2018

Math Science Partnership (MSP) Evaluation

Final report

THE UNIVERSITY OF UTAH
UTAH EDUCATION POLICY CENTER

Utah Education Policy Center

January 2018

http://uepc.utah.edu/

Math Science Partnership Overview

Since 2009, the University of Utah's Center for Science & Mathematics Education (CSME) Masters of Science for Secondary School Teachers (MSSST) program has provided scientific and content-based pedagogical training to Utah middle and high school teachers of math, physics, biology, chemistry, and Earth science. In 2015, the MSSST program received funding to implement the Math Science Partnership (MSP). Through district and university partnerships, the MSP paired science and education researchers from Weber State University (WSU) and University of Utah (UU) with MSSST students. The MSP funding also provided an opportunity to serve a small group of non-degree seeking classroom teachers. This second group of teachers were referred to as Teacher Research Fellows (TRFs).

The primary purpose of the MSP program was to increase the academic achievement of Utah's K-12 students in mathematics and science by improving science and mathematics teaching practices. The CSME had 15 MSSST teachers already enrolled when the MSP program began. An additional 10 TRF participants were recruited to participate. Participants received stipends for attending workshops and participating in summer research experiences. MSSST participants received $4,450, and TRF participants received $2,450.

The MSP program began with a one-day workshop to set expectations and discuss Utah's new Science and Engineering Education (SEEd) standards.[1] These standards are based on the National Research Council's Framework for K-12 Science Education, otherwise known as the Next Generation Science Standards (NGSS).[2] Following the initial workshop, in 2016, MSP participants engaged in a summer long research experience with their university research mentor. This summer experience was the core of MSP implementation and provided an opportunity for teachers to get first-hand experience with the research process. With the summer experience complete, MSP participants returned to their classrooms to implement what they learned through the program. Finally, a select group of MSP participants conducted a four-day workshop for a group of K-12 teachers in August 2017. During the workshop, the MSP participants taught their peers about Utah's SEEd Standards and cross-cutting science concepts.

Evaluation Activities

The CSME asked the Utah Education Policy Center (UEPC) to evaluate the MSP program. The UEPC developed four surveys, each of which are described below. Survey administration followed implementation activities, such as workshops and research experiences. In addition to the four UEPC surveys, MSP program administrators also designed surveys that they administered immediately prior to and following the final four day teacher training workshop. Table 1 displays key MSP implementation activities and the UEPC surveys that followed those activities.

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[1] Utah Public Education press release (April 27, 2015). Grades 6-8 Science Standards. Retrieved from http://utahpubliceducation.org/2015/04/27/grades-6-8-science-standards/#.WkvnR9-nG70

[2] The National Research Council (NRC) of the National Academy of Sciences developed the "Next Generation Science Standards (NGSS)" as a framework to provide an evidence-based foundations for science standards that state education agencies, local education agencies, elementary, middle, and secondary schools could use to develop and evaluate science, technology, math, and engineering (STEM) curriculum and pedagogic practices. See https://www.nextgenscience.org/framework-k-12-science-education

Table 1. MSP Implementation and Evaluation Activities

MSP Program Implementation Activity	Survey	Survey Administration Dates	Survey Description
Initial one-day workshop, October 2015	MSSST and TRF October 2015 Workshop Survey	October 14 – 30, 2015 (n=23)	Included workshop evaluation questions and items used to measure baseline understanding of the NGSS and beliefs about teaching science from the Beliefs About Reformed Science Teaching and Learning (BARSTL) Survey.[3]
Summer Research Experience, June-August 2016	MSSST and TRF 2016 Summer Teacher Research Experiences Survey	August 22 – September 5, 2016 (n=20)	Included questions used to assess the mentoring and personal research component of the summer research experience, and items used to assess teachers' understanding of the NGSS.
	MSSST and TRF Program Experience and Implementation Survey	December 5 – December 22, 2016 (n=21)	Included questions used to assess teachers' ability to teach the NGSS, and included items from the BARSTL used to assess change in teachers' beliefs about teaching science.
SEEd Swap Teacher Workshop, August 2017	SEEd Swap Teacher Workshop Implementation Survey	October 31 – December 4, 2017 (n=35)	This survey followed a workshop hosted by a small group of MSSST and TRF participants, who taught their peers about Utah's SEEd Standards and crosscutting science concepts. This survey included questions and items used to understand the teachers' experiences implementing workshop content.

Results from each of the four surveys are attached.

[3] The Beliefs About Reformed Science Teaching and Learning (BARSTL) instrument organizes sets of questions to measure four specific subscales of perceptions in science teaching. See Sampson, V., Grooms, J., & Enderle, P. (2013). Development and initial validation of the Beliefs About Reformed Science Teaching and Learning (BARSTL) questionnaire. *School Science and Mathematics, 113*(1), 3-15.

2015

MSSST and TRF October 2015 Workshop Survey Results

Utah Education Policy Center

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MSSST and TRF Workshop Survey Results

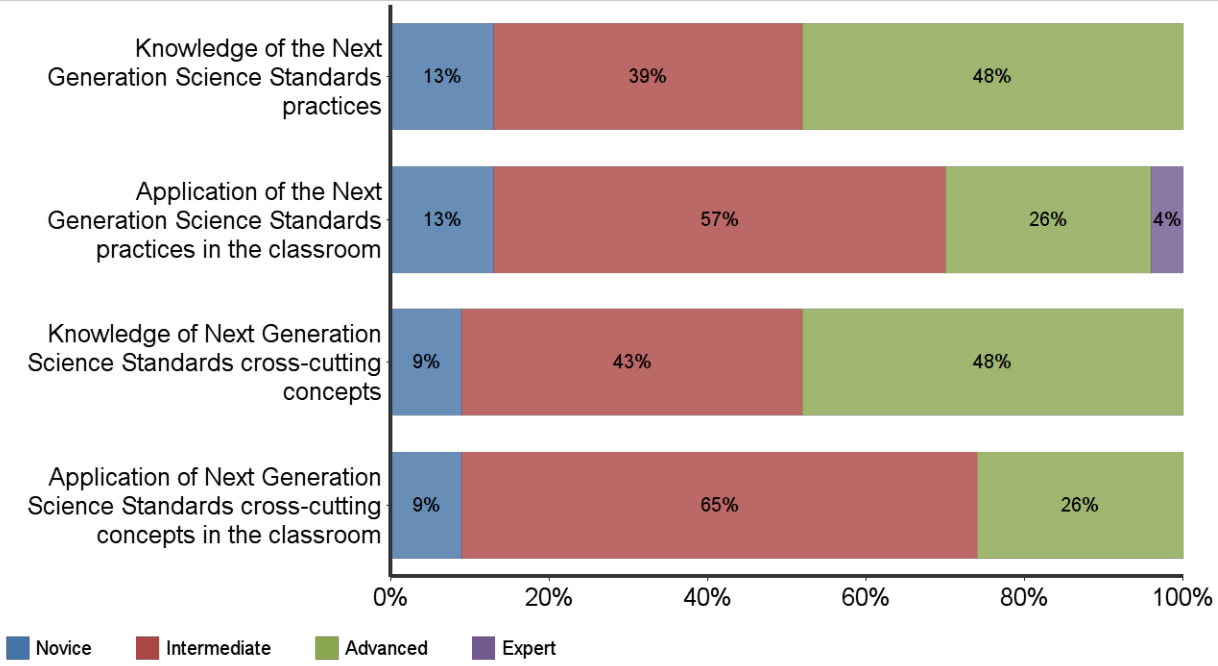
October 2015

This report presents a summary of results from a survey that was administered following an MSSST and TRF workshop that occured on October 10. The purpose of this survey was to evaluate the quality and usefulness of the workshop, as well to provide baseline data for the MSSST project. Figures and tables in this report display participant responses to all of the items on the survey except for the identification of school districts.

