groups

Gain scores of students were used as a measure of program impact, though only scores from the 2019 survey could meaningfully be used (see page 30 for explanation).

Table C66. 2019 Student Total *Gain* Scores as a Measure of Impact for Middle and High School Student Respondents

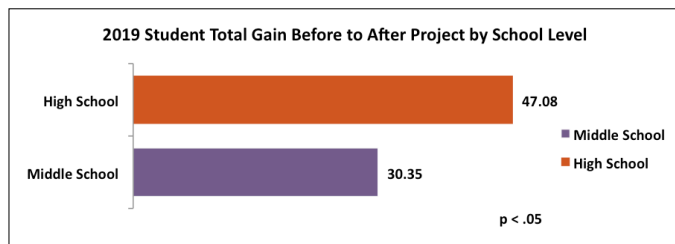| School Level	Mean	SD
Middle School	30.35	27.42
High School	47.08	32.41

Figure C66. 2019 student respondents' total *Gain* scores by school level

Table C67. 2019 Student *Gain* Scores per Item for Middle School (*N*=53) and High School (*N*=175) Student Respondents (Figure 40 on page 37 is not repeated here)

Student Gain Scores	Middle School		High School	
	Mean	SD	Mean	SD
My STEM topic	2.88	2.96	3.57	2.46
Competitions could help you get accepted into the college or university	2.02	2.62	2.69	3.02
Competitions give prizes (scholarships/other monetary awards) *	1.50	2.17	2.63	2.83
Other STEM topics *	1.38	2.02	2.22	1.95
Writing a scientific journal article **	0.81	1.72	2.14	1.95
Ability to present my project to scientists or engineers **	1.00	2.00	2.13	2.01
The scientific process *	1.30	1.79	2.05	2.07
Ability to present my research to other students **	1.00	1.80	2.01	1.88
My confidence in handling STEM activities **	0.92	1.34	2.00	1.96
The engineering design process *	1.01	1.76	1.98	2.06
Ability to present my project to the general public *	1.00	2.19	1.97	2.04
My interest in participating in STEM activities *	1.10	1.67	1.95	2.13
How STEM supports my community **	0.70	1.58	1.91	2.34
Oral presentation skills	1.38	1.93	1.81	1.70
Options for STEM careers *	0.90	1.54	1.80	2.08
The value I place on scientific research **	0.86	1.64	1.80	1.97
My comfort in working with adults **	0.59	0.89	1.71	2.00
My confidence that I can be successful if I put my mind to something *	0.93	1.44	1.61	1.88
My confidence in serving as a role model to younger students **	0.67	1.06	1.57	1.75
Time management	1.17	2.12	1.39	1.62
Options for education after high school *	0.59	1.37	1.32	1.71
My interest in a STEM related career *	0.70	1.38	1.31	2.03
Writing skills	0.74	1.74	1.16	1.48
My interest in taking science and math classes in high school & beyond *	0.55	0.84	1.09	1.74
Meeting deadlines	0.70	2.09	1.04	1.68
My interest in going to college	0.33	0.75	0.76	1.77

* $p < .05$ ** $p < .001$

Table C68. 2019 Student Total *Gain* Scores For Those Who Entered Competitions and Did (*N*=106) or Did Not (*N*=74) Win Awards

Awards?	Mean	SD
Won Award(s)	49.49	36.83
Did Not Win Award	35.03	26.88

2019 Student Total Gain Before to After Project by Winning and Not Winning Awards

Won Award(s) — 49.49
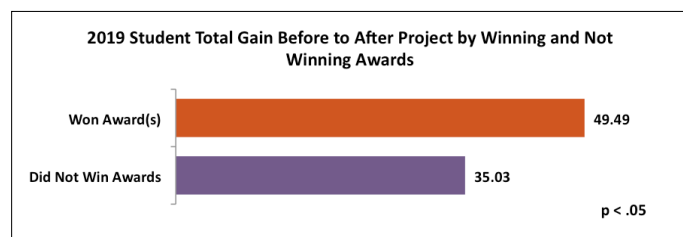Did Not Win Awards — 35.03
$p < .05$

Figure C68. 2019 student respondents' total *Gain* scores by award winning

Table C69. 2019 Advocate Respondents' Total *Gain* Scores By Community Setting

Community Setting	N	Mean	SD
Urban	21	84.19	36.53
Suburban	7	60.71	42.52
Small town	5	79.89	36.53
Rural	12	84.17	46.29
Total	45	80.06	39.78

2019 Advocate Total Gain Scores by Community Setting
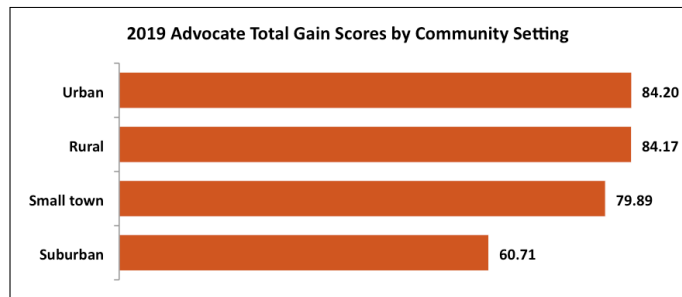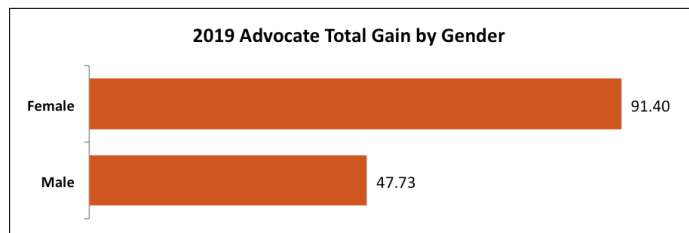
Urban 84.20
Rural 84.17
Small town 79.89
Suburban 60.71

Figure C69. 2019 Advocate respondents' total Gain scores by community setting (same as Figure 41, p. 38)

Table C70. 2019 Advocate Respondents' Total *Gain* Scores By Gender Identity

Gender Identity	N	Mean	SD
Male	12	47.73	26.48
Female	32	91.40	37.94

p< .001

2019 Advocate Total Gain by Gender

Female 91.40
Male 47.73

Figure C70. 2019 Advocate respondents' total *Gain* scores by gender identity