

**Colorado Consortium for Earth and Space Science Education**

**Year Two Evaluation: Final Report**

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## OVERVIEW

The Colorado Consortium for Earth and Space Science Education (CCESSE) has completed the second year of their STEM project (March, 2011- June, 2012), and this report contains an evaluation of the project's impact. Evaluation data for the following partners are included herein: (1) Challenger Learning Center, a series of on-site simulated missions to space designed for middle grade students, (2) Cool Science, a program designed to promote knowledge and interest in the STEM fields through on-site demonstrations at elementary schools across Southern Colorado, (3) Project Lead the Way, a series of week-long summer student camps focused on STEM learning for both middle and high school students, (4) Peak Area Leadership in Science (PALS), a group of educators who organize Saturday professional training events for other educators primarily in grades 6 – 12, and (5) the Science Olympiad, a series of “competitive” science events held at the University of Colorado at Colorado Springs.

Year Two was very successful – over 4,100 students participated directly in CCESSE events and thousands of other students participated indirectly through instruction received by their teachers during summer PALS workshops. Over 200 teachers participated either directly or indirectly in one of the five programs. Quantitative and qualitative results demonstrate that the events were extremely successful. Details provided in the following report illuminate the project's success. Refinements to the evaluation questions and to the data management system resulted in reliable data reflective of the project's impact.

Important to note is that more students and teachers participated than are represented in the data analyses included in this report but because the programs must rely on self-report data, not all participants completed all evaluations. The five distinct programs in the Consortium conducted their own evaluations as requested by the project director. When possible, data were combined but in most cases, evaluation questions differed across programs.

The first two programs evaluated herein include the Challenger Learning Center space exploration missions and the one-day Cool Science events. These two programs required students to complete some of the same evaluation questions related to perceptions and beliefs toward mathematics, science, and teamwork. These results are displayed in Table 1 below. Table 1 reflects a five-point Likert scale, a score of “1” is the lowest and a score of “5” is the highest possible score.

Table 1 reveals that scores on all eight questions asked across the two programs ranged from 2.49 to 4.71 with scores related to the Challenger missions earning higher scores across all eight questions. Standard deviations were within moderate range showing that variability across student responses was not extreme.

Table 1. Mean Scores on Questions Asked Across Two of the Student Programs

<i>Post Event Question</i>	<i>Challenger</i>	<i>Cool Science</i>
I am interested in finding out more about careers in math and science.		
N	2,999.00	852.00
Mean	3.62	2.71
SD	1.10	1.02
I like math.		
N	2,999.00	852.00
Average Score	3.49	2.91
SD	1.33	1.13
I like science.		
N	2,999.00	852.00
Mean	3.95	3.10
SD	1.08	0.94
I like working in teams rather than by myself.		
N	2,999.00	
Mean	4.17	N/A
SD	1.05	
I like technology.		
N	2,999.00	852.00
Mean	4.14	3.05
SD	1.08	1.06
I understand what scientists and mathematicians do.		
N	2,999.00	852.00
Mean	3.95	2.49
SD	1.00	1.05
I liked learning about science and math the way it was presented during this experience.		
N	2,999.00	298.00
Mean	4.35	2.82
SD	0.92	0.99
I had a lot of fun during this experience		
N	2,999.00	298.00
Mean	4.71	2.94
SD	0.69	1.04

Specific evaluation findings for each of these two programs, as well as the three additional programs, are shared in the remainder of the report.

## CHALLENGER LEARNING CENTER

This is the final evaluation of activities conducted at Challenger Learning Center during the second and final year of this project. Challenger Learning Center has assumed the leadership role in this project, providing project leadership and serving the largest numbers of students (approximately 3,000 during year two). Due to the completion of a data management system at the onset of year two, online data were collected prior to student visits to the Center, during their onsite missions, and post mission. Data also were collected from teachers. At this point in the system’s development, pre-post student and teacher responses can now be generated. Year Two data are available for 2,999 students, represented by approximately 75 teachers, who completed at least one of the three most popular onsite missions. Demographic data on these students are provided below.

Table 2. *Student Demographic Data*

Ethnicity	Male	Female	Unknown	Total
African-American	91	95	2	188
Asian/Pacific Isl.	70	77	3	150
Caucasian	849	857	10	1716
Native American	62	82	0	144
Latino/Hispanic	202	208	1	411
Other	171	168	2	341
Unknown	16	9	24	49
Total	1461	1496	42	2999

Although some evaluation questions are asked across missions (see Table 1), data also are collected on each mission and analyzed separately. In this way, comparisons can be made across the missions. Each of the missions described herein allowed for data to be collected at three points in time: (1) prior to the mission, (2) during the day of the mission at the Challenger Learning Center, and (3) approximately two weeks after completion of the mission. Because Center staff cannot oversee the pre-and post survey completion, data are variable and largely dependent on the commitment of participating teachers. Very few students complete more than one mission per year so analyses are conducted on each mission. The success of the three missions is illustrated in the following three sections; each section is labeled by mission name.

### **Rendezvous with a Comet – Survey Results**

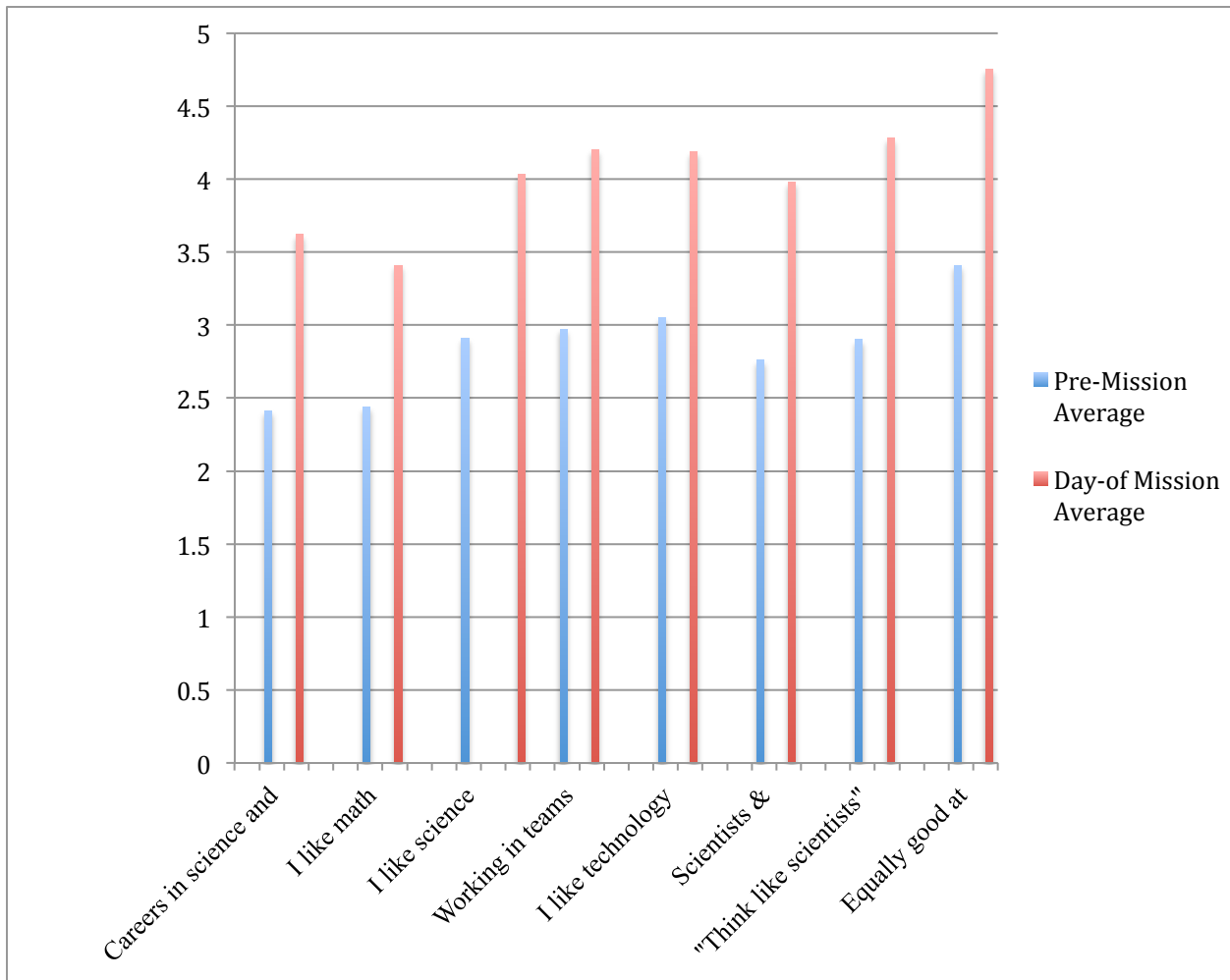
Student responses to their on-site experience were very positive with few differences across questions. On the five-point Likert scale used for the evaluation, a score of “5” represents the highest score and a score of “1” represents the lowest score. These data highlight the success of the activities that occurred at the Challenger Learning Center during 2011-2012 and emphasize students’ desire to return to the Center for another mission. This conclusion is reliable in that the number of students who participated in this mission, Rendezvous with a Comet was quite large ( $N = 1,612$ ).

As previously noted, although 1,612 completed this mission, data for only those students who completed answers to questions on two separate occasions are provided in the first three sections. Data in the first section represent student answers before and after their mission. Eight questions were completed once before the experience and once immediately after the experience at the Center. These data are labeled as “pre – day of” data. Data in the second section represent two questions completed by students before their experience and approximately two weeks after their experience (“pre – post”). Section three represents data for the three questions answered immediately after the experience and again approximately two weeks later (“day of – post”). Finally, sections four and five contain quantitative and qualitative data on student and teacher responses during one point in time, following the conclusion of the mission at the Center.

***Section One: Mean Scores of Survey Responses for Pre-Mission and Day Of Mission***

The graph and table below represent the same data and contain data for only those students who answered the questions on these two occasions. (If students completed the survey at one point in time but not at another point in time, their data are not included.)

Graph 1. Mean Scores on Pre-and Day Of Mission - (Rendezvous with a Comet)



As the graph above makes clear, mean differences between the two surveys are obvious and all differences are statistically significant ( $p < .05$ ) favoring the day-of survey answers. These data illustrate that the experience had a *significant positive impact* on students. The question that

showed the greatest gains was the following question, “People who explore space think like scientists” (*Gain Score* = 1.38). And, the question showing the second largest gains was the following, “Women and men are equally good at space exploration” (*Gain Score* = 1.34). The question that showed the least amount of gain, but still significantly different from pre-mission was “I like math” (*Gain Score* = 0.97). Math skills were emphasized less during this experience than science skills so this outcome is not surprising.

The Table below provides additional data to compliment the graph above.