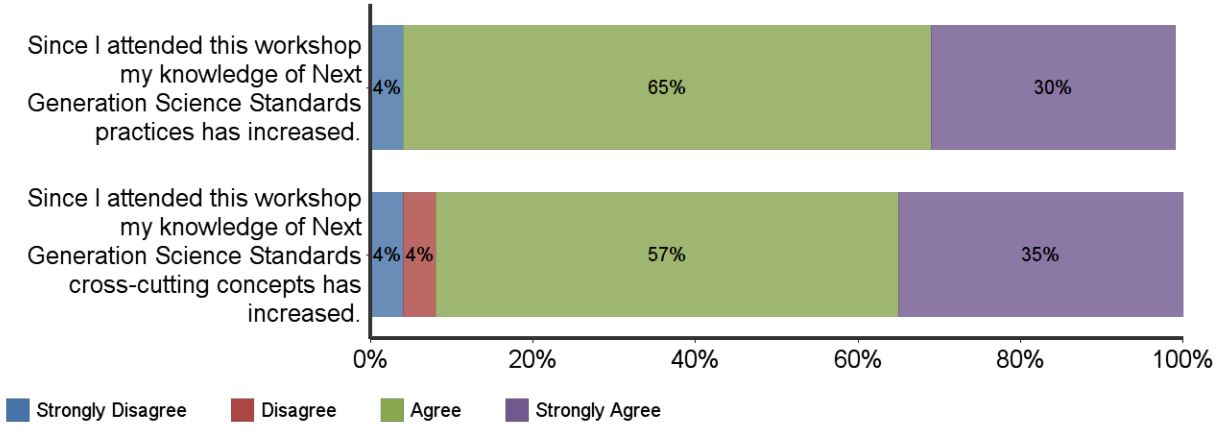
Please indicate your role:

Answer	Bar	Response	%
MSSST Teacher		14	61%
Teacher Research Fellow (TRF)		9	39%
Total		23	100%

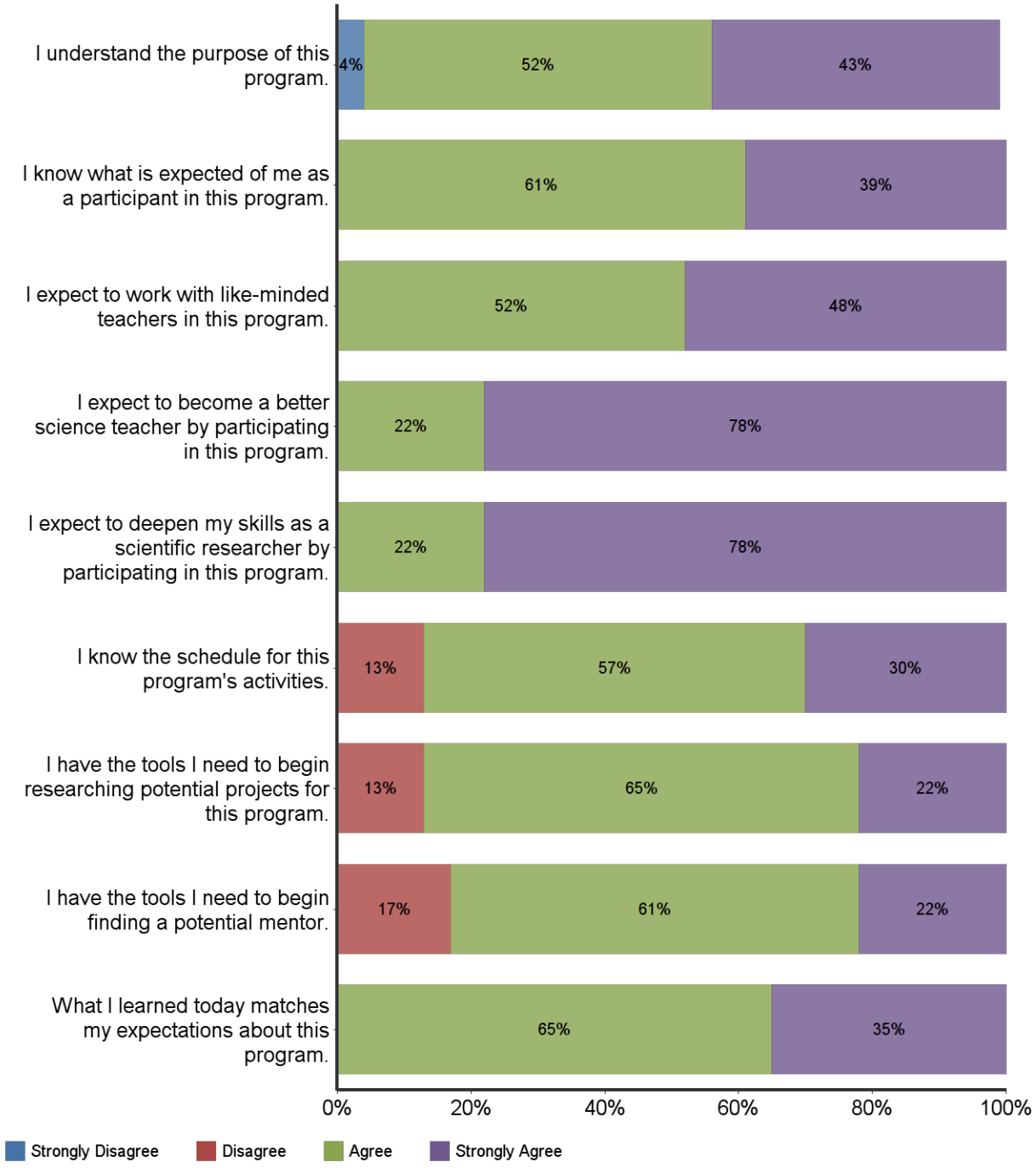
Please rate your level of competency in the following areas.



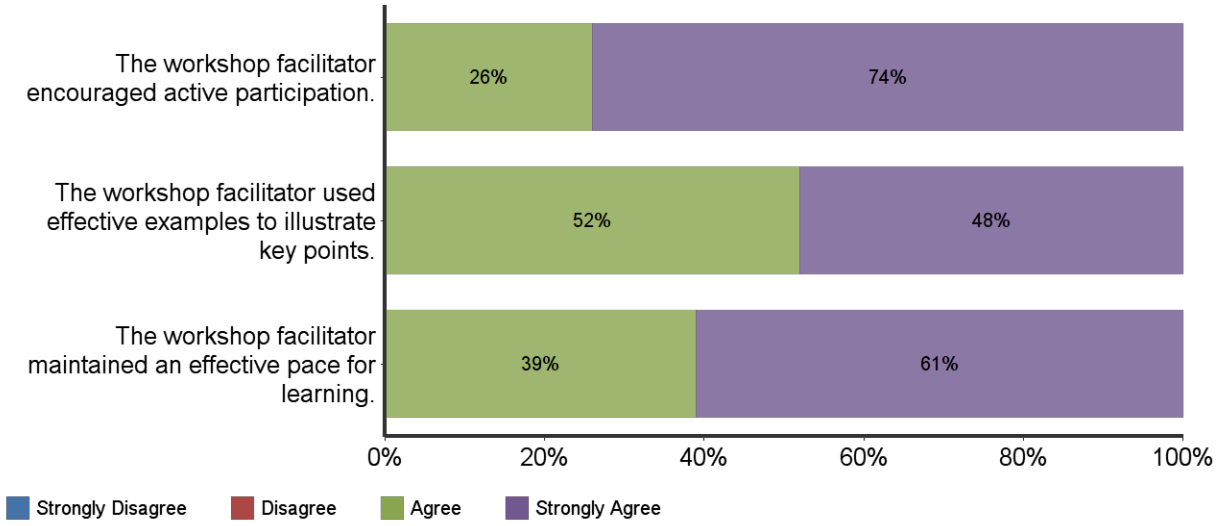
How strongly do you disagree or agree with the following statements about attending this workshop?



How strongly do you disagree or agree with the following statements about the content covered in this workshop?



How strongly do you disagree or agree with the following statement about the workshop facilitator?



Please indicate the primary reasons you are participating in this program. Select all that apply.

Answer	Bar	Response	%
Deepen my understanding of scientific research		21	91%
Deepen my understanding of scientific practices in the classroom		18	78%
Develop my skills as a teacher-leader		13	57%
Network with other science teachers		12	52%
Network with other scientists or university faculty		12	52%
Other		0	0%
Total		76	100%

To what extend did the stipend influence your decision to participate in this program?

Answer	Bar	Response	%
None		5	22%
A Little		2	9%
Somewhat		13	57%
A Lot		3	13%
Total		23	100%

Please use the space below to provide additional comments or feedback about the workshop.

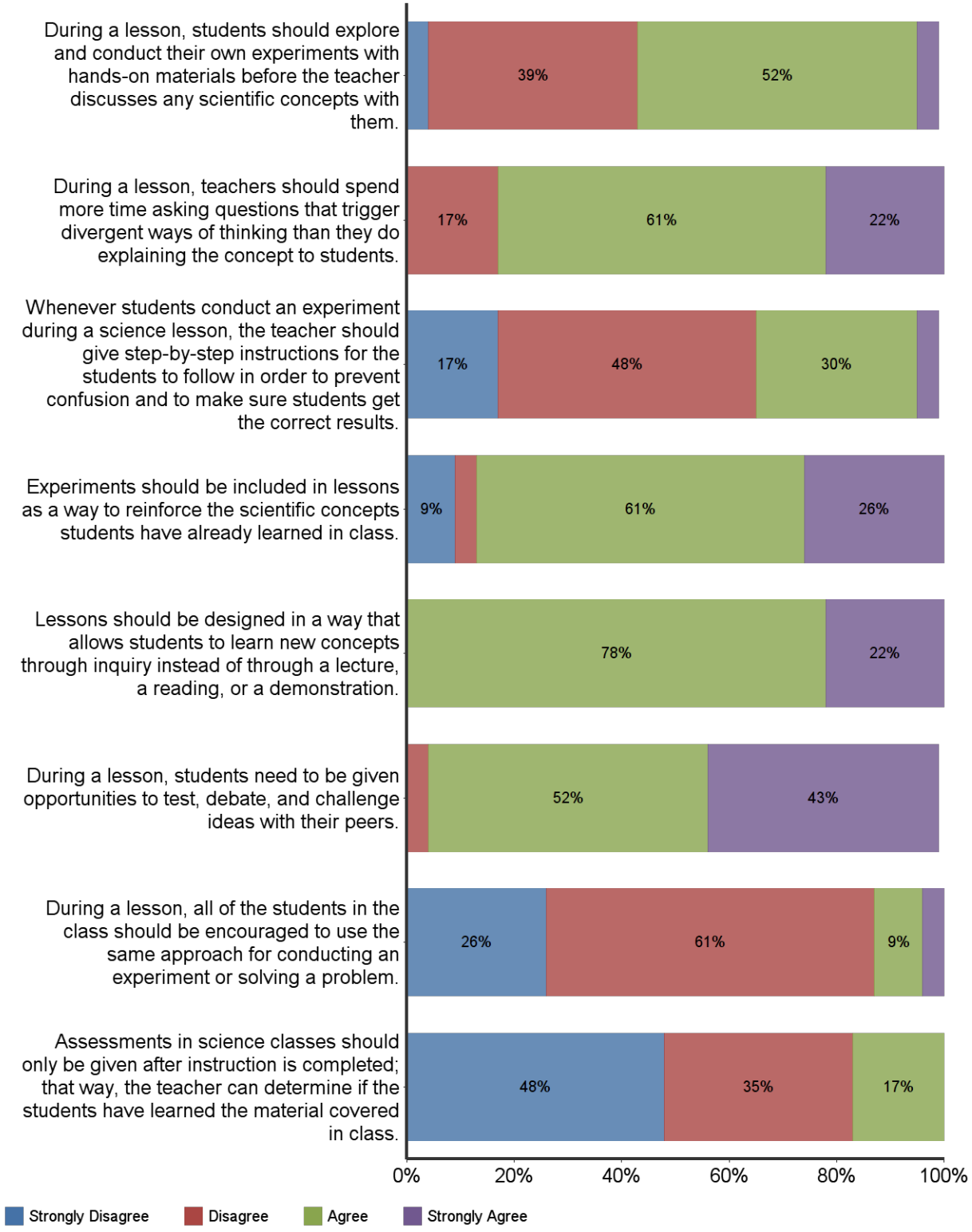
It was very enjoyable and informative about the expectations for the research.
I thought that it would all be laid out for me and I would just show up and participate, I'm excited about the prospect of working in a real research setting on a real-world topic!
I am so excited to have this opportunity. This is more responsibility and more opportunity that I anticipated and I am excited to take it on.
I am so grateful for this opportunity! I think it is important for science teachers to also be scientists and this program allows us to do this.
I selected that the stipend affected my decision to participate "a lot" on the previous page. I want to add that after attending this first meeting I am so excited that the stipend means less to me. I see this as an opportunity of a lifetime for me.
Very informative!
I was a little disappointed that we didn't get to do more outside. The water sample stuff was nice but it would have been better to actually go out and do it as its own thing and not attached to the end of lunch.
It was one of the most effective progessional development actvities I have attended in recent histor y.
The TRF went into this blind. additional information sent to them about the research would have been helpful
I really liked the flow of this workshop. However, it would have been beneficial to provide a little more scaffolding on expectations beyond the research portion. I am excited and I think this is going to be a unique experience that I really hope to learn from, as well as work with like-minded individuals on the same objective: implementation of authentic, field research within the classroom.
I am still worried about when all of this is going to come together with whatever professor that I work with and how to move forward from here. I have been looking up bios about some of the professors, but am still a little unclear about what my involvement will be in the project.

What additional workshop topics would be helpful to include in future workshops?

Practice on writing the thesis.
I am very interested in pursuing a masters in content teaching and would love to see the MSSST program continue.
-Specific examples of how to run activities based on NGSS practices and cross-cutting principals.
This just came to me which does not mean that I expect or even necessarily want it to happen. Training or discussions about other aspects of research, e.g. funding, grant writing, getting published. It seems to fit with the purpose of the program and really is a huge part of research.
Using 3D science in actual classroom activities.
More ideas for implementing engineering practices into my instruction.
Future workshops should possibly model this scenario, particularly the end goal. I would also really like more info on the future dissemination opportunities.