Table 3. *Mean Scores on Pre-and Day Of Mission - (Rendezvous with a Comet)*

Question	N	Pre-Mission Mean	SD	Day-of Mission Mean	SD
I am interested in finding out more about careers in science and math.	510	2.41	1.15	3.62	1.13
I like math.	511	2.44	1.37	3.41	1.38
I like science.	509	2.91	1.06	4.03	1.06
I like working in teams rather than by myself.	512	2.97	1.10	4.20	1.06
I like technology.	509	3.05	1.01	4.19	1.04
I understand what scientists and mathematicians do.	510	2.76	0.94	3.98	1.05
People who explore space “think like scientists.”	512	2.90	0.82	4.28	0.95
Women and men are equally good at space exploration.	511	3.41	0.97	4.75	0.63

### ***Section Two: Mean Scores of Survey Responses for Pre-Mission and Post-Mission***

Only two questions were completed by students at pre and post mission for Rendezvous with a Comet. Neither of the questions showed a significant difference. One of these questions read, “I could play a role in future explorations of space”. The second question read, “My science and math grades are usually A’s or B’s”. It is unclear why students’ did not report higher scores on the first question post mission; it may be an artifact of the amount of time that had passed between pre- and post-mission. But, the fact that answers to the question about student grades did not vary lends some support to the reliability of the self-report data contained in this evaluation (as no difference in student answers to the grade they typically earn should have been apparent).

### ***Section Three: Mean Scores of Survey Responses for Day-Of and Post-Mission***

A delayed post-test provides evidence of the ability of effects to remain stable over time. Thus, the three questions reported in Table 4 below evaluate students’ beliefs about their experience long after that experience concludes. If scores remain consistent, one can assume that the experience had a lasting effect. In Table 4 below, average scores were more than one point greater at the day-of evaluation as compared to the post-mission mean scores. The effect of time on students’ enthusiasm may be responsible for this difference.

Table 4. Mean Scores of Survey Responses for Day-Of and Post-Mission - (Rendezvous with a Comet)

Question	N	Day-of Mission Mean	SD	Post- Mission Mean	SD
I would like to be part of another Challenger Learning Center experience.	420	4.70	0.70	3.42	0.93
My flight directors were a big part of making my experience worthwhile.	420	4.49	0.80	3.17	0.97
The mission taught me teamwork skills.	420	4.45	0.90	3.10	0.94

**Section Four: Student Responses on the Day-Of the Mission**

Students also answered five questions on the day of the mission only. Some of these questions were included in Table 1 previously, but that table combines mean scores across all Challenger Missions, whereas, these answers relate only to the Rendezvous with a Comet Mission.

Table 5. Mean Scores of Survey Responses for Day-Of Mission – (Rendezvous with a Comet)

Day of Mission Question	N	M	SD
I had a lot of fun during this experience	1236	4.81	0.56
I have a greater understanding of science and math concepts because of my Challenger Learning Center mission.	1234	4.19	0.93
I helped to make the mission successful.	1237	4.53	0.90
I learned a lot about science, math, and teamwork from my flight directors.	1233	4.26	0.87
I liked learning about science and math the way it was presented during this experience.	1236	4.50	0.84

As the results in Table 5, above, make clear, students rated their experience at the Center on the day of their mission as exceptional. Responses were all extremely positive and little variability existed across scores. Over 1,200 students answered these questions (77% of all students who attended this mission), making data interpretation very reliable.

Qualitative data was collected from students through use of open-ended questions. At post-mission, approximately 500 students chose to complete the question posed in Table 6 below. The table includes the answers of the first 22 students as pulled verbatim from the database. This list of answers reflects the general themes of the answers provided by more than 500 students. Reading through this unedited list makes clear that students enjoyed their Rendezvous with a Comet experience, found it challenging, learned to respect teamwork, and appreciated the hands-on learning environment provided by the Challenger Learning Center.

Table 6. *What did you like most about the [Rendezvous with a Comet] experience?*

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*I love the real life situations and [the] pressure administered at all times.*

*How to work as a team and not to freak out when things go wrong.*

*I kind of liked how when we had to abort the mission, the others had a chance to experience what [it is] like to be an astronaut. Even though I was one of the first and had to abort, it was just as fun to be in Mission Control.*

*I liked the part when my partner and i had to get the cordinants from mission control and we had to hit the comet with the rocket...*

*i liked how we were parred up and used teamwork equally and swithed from s.t. to m.c.*

*everything because it was so fun and awesome*

*Everything!*

*Getting to send the other person orders while in mission control.*

*I liked everything about the mission.*

*The thing I liked the most about this Challenger Learning Center experience would be that I got to work with my classmates. Also that we got to learn in a really fun way. Lastly, I liked working with the Flight Directors and being an astronaut.*

*When I figured out how to do my job as an isolation team and learnig how to do it .*

*That you shut the air off and a student hade to turn it back on*

*There were a lot of cool things at the Challenger Learning Center. One thing I liked about the mission was having two chances to complete the mission.*

***I learned that working in teams is way better than i thought because i thought that working in teams is boring. But when you work in teams your team mates help you alot. I also learned more about math skills and science skills. Another thing i learned about is that space is way more cool than i thought.***

*What I liked most about Challenger Learning Center is that we were able to complete our mission and I learned how to work with others.*

*The thing I liked the most about Challenger Learning Center was that it pumped my blood. It was exciting and MOST of the time my heart was racing. I panicked a few times because I couldn't find my lines and the other COM [student's name] kept repeating the line and I was like UUUGH HELP MEEEE. THEN I didn't even know how to work the camera. I was looking at the wrong screen the whole time and at the VERY end of the mission I noticed the right screen was ABOVE the screen i was stairing at the whole time. I felt so STUPID D. It made my heart race though, it was really fun. I hope to go back sometime.*

*What I like most was I got to test peoples blood pressure and I got to sin people in a chair. going to challener was the best feildtrip I ever had*

*i liked that we seceded*

*it made me have the experiance of havring fun and learning at the same time.*

*I like the robotic [arms]*

***iT WAS FUN AND ENTERTAINING WE LEARNED NEW SKILLS WE LEARNED FACTS.***

*Actually, there was not a favorite... I LOVED EVERYTHING! Especially when I got to talk in a small microphone. I will never, ever forget that experience at Challenger. It is one of my favorite fieldtrips that I ever had. I hope to visit it again.*

*Thank You So Much!*

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### ***Section Five: Teacher Responses on the Day-Of the Mission***

Twenty-six participating teachers were asked 17 questions focusing on their experience in preparing students for their mission and their experiences on-site at the Challenger Learning Center. Teacher responses were overwhelmingly positive although not all teachers responded to all questions. Answers for two of these 17 questions are provided below.

Fourteen teachers answered a true-false question about the Rendezvous with a Comet Mission followed by an open-ended response. Eleven teachers answered “true”, two teachers answered “false” and two teachers answered “NA”. Below are verbatim answers from these 14 teachers.

Table 7. *Teacher Responses to “I would be interested in additional Challenger missions . . .”*

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*We have had great success over the years with this program; however, I like to encourage the students to come back later for other missions!*

*Students were completely engaged in the process of completing the mission. They seamlessly and enthusiastically integrate content knowledge from the classroom to completing their tasks.*

*practical application*

***The Comet mission was both educational and fun. The kids really enjoyed it, and also had exceptional work with both mathematical and scientific concepts. The mission commanders were great and taught the kids valuable lessons.***

*This program is a wonderful opportunity for real world application of math and science concepts.*

*We have done the comet mission, and would love to do others*

*I would be interested in other missions because my students are able to use their sciences in a fun and challenging environment.*

*This is my 7th mission at the Challenger Center and every experience has been top notch. Great staff, very informative and great rapport with the students.*

*Challenger is one of the best and most engaging learning experiences we have ever participated in.*

*I think it would be nice if 8th grade at DCC integrated a simulated mission to Mars. I don't think 6th grade would have time to do another mission in a school year.*

*Great program. Loved seeing all levels of learners engage and gain confidence.*

*Because this experience is extremely hands on learning environment!!!*

*It would be great to get most students into summer programs etc.*

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Thirteen of the same teachers answered a question about the alignment of the mission to their traditional curriculum. Their verbatim answers are shared on the following page.

Table 8. *Teacher Responses to “Please provide constructive suggestions on how the program could be modified to make it better align with your curriculum.”*

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<i>None</i>
<i>The program is very well organized. One of our continued requests is for the cards to be available in Spanish as we continue to bring students with limited English Language skills. These students do sometimes have the ability to read Spanish, however.</i>
<i>I would love to, but it is already fairly perfectly aligned.</i>
<i>Aligning to middle school standards was done thoughtfully.</i>
<i>Aligns extremely well with our curriculum</i>
<i>None. They are great.</i>
<i>I really have no suggestions. We are happy with the lessons and projects supplied by the Challenger staff.</i>
<i>super program- great every time</i>
<i>Adding history/literature lessons.</i>
<i>The mission is perfectly aligned with our curriculum and Space Week.</i>
<i>none at this time</i>
<i>None, there were great content and the team building lessons that we were able to prepare with.</i>
<i>None</i>
<i>maybe a lab on mass, weight, volume and density</i>

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## **Voyage to Mars – Survey Results**