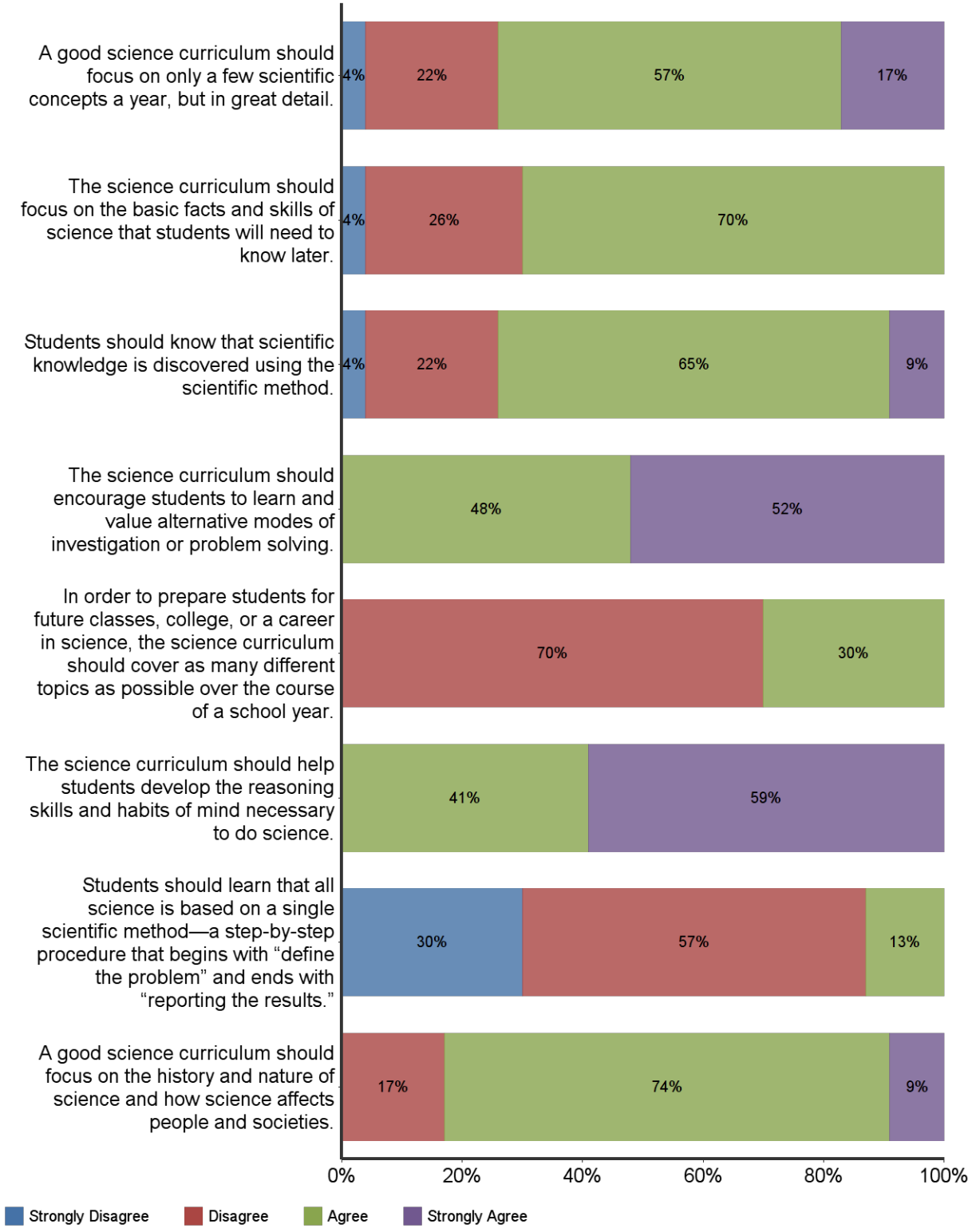
The statements below describe different viewpoints concerning the ways students learn about science. Based on your beliefs about how people learn, please indicate how strongly you disagree or agree with each of the following statements.

The statements below describe different ways science lessons can be designed and taught in school. Based on your opinion of how science should be taught, please indicate how strongly you disagree or agree with each of the following statements.



The statements below describe different characteristics of teachers and classroom learning environments. Based on your opinion of what a good science teacher is like and what a classroom should be like, please indicate how strongly you disagree or agree with each of the following statements.

The following statements describe different things that students can learn about in science while in school. Based on your opinion of what students should learn about during their science classes, please indicate how strongly you disagree or agree with each of the following statements.



2016

MSSST and TRF 2016 Summer Teacher Research Experiences

Survey Results

Utah Education Policy Center

September 2016

http://uepc.utah.edu/

Summer Research Experience 2016
Aggregate Report

This report presents a summary of results from a survey that was administered following the MSSST and TRF Summer Research Experience in 2016. The purpose of the survey was to evaluate the quality and usefulness of the research experience, the degree to which participants learned and feel they can now teach the Next Generation Science Standards (NGSS), and gather information regarding what additional assistance or training might be needed to help MSSST and TRF participants be successful in their classrooms.

This report presents all survey results from all MSSST and TRF participants in aggregate.

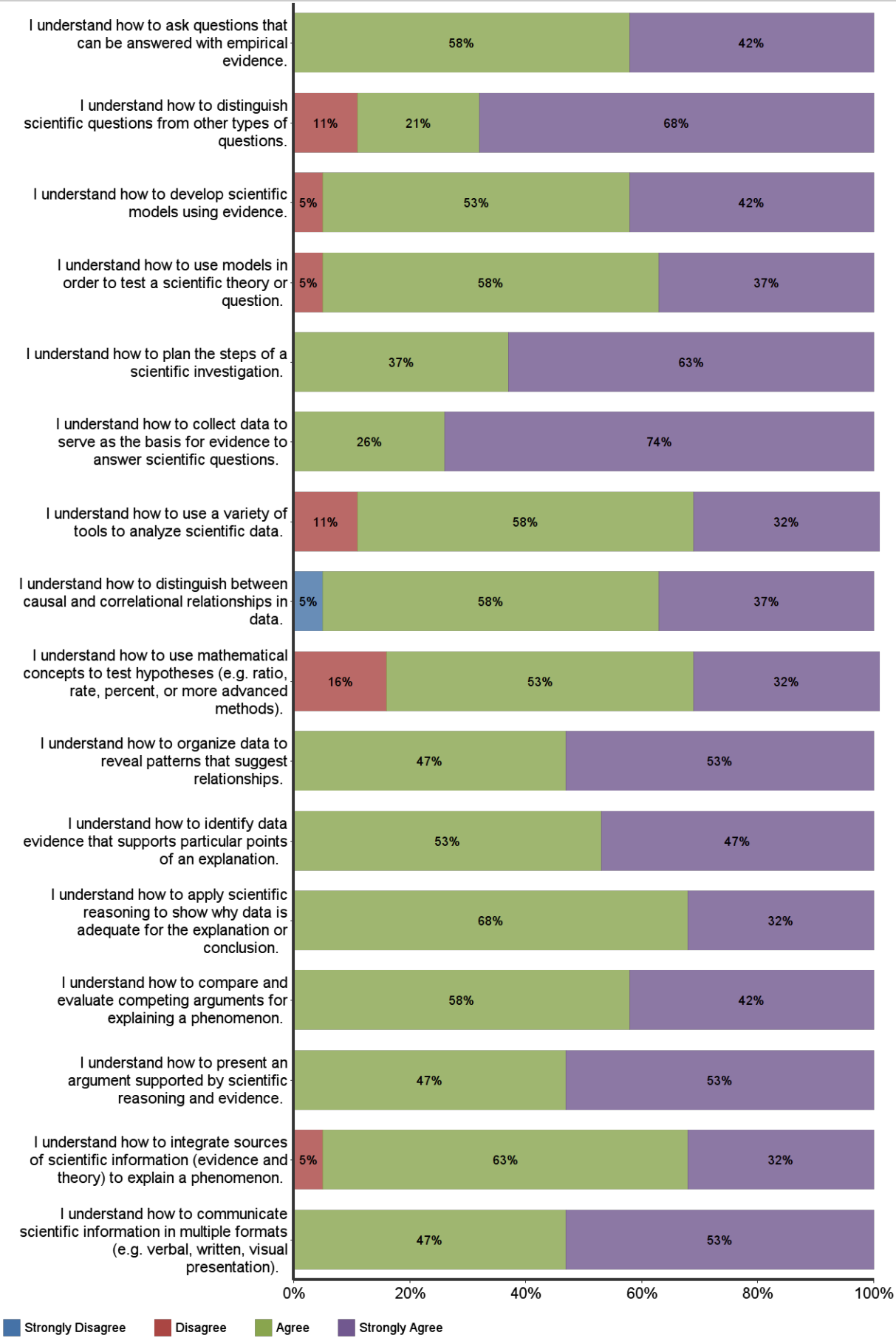
Please select your school district from the options below.