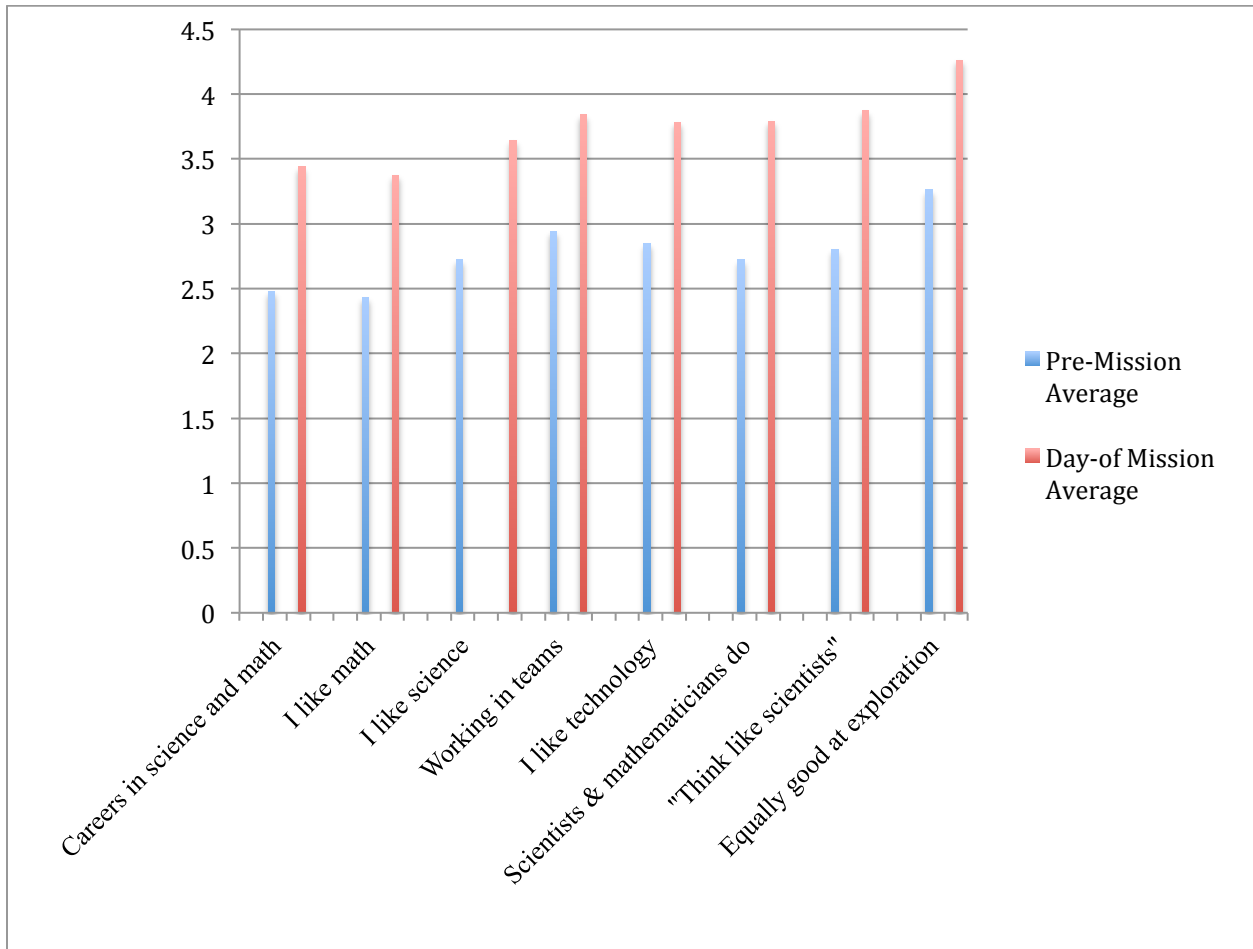
Student responses to their Voyage to Mars simulation were very positive. On the five-point Likert scale used for the evaluation, a score of “5” represented the highest score and a score of “1” represented the lowest score. The data shared in this section of the report highlight the success of the Voyage to Mars mission at the Challenger Learning Center. This conclusion is reliable in that the number of students who participated in this mission was very large ( $N = 1,617$ ).

Although 1,617 completed this mission, only the data for those students who completed answers to questions on two separate occasions are provided in the first three sections. Analyses in sections four and five include quantitative and qualitative data provided by students and teachers following their on-site mission and completed at the Challenger Learning Center.

### ***Section One: Mean Scores of Survey Responses for Pre-Mission and Day Of Mission***

As Graph 2 makes clear, mean differences between the two surveys are obvious demonstrating the positive effect the mission had on students’ perceptions and beliefs about mathematics, science and teamwork. These data illustrate that the experience had a significant positive impact on students. Four of the questions showed more than a one-point gain on a five-point scale. The other four questions also showed improvement in students’ beliefs after they completed the mission but differences were not quite as large.

Graph 2. Mean Scores on Pre-and Day Of Mission - (Voyage to Mars)



The Table below provides additional data to compliment the graph above.

Table 9. Mean Scores on Pre-and Day Of Mission - (Voyage to Mars)

Question	N	Pre-Mission Mean	SD	Day-of Mission Mean	SD
I am interested in finding out more about careers in science and math.	585	2.48	1.14	3.44	1.15
I like math.	585	2.43	1.32	3.37	1.31
I like science.	582	2.72	1.10	3.64	1.18
I like working in teams rather than by myself.	585	2.94	1.06	3.84	1.24
I like technology.	583	2.85	1.04	3.78	1.24
I understand what scientists and mathematicians do.	585	2.72	0.95	3.79	1.09
People who explore space “think like scientists.”	584	2.80	0.79	3.87	1.15
Women and men are equally good at space exploration.	584	3.26	0.98	4.26	1.24

### ***Section Two: Mean Scores of Survey Responses for Pre-Mission and Post-Mission***

Only two questions were completed by students at pre, and post mission for Voyage to Mars. Neither of the questions showed a significant difference at pre- and post-mission. Two hundred seventy-eight students answered this question at pre- and post-mission: “I could play a role in future explorations of space”. The same number of students answered a second question: “My science and math grades are usually A’s or B’s”. Although a significant difference in student answers to the first question would be optimal (showing the positive effect that the mission had on their perceptions), the time delay between pre- and post answers may have affected their scores. The fact that answers to the question about student grades did not vary lends some support to the reliability of the self-report data contained in this evaluation.

### ***Section Three: Mean Scores of Survey Responses for Day-Of and Post-Mission***

A delayed post-test provides evidence of the ability of effects to remain stable over time. Thus, the four questions reported in Table 8 below evaluate students’ beliefs about their experience long after that experience concludes.

Table 10. *Mean Scores of Survey Responses for Day-Of and Post-Mission – Voyage to Mars*

Question	N	Day-of Mission Mean	SD	Post-Mission Mean	SD
I liked learning about science and math the way it was presented in my Challenger Learning Center experience.	31	3.10	0.98	2.23	1.33
I would like to be part of another Challenger Learning Center experience.	227	4.07	3.70	3.02	1.08
My flight directors were a big part of making my experience worthwhile.	226	4.08	1.14	2.22	1.03
The mission taught me teamwork skills.	227	3.93	1.24	2.18	1.04

In the table above, scores on the last three questions revealed a significant difference between students’ answers on day-of-mission versus answers post-mission. These differences imply that students evaluated the experience less positively post-mission. It is unclear why student answers changed significantly after the mission. Two variables may have impacted student responses. First, contextual variables were unmeasured as students completed answers post-mission in their respective classrooms and the affect of classroom climate may have varied. Second, the time difference between day-of and post-mission differed across classrooms. It is also important to note that only one-eighth of the students who completed Day-of questions also completed post-mission questions, causing some concern for sampling bias.

### ***Section Four: Student Responses on the Day-Of Mission***

Immediately following the mission, at the Challenger Learning Center, students were asked to complete a series of five Likert-scale questions and a number of open-ended questions. The large number of responses is due to the fact that students completed questions only once, at the Center.

Table 11. *Mean Scores of Survey Responses for Day-Of Mission – (Voyage to Mars)*

Day of Mission Question	<i>N</i>	<i>M</i>	<i>SD</i>
I had a lot of fun during this experience	1158	4.30	1.15
I have a greater understanding of science and math concepts because of my Challenger Learning Center mission.	1156	3.80	1.11
I helped to make the mission successful.	1156	4.18	1.18
I learned a lot about science, math, and teamwork from my flight directors.	1156	3.84	1.11
I liked learning about science and math the way it was presented during this experience.	1088	4.17	0.98

As the results in Table 11 make clear, students rated their experience at the Center on the day of their mission very high. Responses were all extremely positive and little variability existed across scores. Approximately 1,100 students answered these questions (72% of all students who attended this mission), increasing the reliability of data interpretation.

In the table below, students answered the following question: “What did you like most about the Challenger Learning Center experience?” Three hundred thirty-two students chose to complete this question at post-mission. The table on the next page includes the answers of the first 33 students who answered as pulled verbatim from the database. This list, representing 10% of the answers, reflects the general themes of the answers provided by the students. Reading through this unedited list makes clear that students enjoyed their Voyage to Mars experience, found it challenging, learned to respect teamwork, and appreciated the hands-on learning environment provided by the Challenger Learning Center.

Table 12. *What did you like most about the [Voyage to Mars] experience?*

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*I liked that we worked really well together as a class and a team to complete this mission. We all had are own job to do, and if we didn't complet our job the misson would have failed. i liked watchin other people freak out about the tough situations!*

*I liked that it felt like we were actualy in a rocket ship. getting out of school. it was fun*

*what i liked most about the challanger space center is how the people pulled a prank on us i liked that we got away from school and that it was fun.*

*What i liked most about the challenger learning center experience was that they treated us as if we were actually in space and also the jobs we got.*

*i loved my job on probe team*

*i like how we have a chance to work together*

*com center communications*

*I liked moving the robtic arm*

*Team*

*that i got to be com team it was fun i got to control the camera and i got to work as a team how i had to help with the life support place and helping save every one in under 3 seconds*

*The robot arms*

*that it was fun*

*i liked that we all had a part of the mission*

*i liked how they tried theyre hardest to make the mission seem real!*

***I liked that our mission was filled with complications that our team had to decide on. Also, the jobs weren't simple, but very engaged. I'm also very happy that we got our team to succeed.***

*I very much enjoyed the space thingy bobber:)*

***What i liked most about the challenger was that my job was so cool it made me feel very important.***

*I liked how the space simulation was really realalistic. it was awesome how that we got to go to mars and back in a little bit of time. **Im going to persue a carrear in the sience field now. the trip was awesome we should go again.***

*I liked the way that the adults didnt do anything for us.*

*the problems that made it more difficult*

*How no mater how exsperianced a person is that their are always surprises you might not exspect.*

*My favorite part of the Challenger Trip was when I got to use the robotic arm to collect samples*

*the man*

*It felt very real and it was really fun.*

*The team had to work together to achieve mission success and it was fun when doing life or death situations which was a bit scary.*

*How the teams worked together.*

*being on communications team*

*all of it*

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### ***Section Five: Teacher Responses on the Day-Of the Mission***

Thirty-three participating teachers were asked 17 questions focusing on their experience in preparing students for their mission and their experiences on-site at the Challenger Learning

Center. Teacher responses were overwhelmingly positive although not all teachers responded to all questions. Answers for two of the questions are provided below.

Twenty teachers answered a true-false question about the Voyage to Mars Mission followed by an open-ended response. Ten teachers answered “true”, seven teachers answered “false” and three teachers answered “NA”. Below are verbatim answers from these 20 teachers. Most of the teachers who answered that they would not be interested in additional Challenger missions still responded positively to the open-ended question.

Table 13. *Teacher Responses to “I would be interested in additional Challenger missions.”*

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<i>Great experience but give teachers a job</i>
<i>Great experience. Hands on learning</i>
<i>N/A</i>
<i>I found the hands on activities great</i>
<i>Very engaging program that engages all learning styles</i>
<i>Na</i>
<i>This was a great way to integrate science and math. Also, a fun and interesting way to learn about space.</i>
<i>I believe one trip per year would be ok, unless it was done at the very end of the year.</i>
<i>The students, even those that are too cool for school, get pretty excited when they see what is going on. They use a lot of math and science without really realizing it.</i>
<i>JSAA is space themed school</i>
<i>Engaging for students</i>
<i>This is one of the most valuable and meaningful opportunities that my students experience each year!</i>
<i>Challenger missions are well-organized, standards-referenced, and easy and fun to teach! I love this time of year.</i>
<i>N/A</i>
<i>Awesome experience for both students and teachers!</i>
<i>Application of knowledge as well as preparation for this mission was a necessity to it being successful.</i>
<i>It's a fun experience</i>
<i>Great example of what its like to work on a team, where you have to rely on others as well as yourself, and the team really can't succeed unless everyone is involved.</i>
<i>Very good for my gifted students.</i>
<i>It gets kids excited about math, science, and space. The kids have a great time and it is an experience they wont forget!</i>

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Eighteen of the same teachers answered a question about the alignment of the mission to their traditional curriculum. Their verbatim answers are shared next.