Answer	Bar	Response	%
Weber School District		5	25%
Davis School District		3	15%
Salt Lake City School District		3	15%
Murray School District		1	5%
Jordan School Distict		1	5%
Alpine School District		2	10%
Granite School District		3	15%
Ogden School District		0	0%
Canyons School District		2	10%
Other		0	0%
Total		20	100%

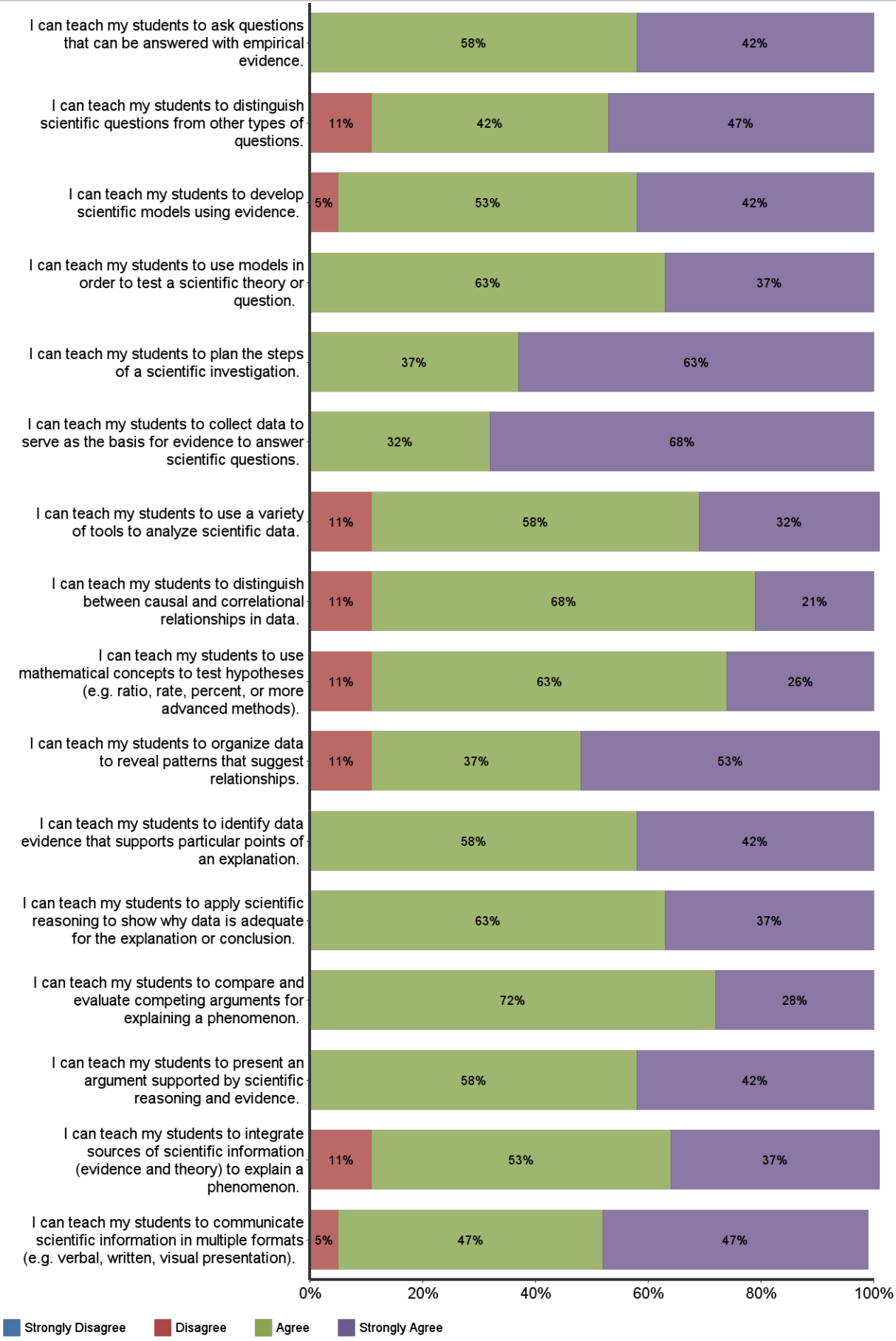
Please indicate your role:

Answer	Bar	Response	%
Masters of Science for Secondary School Teacher (MSSST)		11	55%
Teacher Research Fellow (TRF)		9	45%
Total		20	100%

To what extent do you disagree or agree with the following statements about *your understanding of* the the NGSS:



To what extent do you disagree or agree with the following statements about *teaching*?



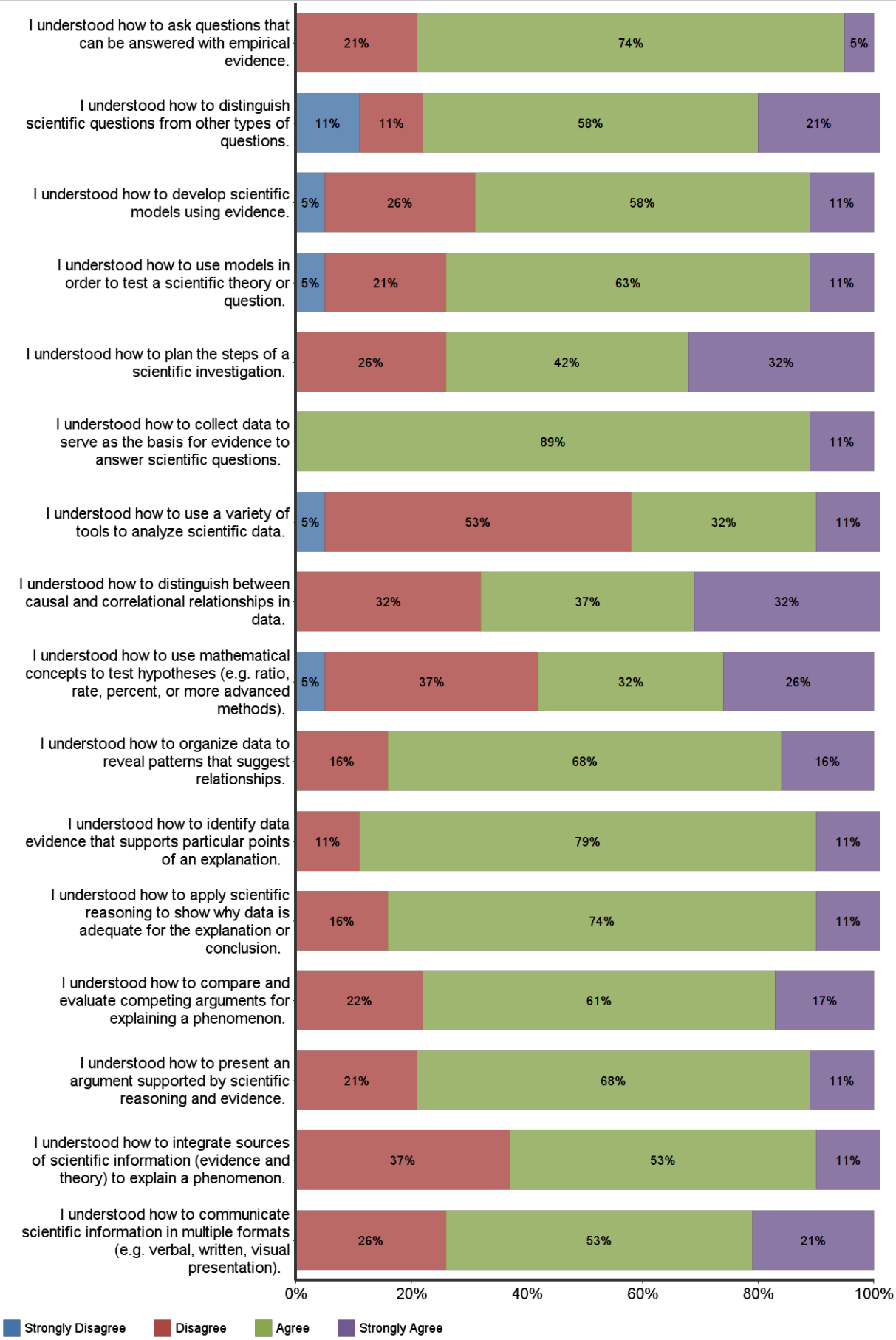
What did you learn that was new about the Next Generation Science Standards (NGSS) and cross-cutting (CC) science concepts?

I learned what they are first of all, but I think the idea of using models was relativel new to me.
I like the fact that concepts are less isolated. In Earth Science, everything is integrally connected to everything else. Teaching this way makes more sense.
The depth requirements are much greater than the current core.
I learned that analyzing data can take years. I learned that understanding how computer programs that organize extremely large sets of genetic data is important. I learned that scientists really have to be good writers.
Nothing
That I already use many of the ideas in the NGSS but some of standards will be difficult to integrate in the time available during the school year.
Since I have been learning about the NGSS during its earliest adoption in other states in my undergrad I am very familiar with the NGSS and cross-cutting science concepts. I am at the point where any introductory class on the NGSS, which is all I have been able to find in Utah as they took 2 years to adopt a modified version of the NGSS in their middle grade because it is a state that is quite frankly scared of science, to me is repetitive and not a good utilization of my time especially as I fully expect the Utah School Board to take another 3-5 years and several thousands of dollars wasted before they decided they will adopt a modified NGSS at the high school level.
Before the TRF program, I had no idea what NGSS was other than the fact that I heard the new AP Physics 1 curriculum is based off them. I learned NGSS is a new way of organizing standards for science education. It transitions from saying what students should "know" into what they are able to do. NGSS defines performance expectations that state what students should be able to do in order to demonstrate that they learned the stuff. Cross-cutting concepts are the skills and ways of thinking that apply to more than just one branch of science. My research experience showed me how important it is to be well-rounded in scientific abilities and knowledge. The more CC concepts I fully understand, the better I will understand the world in general, and the more useful I will be in a lab (or collaborative) setting.
Argument in science (which is a practice) is not arguing to argue- but to give evidence for an earlier claim given.
The MSSST program introduced me to the NGSS so everything was new.
When you see the value of using them together, they are not as daunting as initially preceived
I learned that the more flexible I am with teaching science concepts under the new standards facilitates a more student-centered engaged classroom. Also, when students know how to navigate through the different practices and understand that the cross-cutting concepts are the underling big ideas, they are more capable of making connections during their learning process. Overall, this promotes a learning environment that demands students to participate on a higher level. It also becomes easier for students to recognize that they are actually ‘doing’ science.
I learned that science is not really as separate as I, and many others I believe, have thought. Biology, geology, chemistry, and environmental science utilize the same thinking and processing actions in addition to any and all other branches of science. Bringing that fact to the front made teaching one subject easier.
I learned how to present a phoenomenon and allow students to have experiences that guide them to explanation instead of just giving them explanations.
During this process I learned so much about the NGSS and cc concepts. My prior exposure and knowledge was limited. I learned about the intersection of the core, ccc's and practices. I learned ideas on how to begin teaching and using the practices and ccc's within existing lesson plans.
The way they are being intergrated across grade levels and the benefit for all grade levels.
All disciplines of science have many connections.
importance of patterns; cause and effect relationships; use of scales over time and space

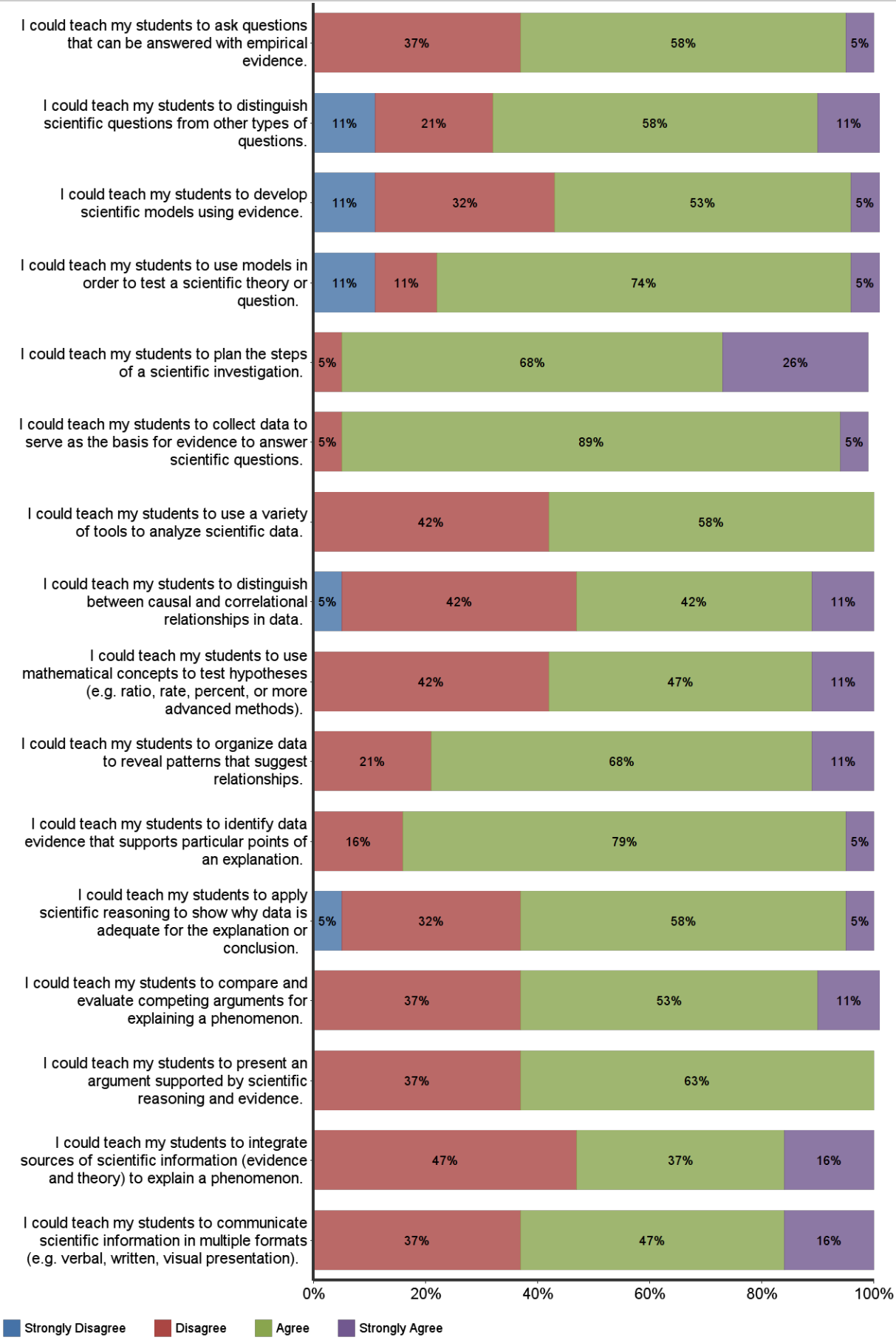
What else did you learn beyond the standards and concepts as a result of participating in the summer research experience?