Table 14. *Teacher Responses to “Please provide constructive suggestions on how the program could be modified to make it better align with your curriculum.”*

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*Some post history lessons*

*They did a great job making it real.*

*They were interested in the rovers.*

*Time. A space unit did not fit into the current units I was teaching at the current time. Space does not come until later in the school year for district 11*

*More integration of Earth and sun relationship concepts*

*A way to differentiate each lesson or modify*

*Maybe don't have the patch as a requirement, it takes from our instructional time.*

*The program is great; it's difficult for us to spend too much time as we need to finish this space unit prior to TCAP testing in March.*

*I like it the way it is*

*Aligned more with state standards for 8th grade*

*I teach chemistry, so more chemistry based lessons might be helpful.*

*I was actually concerned to read the new CO Science standards as they did not contain the emphasis on space science that was in the previous standards - I would like to see some renewed emphasis on these items for 2 reasons: space excites students about science and space is OUR future!*

*None - Very well planned out! Loved the lesson plans.*

*The students could have more information on everything that each station has to do job wise.*

*More analytical writing options*

*Can't think of anything*

*I don't teach a content area, but I do teach critical thinking and problem solving. The program fits very well with those strategies.*

---

## **Return to the Moon – Survey Results**

Student responses to their Return to the Moon simulation were very positive. On the five-point Likert scale used for the evaluation, a score of “5” represented the highest score and a score of “1” represented the lowest score. These data highlight the success of the activities that occurred at the Challenger Learning Center during 2011-2012 and emphasized students’ desire to return to the Center for another mission. The number of students who participated in this mission was less than half of the number of students who participated in the previous two missions (N = 739).

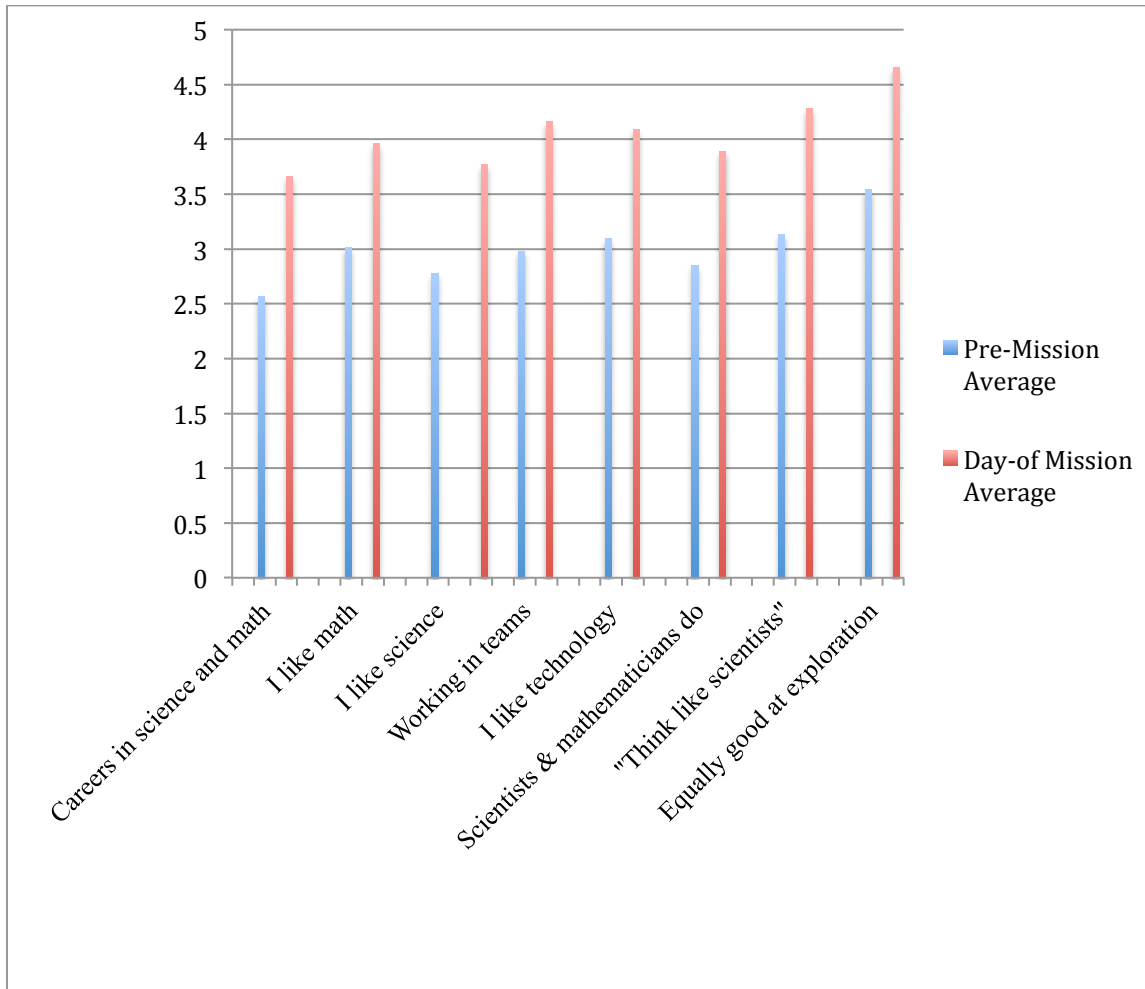
Although 739 students completed this mission, data for only those students who completed answers to questions on two separate occasions are provided in the first three sections below. Data in the first section represent student answers before and after their mission. Eight questions were completed once before the experience and once immediately after the experience at the Center. These data are labeled as “pre – day of” data. Data in the second section represent two questions completed by students before their experience and approximately two weeks after their experience (“pre – post”). Section three represents data for the four questions answered immediately after the experience and again approximately two weeks later (“day of – post”).



**Section One: Mean Scores of Survey Responses for Pre-Mission and Day Of Mission**

The graph and table below represent only those students who answered the questions on two occasions. If students completed the survey at one point in time but not at another point in time, their data are not included.

Graph 3. Mean Scores on Pre-and Day Of Mission – (Return to the Moon)



As the graph above makes clear, mean differences between the two surveys are obvious and most questions were statistically significant favoring the day-of survey answers. These data illustrate that the experience had a significant positive impact on students. The question that showed the greatest gains was the last question, “I like working in teams rather than by myself” (Gain Score = 1.28), revealing more than a one-point difference as did three other questions. This experience definitely influenced students’ beliefs about science, math, teamwork, and the affect of gender on space exploration. The question that showed the least amount of gain for the Return to the Moon mission was the following question: “I like math,” which showed only a 0.86 point gain. As with earlier missions, this question was least related to the actual Challenger experience.

Table 15, on the following page, provides additional data to compliment the graph above.

Table 15. *Mean Scores on Pre-and Day Of Mission – (Return to the Moon)*

Question	N	Pre-Mission Mean	SD	Day-of Mission Mean	SD
I am interested in finding out more about careers in science and math.	369	2.57	1.04	3.66	1.06
I like math.	370	3.01	1.13	3.96	1.16
I like science.	368	2.78	1.17	3.77	1.16
I like working in teams rather than by myself.	370	2.98	1.12	4.16	1.05
I like technology.	369	3.10	1.04	4.09	1.12
I understand what scientists and mathematicians do.	369	2.85	0.90	3.89	1.03
People who explore space “think like scientists.”	368	3.13	0.76	4.28	0.90
Women and men are equally good at space exploration.	370	3.54	0.80	4.66	0.73

***Section Two: Mean Scores of Survey Responses for Pre-Mission and Post-Mission***

Only two questions were completed by students at pre, and post, mission for Return to the Moon. Similar to what was reported for earlier missions, neither of these questions showed a significant difference. Students answered these questions at pre- and post-mission: “I could play a role in future explorations of space,” and “My science and math grades are usually A’s or B’s”.

***Section Three: Mean Scores of Survey Responses for Day-Of and Post-Mission***

A delayed post-test provides evidence of the ability of effects to remain stable over time. Thus, the four questions reported in Table 16 below evaluate students’ beliefs about their experience well after that experience concludes.

Table 16. *Mean Scores of Survey Responses for Day-Of and Post-Mission – (Return to the Moon)*

Question	N	Day-of Mission Mean	SD	Post-Mission Mean	SD
I liked learning about science and math the way it was presented in my Challenger Learning Center experience.	31	3.10	0.98	2.23	1.33
I would like to be part of another Challenger Learning Center experience.	227	4.07	3.70	3.02	1.08
My flight directors were a big part of making my experience worthwhile.	226	4.08	1.14	2.22	1.03
The mission taught me teamwork skills.	227	3.93	1.24	2.18	1.04

In the table above, the last three questions revealed a significant difference between students' answers on day-of-mission versus answers post-mission ( $p < .05$ ). These differences imply that students evaluated the experience less positively post-mission.

***Section Four: Student Responses on the Day-Of Mission***

Data were collected on Likert-scale questions as well as on open-ended question asked of students. Five Likert-scale questions were answered by students on the day of the mission only. Those students attending the Return to the Moon mission provided the answers below.

Table 17. Mean Scores of Survey Responses for Day-Of Mission – (Return to the Moon)

Day of Mission Question	<i>N</i>	<i>M</i>	<i>SD</i>
I had a lot of fun during this experience	551	4.81	0.54
I have a greater understanding of science and math concepts because of my Challenger Learning Center mission.	551	4.22	0.91
I helped to make the mission successful.	551	4.59	0.74
I learned a lot about science, math, and teamwork from my flight directors.	551	4.33	0.86
I liked learning about science and math the way it was presented during this experience.	551	4.39	0.87

As the results in Table 17 make clear, students rated their experience at the Center on the day of their mission very high. Responses were all extremely positive and little variability existed across scores. Five hundred fifty-one students answered these questions (75% of all students who attended this mission), increasing the reliability of data interpretation.

In the table below, students answered the following question: “What did you like most about the Challenger Learning Center experience?” Three hundred-eleven students chose to complete this question at post-mission. The table on the next page includes the answers of the first 31 students who answered as pulled verbatim from the database. This list, representing 10% of the answers, reflects the general themes of the answers provided by the students. Reading through this list makes clear that students enjoyed their Return to the Moon experience, including being in the spaceship and at mission control, enjoyed the level of cooperation required during the mission, and appreciated the support of their flight directors.

Table 18. *What did you like most about the [Return to the Moon] experience?*

---

*how we work together*

*I liked working on the probe.*

*My job and observing it.*

*what i liked most about my challenger learning center exsperience was learning how to control a remote controled claw to move dangerous toxsic chemicals!*

*I liked working together to try to have a successful mission.*

***My favorite part about this experience is when I work with my teammates. I've never cooperated with my teammates this good.***

*I liked that when I was in the spaceship because we got to do funnier stuff than mission control.*

*I liked my job as a data officer because you had a bunch of responsibilities and privileges. It was stressful, but I learned how to stay calm during an emergency.*

*What I liked most was that I was a big part of the mission being successful.*

*i liked being in the spacecraft and being mission ncontral*

*i liked that we got to work together to collect data and launch the probe and that everyone was safe!*

*about how we got to spin people in chairs.*

*I liked that we worked in pairs to solve a problem and that we got to do both in space and on the ground*

*geting to work with my hands alat*

*Giting spun in a cher*

*i liked being in the space craft and having to be a team and work together to land and not fail.*

*Being in the clean room working on the probe*

*i liked the working together and going two times*

*working the robot arms in isolation.*

*what i liked most about challenger was being able to pretend i was actooly in a space ship.*

***What I liked the most about the Challenger Learning Center experience is when our flight officers made the misson sound so real and makes you realize what it feels like to be astronauts and to be in misson control.***

*Just being the com officer.*

*Everything*

*I liked most of all of the challenger experience was being able to work in a lab and make sure all the passengers on the ship were save and were in good conditions to be in space because my job was life support.*

*I liked the most when we got to exprience the launch into outer space.*

*What i liked most was how i got to work with my hands in the probe.*

*I liked that it was a fun way to use science and math.*

*using the robotic arm*

*I liked being in the spacecraft, and going into space. it was fun, and my partner and i had fun in the spacecraft taking tests and learning new things about differant factors that influence how the spacecraft flies.*

*What i liked most about the Challenger Learning Center Experience was that we got to work in Mission Control and out in Space. I thought that was really cool how they did that, but at first I was really disappointed when they said that our mission was over early because of the metor shower.*

---

### **Section Five: Teacher Responses on the Day-Of Mission**

Eighteen participating teachers were asked 17 questions focusing on their experience in preparing students for their mission and their experiences on-site at the Challenger Learning Center. Teacher responses were overwhelmingly positive although not all teachers responded to all questions. Answers for two of these 17 questions are provided below.

Thirteen teachers answered a true-false question about the Return to the Moon Mission followed by an open-ended response. Nine teachers answered “true” and four teachers answered “NA”. Below are verbatim answers from these 13 teachers. Most of the teachers who answered that they would not be interested in additional Challenger missions explained that the Return to the Moon mission aligned with their curricula but other Challenger missions were less well aligned.

Table 19. *Teacher Responses to “I would be interested in additional Challenger missions.”*

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*I loved attending the Challenger mission and I know the students loved the experience. Upon reviewing the standards, I believe this experience would fit in better with the standards of 7th or 8th grade. Space is not a 6th grade standard.*

*The students have been so excited and involved in this program. This is a great way to create life long learners in both the science and math fields.*

*Parents are interested in how they can come and learn with their children. Other opportunities for families.*

*Hands on, EXCITING!*

***It was a very positive experience. One of my students that is extremely quiet, really came out of her shell and was totally involved in the mission. The students found their strengths and were able to appreciate them.***

*I think this is a great experience for all students. I saw kids today who rarely show enthusiasm in the classroom, be excited and interested in learning today.*

*My unit of study is called Sun, Earth Moon, and I think this Mission fits well. I will, however, pass on the information to our 6th grade science teachers who teacher other space curriculum.*

*Any time students can take classroom knowledge and apply it to life like situations and problem solve success has been achieved!*

***This is an amazing program to show students how the concepts taught in school are practical in the real world***

***The experiences the students have is priceless and worth every minute of the mission.***

*I really enjoyed the mission, but difficult to prepare students because it was not part of the 6th grade curriculum.*

*I love the program, but it is being moved to another grade level for future missions.*

*Excellent application of math and science that helps generate enthusiasm for these fields.*

---

The same teachers answered a question about the alignment of the mission to their traditional curriculum. Their verbatim answers are shared below.

Table 20. *Teacher Responses to “Please provide constructive suggestions on how the program could be modified to make it better align with your curriculum.”*

---

*As stated before, it does not align with our grade level science standards, but it does align with many of the math standards (coordinate grid and such).*

*The only idea I have is to add information on the Survivor activity. Giving the teacher some ideas on which objects should be considered and WHY. This would allow some good discussion points between students and teacher.*

*Program aligns well with current instructional practices*

*Its great*

*We both conducted lessons in our afterschool GT program, so they worked fine.*

*None*

*None*

*Unfortunately, these missions are more appropriate for 7th and 8th grade science curriculums. State standards have changed as well as D20 science curriculums.*

*I have no suggestions at this time*

*Have a lesson on emailing and sending and receiving them.*

*I really had good information to prepare the students. The curriculum does compliment the space standards.*

*It already works well with inquiry and collaboration.*

*Maybe reevaluate tie in of Challenger activities with common core standards.*

---

### **Summary Across All Three Challenger Missions**

The space simulations students engaged in at the Challenger Learning Center were all rated very high by teachers and students. The Rendezvous with a Comet mission revealed the greatest gains when comparing students’ survey scores at pre- and day-of mission. But, all three missions showed gains and most of these gains were statistically significant. When comparing the three missions by day-of mission scores only, two of these missions, Rendezvous with a Comet and Return to the Moon were rated similarly (highest) with Voyage to Mars rated least favorably (but still high).

Students did not score the simulations as high at post-mission. Reasons provided for the post-mission reduction in student evaluations of their experiences include the effect of time on students’ recall and the differences across classrooms where the post-evaluations occurred.

Qualitative and quantitative analyses across all three simulations revealed similar themes. Students and teachers both shared that the experiences had the most effect on the following: (1) students perceptions of the importance of teamwork, (2) students engagement and enthusiasm for the simulations and the prospect of exploring space in “real-life”, (3) students self-confidence, and (4) the dedication of the Challenger staff. Moreover, teachers rated the simulations as being well-aligned with their current curricula (although some suggestions for future modifications were shared), and were very pleased with the material that the Center provided to them, the professionalism of the Center staff, and the real-world scenarios in which students could generalize their knowledge and skills.

## COOL SCIENCE EVENTS

A total of 862 students participated in the Cool Science one-day hands-on experiments and demonstrations, with the database capturing responses from all but ten of these students. As Table 18 reveals, approximately 50% of the students completing the Cool Science events were Caucasian. One hundred seventy-six students either listed “other” or did not specify an ethnic group. A fairly equal number of boys and girls completed the program.

Table 21. *Demographics of Cool Science Participants*

<i>Ethnicity</i>	<i>Female</i>	<i>Male</i>	<i>Non-Specified</i>	<i>Total</i>
African-American	35	41	0	76
Asian-Pacific Island	17	14	0	31
Caucasian	184	232	0	416
Latino/Hispanic	65	61	0	126
Native American	19	18	0	37
Other	75	81	0	156
Non-specified	0	0	20	20
Total	395	447	20	862

Mean scores from primary evaluation questions completed by this group of students are provided in Table 1. Cool Science also asked boys and girls open-ended questions about their experiences. Two hundred ninety-seven students out of the 862 who participated responded to one open-ended question asking them about what interested them about the day they spent with Cool Science. The majority of these students responded positively ( $N = 264$ ), while 33 students (11%) responded negatively (nothing interested them about the experiments). Some responses, reflective of the positive feedback from the majority of students, are listed in Table 22 below.

Table 22. *What did you like most about this experience?*

---

*I really liked all the experiments and how students could participate during this experience.*  
*I really enjoyed the gas flame demonstrated at the end.*  
*i loved it when the huge explosion happend inside the big bottle*  
*I liked when you did the electricity thing with all the different kids.*  
*i liked when the scientists put the match in the water jug and made a huge colum of fire*  
*I liked when the large bottle lit on fire*  
*I liked when the cool science people made the golf ball spin.*  
*I liked when the bottle blew up.*  
*I liked the tesla coils very very much. The magnets were awesome too!*  
*I liked the scientific method.*  
*i liked the popping cup thingy*  
*I liked the ping pong experament.*  
*i liked the part were she made fire come flying up out of the tank*  
*I liked the part were I felt electricity go though me and shocking another person.*  
*i liked the new things that i got to learn.*  
*I liked the lightning simulation because of the big spark.*

Table 22 cont.

---

*i liked the lightning bolt experement.*

*I liked the last experiment we had done it was very entertaning and really cool and i would love to*

*To try something like that at home.*

*I liked the hands on exerieence of it and all of the cool experiments that they did.*

*I liked the foam coming out of the tube.*

*I liked the fire thing*

*I liked the explosions especially at the end.*

*I liked the explosion in the water jug at the end of the series of experiments.*

*I liked the experiment where they made people's hair stood up.*

*i liked the end when they lit the stuff in the bottle and it made a big sound*

*I liked the electricity.*

*I liked the eexperiments with electrons and sparks*

*i liked the dry ice experiment*

*I liked the algorithms in math and the sciece experiences in science.*

*I liked the affects of mixing things together and getting something you didn't expect.*

*I liked that it was something i never did befor*

*i liked that it had different expiriments that you would have never seen.*

*I liked that I learned new things.*

*I liked that I learned a lot of stuff*

*I liked seeing the flames and lightining bolts*

*I liked seeing how electrons made my hair stick up.*

*I liked seeing all the experiments because I really like science very much.*

*I liked learning new things, and I had fun doing cool science. I think cool science educates you in science a lot and that is good. I think out of all I liked the experience because i had fun.*

*I liked learning about the uses of science in a fun and interesting way*

*I liked learning about hydin nytrodrin.*

*I liked it when they made the water change different colors as you shook it. That was very interesting.*

*I liked it when she made the colors in the bottle change without food coloring.*

*i like the ball that shocked people and the last part with the water bottle that blew up*

*I like it because we chemicals that can glow in the dark.*

*I like in the experience is when they put a match in a big bottle and when a blue flame came out.*

*i like how the presntators presented this experiement espically the one with fire*

*I like how science can be fun for kids. i also like how there are tons of experaments in this program.*

*I like how it was a hands on experience. It was differnt on what teacher teach you to day.*

*We do hands on like that but not what Cool Science did.*

*i learned alot about space.*

*I just like science a lot.*

*I liked this experience because it is fun and there were alot of colors and smoke*

*I got to learn about the glowing bottle.*

*I especially liked the presentation style of this experience, and how much the students contributed*

*and were involved in this experience.*

*I especially liked the experience was when the cap popped off.*

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## PROJECT LEAD THE WAY (PLTW)

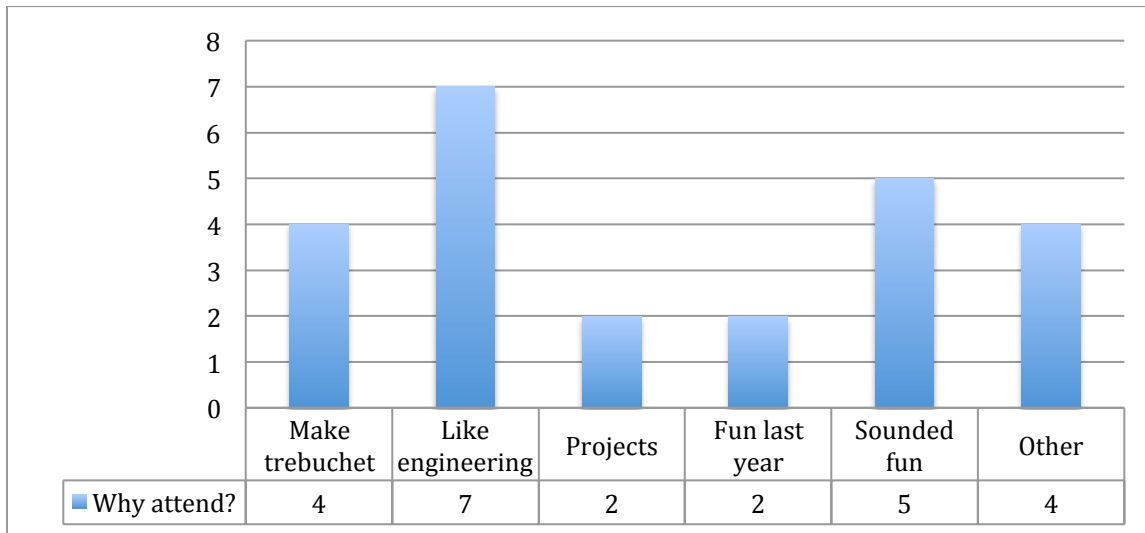
Project Lead the Way activities occur primarily in the summer and the data included in this section represent only one of the camps that students attended in Year Two of the CCESSE project. Below is the feedback from this camp hosted by PLTW for students interested in aerospace.

### Aerospace Institute: Student Survey

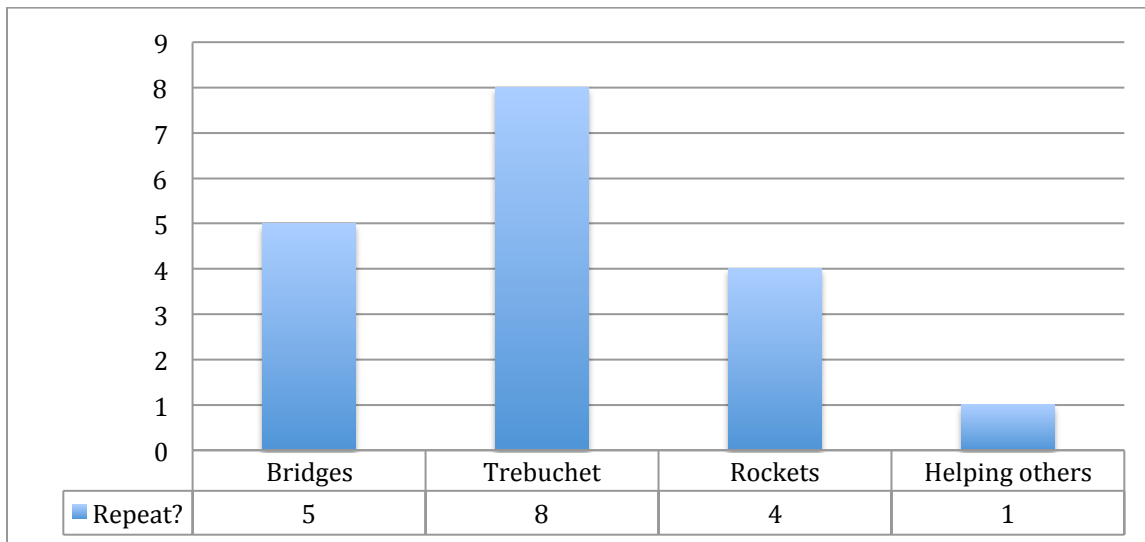
Twenty students attended middle school and five students attended high school. Twenty-three of the students were Caucasian. Eighteen of these students were male and seven were female. Students shared diverse career interests ranging from desiring to become an engineer, scientist or mathematician (most frequent) to becoming a veterinarian, musician, or fashion designer (least frequent), for example. Analyses include data from all students attending one of the 2012 camps.

In the three graphs that follow, data from students' open-ended answers are summarized into major themes.

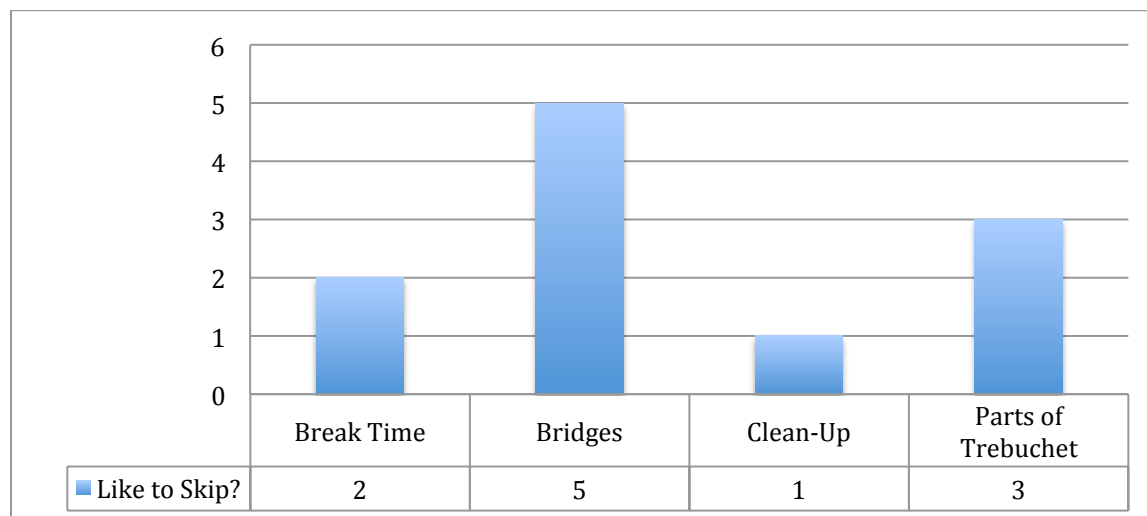
Graph 4. Why did you choose to attend the Gateway Academy this summer?



Graph 5. If you could repeat one part of the Gateway Academy, what would it be?



Graph 6. *If you could have skipped one part of the Gateway Academy, what would it have been?*



The fourth question asked students about the likelihood of their recommendation of the program to their friends. Of the 11 students that answered, 11 replied in the affirmative. The fifth question that students were asked and all of their answers verbatim are shared below.

Table 23. *How has the Gateway Academy changed how you feel about science, technology, engineering or math (STEM)?*

*I love engineering.*

*Mainly with the trebuchet, I realized that ratios are really important and that has changed the way I thought about their importance.*

*The Gateway Academy helped me in math.*

*Makes me like it more.*

*It hasn't. I love STEM already and enjoy doing it.*

*It has made me feel more open to the hard parts about math. It made me like all 4 subjects.*

*I feel better about it all.*

*It has taught me that math is really important for lots of the engineering.*

*It CAN be fun.*

*It has made me realize how much STEM affects our lives.*

*It has helped me learn more about STEM.*

*It made me want to become an engineer with Alyssa.*

*It made me like it way more, especially engineering.*

*It has made me more excited about STEM.*

*I find those subjects more interesting.*

*The Gateway Academy has helped me improve my STEM skills.*

*It made me realize that math is in engineering and engineering is pretty awesome.*

*That it is more fun than it looks.*

*It has opened my eyes to the world of STEM.*

*Very good. I love them even more now.*

*It changed me by teaching me how to build.*

*I was already interested in STEM subjects, but this camp reinforced those feelings.*

*I think it reinforced the idea that subjects are used together.*

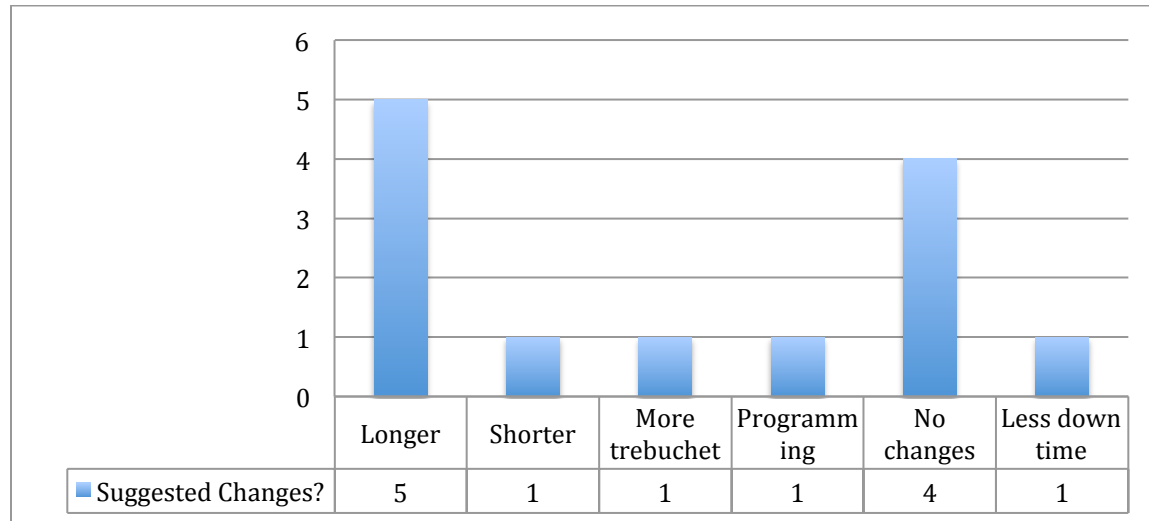
*I feel like there are a lot more options for current careers.*

*It challenged my science knowledge because it was harder to predict outcomes.*

Questions 6 and 7 asked students to share their career interests (see previous) and the amount of schooling they hypothesized they would need to work in these fields. Most students accurately estimated the amount of post-secondary education they may need.

Answers to the final question are reflected in the graph below.

Graph 7. *What suggestions would you make for future camps?*



### Aerospace Institute: Teacher Survey

The Institute for which student data was collected, was taught by two certified teachers; their answers to a set of Institute-specific questions are provided below.

- In what content areas do you currently teach? Include grade level.

Middle School GTT  
PLTW grades 9-12
- Please identify other content areas in which you meet the CDE requirements for “highly qualified.”

Business
- Why did you choose to teach at Gateway Academy this summer?

I enjoyed teaching it last summer and really wanted to do it again.  
This is my 4<sup>th</sup> year of doing the program.
- Which was this summer’s most effective Gateway activity? Why?

I would have to say all of them. The students really took to the projects, worked together when needed, and turned out quality, finished products.  
All of them. We did rockets, bridges, and trebuchets.
- If you could have skipped one activity, what would it have been? Why?

None. All were effective and worth doing again this year.  
None.

- From your interaction with the campers, how does the Gateway Academy change their perceptions about science, technology, engineering, and math (STEM)?  
It opens them up to different ideas and fields and that STEM is cool.  
They have a better understanding of how things are connected.
- How do you believe the Gateway Academy experience might affect a student's performance (academic or otherwise) during the school year?  
All the students have more hands on experience that will help them in Technology and Ind. Tech next year, especially the 6<sup>th</sup> graders who learn the machines sooner.  
In other classes, hopeful the experience will help them relate better and make other connections.  
We tried to relate the activities to what they learn in other disciplines.
- Describe a particular moment from this year's Gateway Academy that stands out in your memory.  
Watching two groups beat my bridge design.  
The excitement in the students' eyes when they are having fun learning and being challenged.

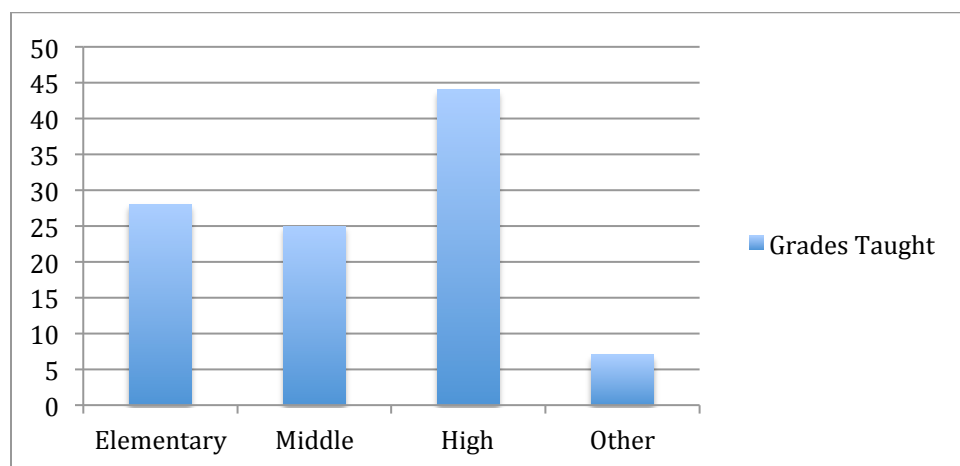
### Peak Area Leadership in Science (PALS)

“PALS” represents a group of educators who organize Saturday professional training events for other educators primarily in grades 6 – 12. Evaluations of three of these Saturday programs have been combined to create the graphs and tables below, capturing the overall success of the trainings.

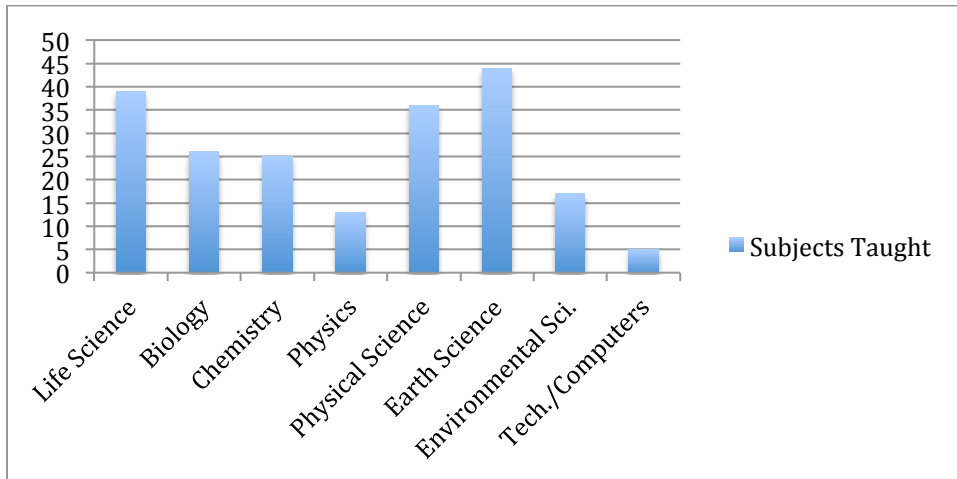
#### Teachers' Attending PALS Training Events – Demographic Data

Nine school districts were represented at the training events that included a total of 89 teachers.

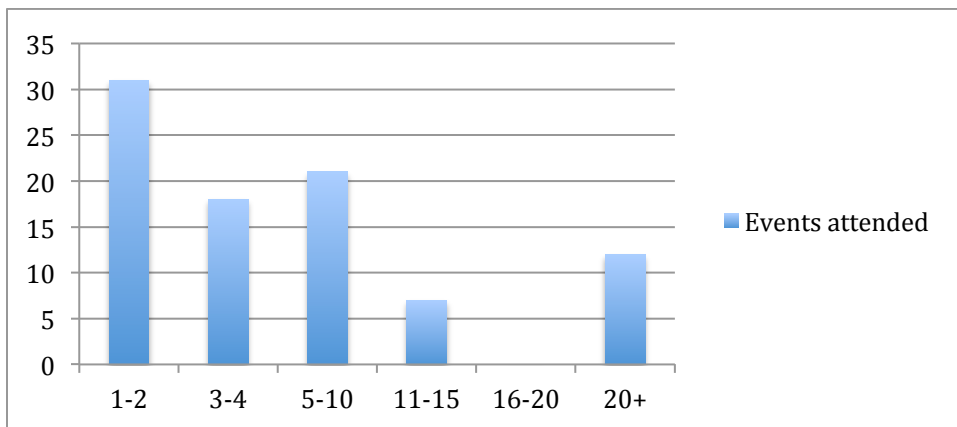
Graph 8. *Grades taught*



Graph 9. *Subjects taught*

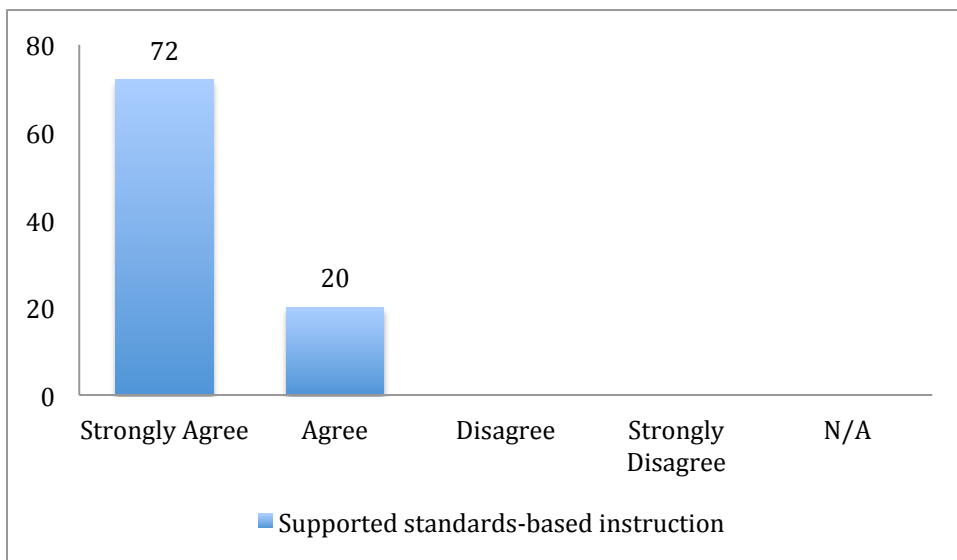


Graph 10. *Number of related training events attended*

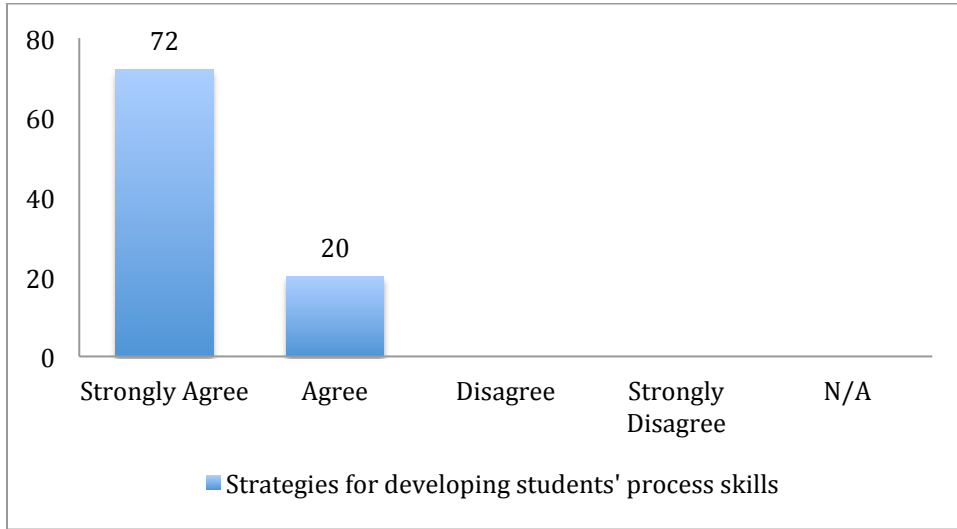


**Teachers' Attending PALS Training Events – Evaluation Data**

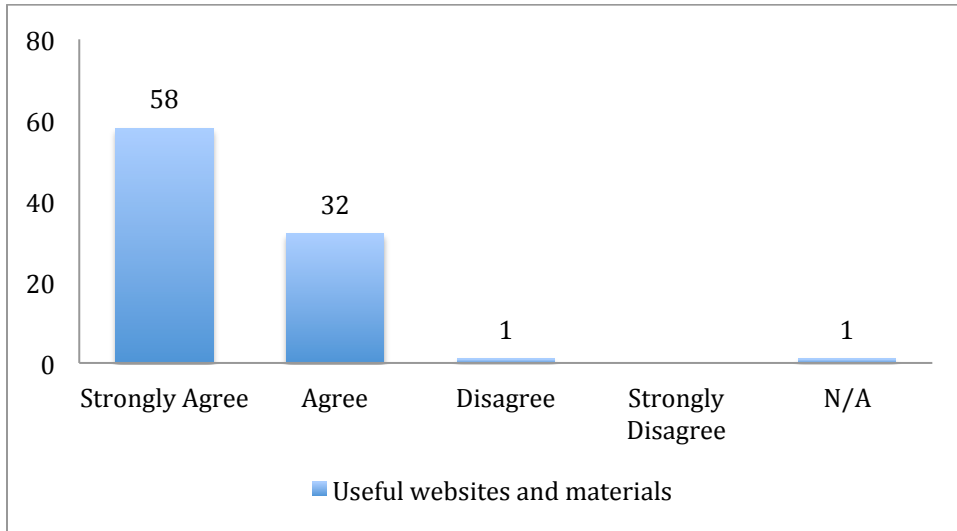
Graph 11. *Session supported standards based instruction.*



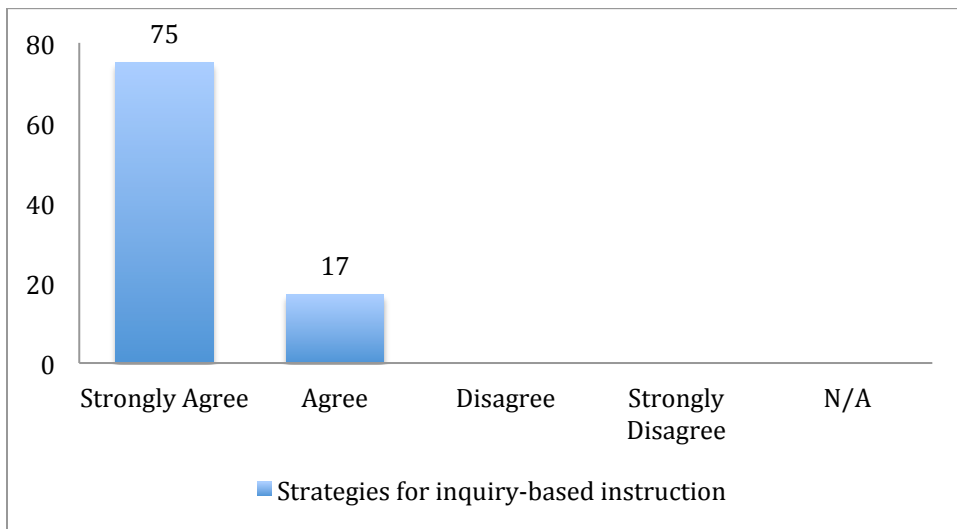
Graph 12. *Session was useful for developing process skills with students.*



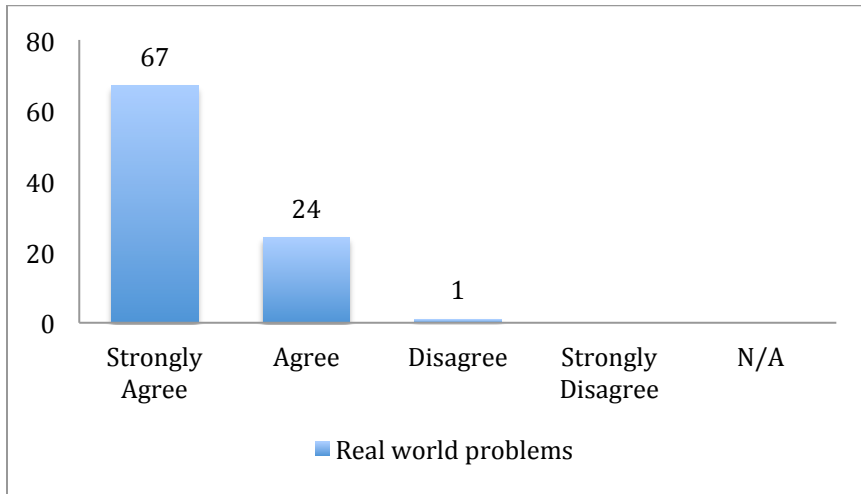
Graph 13. *I can use web sites and material shared in my instructional program.*



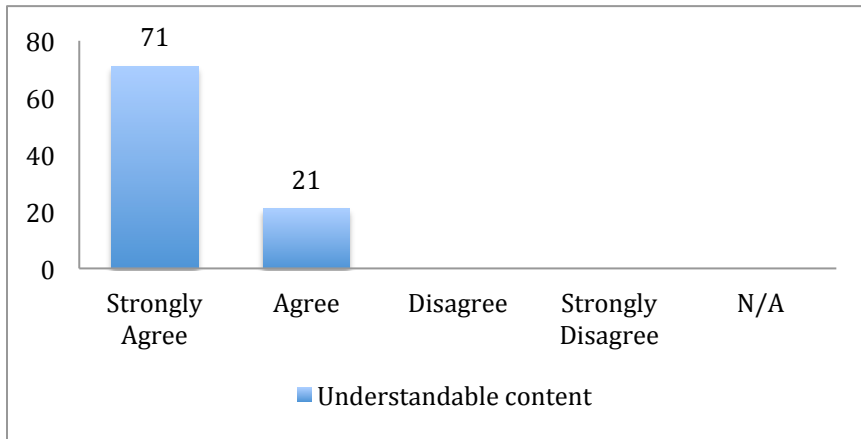
Graph 14. *I [learned strategies] to involve my students in inquiry based instruction.*



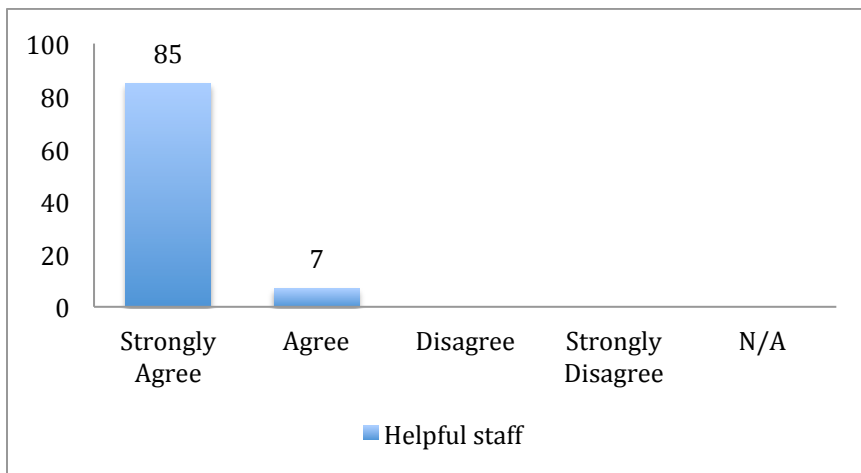
Graph 15. *Session included ideas and activities [to teach students] real world problem solving that would be of interest to them.*



Graph 16. *The content was presented in an understandable manner.*



Graph 17. *The staff was helpful.*



Participants also were asked to provide open-ended comments about the success of the sessions. Table 23 contains all specific comments provided across the sessions. Fifteen general comments (e.g., “great,” “wonderful,” “fantastic”) are excluded from the table.

Table 23. *Provide other comments about the session you attended.*

---

Terrific! Something I can really use in class!  
Very interesting, like that they will loan us the equipment/Info was presented in a very clear & useful way  
Great program. Lots of helpful hints and explanations very clear  
I just felt like there was a lot of down time. It would have been nice if some of the instruction – activities were a little better interwoven  
There is a lot of wait time  
Very interesting! I am looking forward to sharing what I learned with my fellow science teachers. I used to do this all through college so I’m excited to be able to bring it into the classroom.  
This was the best hub to date for me.  
Wow – this was awesome – a different way to think about teaching – by moving  
Neat to see Physics so easily conveyed  
I really loved and will use the radioactive m&ms lab – great idea!  
I enjoyed the content discussions that lent itself to both low and high level concepts  
Little Shop is the SINGLE GREATEST, MOST USEFUL workshop ever. Please keep them coming back!  
Loved it  
The kinesthetic activities mad the concepts easy to understand.  
Fun great information for specific ideas  
Amazing info to add to our Foss science kit  
Awesome energetic activity.  
Awesome kinesthetic lessons  
Excellent hands on – Enjoyed being the student and seeing their perspective  
As always, LSOP does a top notch job! Most enjoyable!  
Awesome! Can’t wait to use the hands on exercises.  
I loved it! Extremely helpful and informative.  
A fantastic workshop!!  
Great Workshop! Highly Recommend!/I had such a fun time. It was great!  
I had such a fun time. It was so interactive and interesting. I actually learned a lot myself!  
Very useful for all levels and subjects in science, not just physics – great work!  
Great organization and time management  
I really enjoyed this meeting – fabulous!  
What a great day! Thank you!  
Very exciting + interesting  
Very informative and fun – HUB is Awesome!  
I loved having time built into the schedule for exploring other parts of the museum  
The people who organized this event were amazing. I appreciate also the email, snacks and transportation!  
I LOVE HUB  
I am thrilled to have had this opportunity-thank you to the behind the scenes work  
Enjoyed the evolution talk  
Excellent and very informative. I feel that students will greatly benefit from the inquiry based strategies that were presented  
Museum staff were very knowledgeable and enthusiastic

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Table 24. *Please write any suggestions for future meetings.*

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October Session:

Medical-anatomy activities  
Medical oriented, Solar technology, Astronomy  
The butterfly pavilion  
Something to do between labs  
More labs – hands on stuff

November Session:

Science of photography  
Great! Thanks! Love that I can walk out & do an activity tomorrow  
Wave-particle duality, System relationships from molecular to planetary  
Just keep ‘em coming!  
Timing better  
Ecosystems  
Hard to hear him at times in gym.

December Session:

Maybe have teachers share opportunities i.e. if someone did NOAA teacher-at-sea program have the teacher present.  
More local examples of evolution  
Astronomy and Space Exploration  
Nanotechnology, Forensics, Genetics, Evolution, Botany, Chemistry  
Forensics Crime scene, morgue, geology, botany  
Continue the excellent quality  
Need more time while in the museum  
Move around with a hands-on. Items at the table are interesting but not really an activity

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### **SCIENCE OLYMPIAD**

The Science Olympiad was held in the first quarter of 2012 at the University of Colorado at Colorado Springs. Approximately 200 students participated. An evaluation of the event was completed by the Center for STEM Education (CSTEME) on April 25, 2012 and is attached herein.

### **CESSE PROJECT SUMMARY AND RECOMMENDATIONS**

The success of all programs offered by the five project partners is apparent throughout this report. Quantitative and qualitative feedback from students was authentic and very positive. Feedback from teachers was also incredibly supportive. The inclusion of five distinct programs in a project of this size assumes that at least one of these programs will achieve less than stellar evaluations; this is not the case in the CESSE project. All programs achieved great success. Much of this success seems to stem from the hands-on, applied, problem-solving nature of the different programs. Teachers and students consistently commended the programs on their ability to convey the meaning of abstract concepts in “real-life” examples. The strategies used by these five programs should be shared widely. Student engagement continues to be a challenge in our PK-12 school settings; programs such as these directly address this challenge.

Recommendations are few as past recommendations have been addressed by the project director of CCESE. See below.

1. All programs should use the same Likert Scale beginning with “1” as the lowest score and “5” as the highest score – this should encourage better understanding across constituents when data are reported. Ensure that the same scale is used across all programs at pre-, day of, and post-experiences.
2. Ensure that a set of questions (for example, the questions listed in Table 1 that all partners agreed on during the first quarter of this project) is asked of student participants at the conclusion of each event. In order to make summary judgments as to the effect of the program in its entirety, similar questions must be asked across events.
3. Ensure that teachers and students have unique identification numbers. Some data for teachers were entered under student identification numbers making analyses more tedious.
4. Allow for larger data sets to be downloaded at one time. System is much improved but could be developed more thoroughly and accessed more intuitively.