I developed a much keener appreciation for how scientific research really works. It has been very big confirmation for me. I have always told my students that scientific processes are not always linear, but did not have first hand knowledge of how true that was until this experience.
Working in an actual lab is something I did not do as an undergrad and it is fascinating to see how meticulous all of the measurements are.
The process of research and discovery requires a lot more data than i thought.
I learned that scientists collaborate a ton. I learned that in genetics you are often "casting a big net" to see if you get anything interesting--in other words, you often don't know exactly what you are looking for at first.
The main thing that research experience taught me was that science is messy and can be very frustrating. The answers are not always clear.
How to better articulate to my students the difficulties involved in conducting science research and how to organize research information to be presented to others.
I learned science doesn't go as planned and one hot day can kill all of your trial specimen in the field and make all your work that week a waste.
The most important thing I learned is the significance of collaboration in experiments and theoretical analysis. In order to understand something better and get new ideas, I found myself asking for help from experts in disciplines outside of physics. Someone who had a PhD in biology gave me the best analogy to understand quantum tunneling. I figured this is because the "cross-cutting concepts" are so deep in that level of science. Regarding the standards, it was obvious that simply lecturing and telling a class about the physics they should know is next to useless. Showing them a logical thought process and reinforcing a scientific way of thinking about approaching things would be a much better use of time. As a result of what I learned this TRF program, I will focus on teaching my current students how to DO science. We will start with an observation of a physical process, build a mathematical model which is testable, then test it in the lab. This will emulate the real-world science much better than my classes have done in the past.
Data is messy, time consuming, and so cool when you start to pull out the relationships.
I learned more about the international science research culture. How scientists from diffrent locations work together to discover new understanding.
Being in the field brings an entirely new level of confidence to what I want to do in the classroom and my ability to do it!
In science, the value of participating in research in order to enhance one’s own teaching is crucial. Not only does it make the teacher more competent in his or her field, but it provides a perspective that is close to what younger students experience when they are discovering scientific concepts for the first time.
Sometimes science is not personally enjoyable. There are questions that are more interesting to some than others, or the question may be interesting, but the process of that experiment is not. It seems that there is an obsession with showing students how awesome and exciting science is. However, field work, and lab work, can be arduous, tedious, and even just unpleasant.
I learned that I really DO love science. I hadn't had a chance to do really important and authentic research and it was something i had always wanted to do. I appreciated this opportuity and it has made me more passionate about my subject.
I have learned the value of collaboration and professional connections. I have learned how to conduct an ethnographic study. I also have learned about the evolving and constantly shifting vision of research.
The research that is going on in the labs is far beyond the spectium and level of what I though was possible.
real world science practices to be applied in the classroom.
I can do lab work and research! I was trained on a lab procedure that was quite difficult, and I finally mastered it. I learned about science practices by using them.

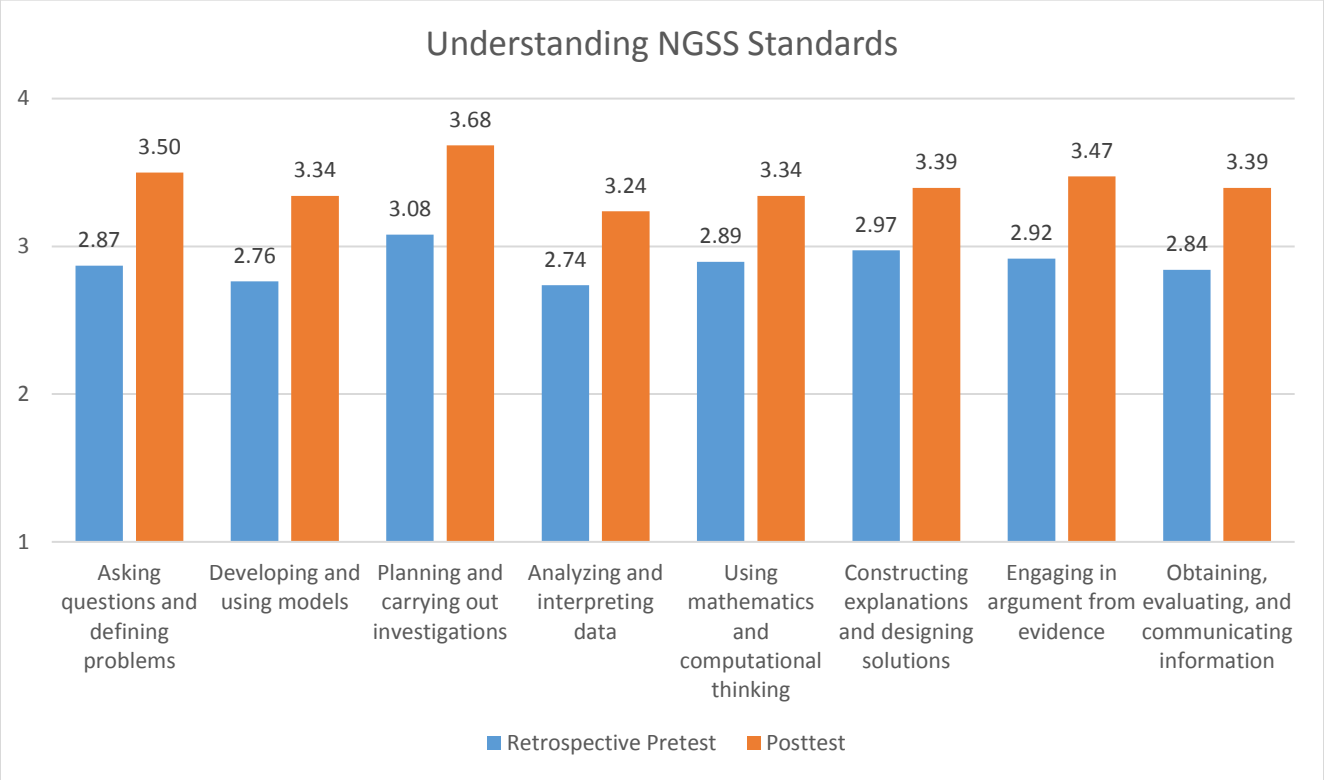
To what extent do you disagree or agree with the following statements about *your understanding of* the the NGSS before participating in the summer research experience:

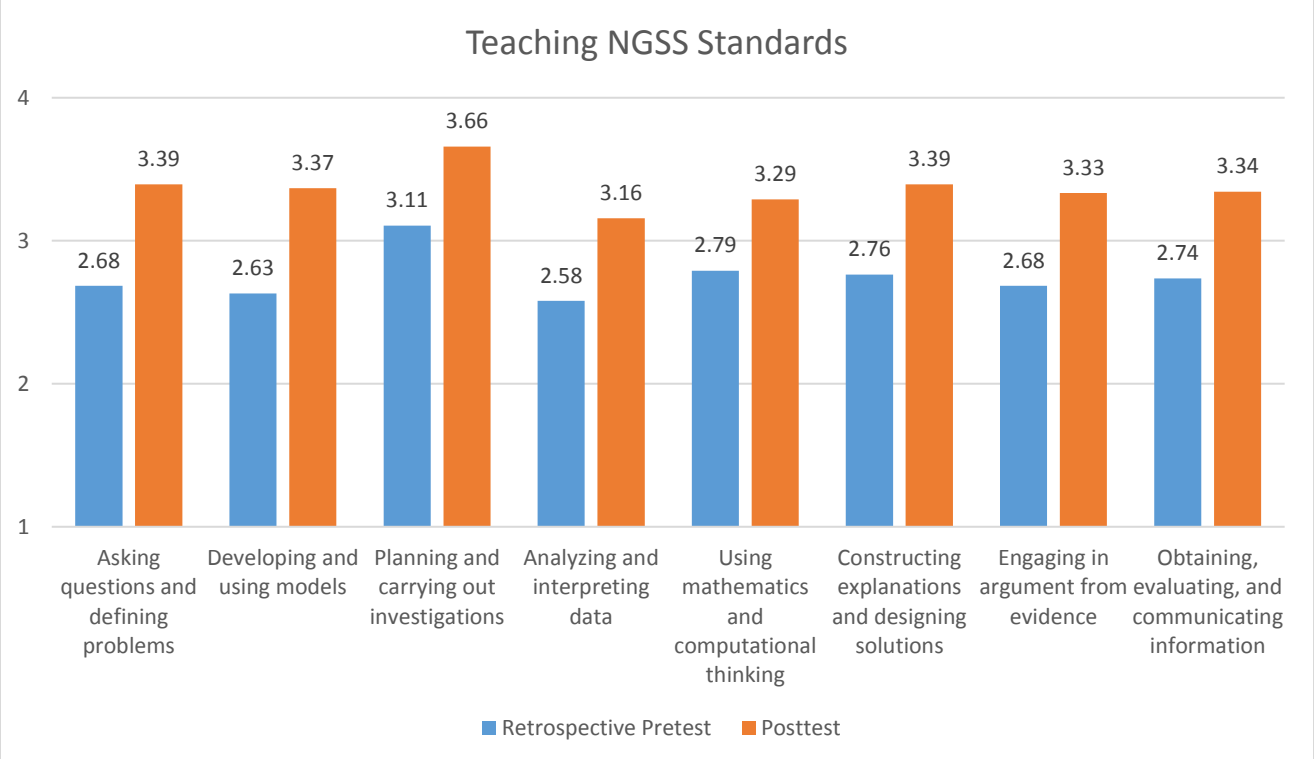


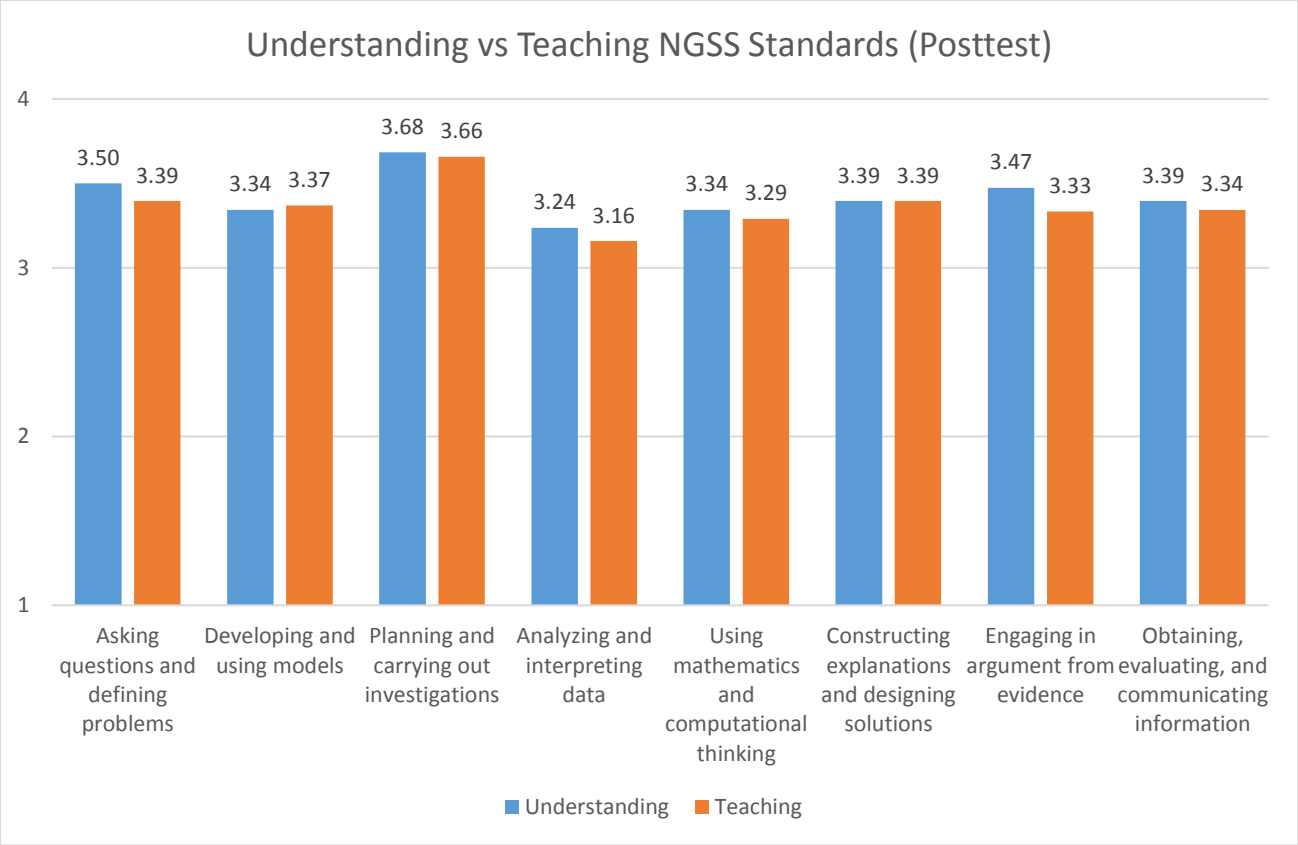
To what extent do you disagree or agree with the following statements about *teaching* these standards <u>before</u> participating in the summer research experience?



NGSS


Understanding NGSS Standards
4
3
2
1
2.87
3.50
2.76
3.34
3.08
3.68
2.74
3.24
2.89
3.34
2.97
3.39
2.92
3.47
2.84
3.39
Asking questions and defining problems
Developing and using models
Planning and carrying out investigations
Analyzing and interpreting data
Using mathematics and computational thinking
Constructing explanations and designing solutions
Engaging in argument from evidence
Obtaining, evaluating, and communicating information
Retrospective Pretest
Posttest


Teaching NGSS Standards
4
3
2
1
2.68
3.39
2.63
3.37
3.11
3.66
2.58
3.16
2.79
3.29
2.76
3.39
2.68
3.33
2.74
3.34
Asking questions and defining problems
Developing and using models
Planning and carrying out investigations
Analyzing and interpreting data
Using mathematics and computational thinking
Constructing explanations and designing solutions
Engaging in argument from evidence
Obtaining, evaluating, and communicating information
Retrospective Pretest
Posttest


Understanding vs Teaching NGSS Standards (Posttest)
4
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3.50
3.39
3.34
3.37
3.68
3.66
3.24
3.16
3.34
3.29
3.39
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3.34
Asking questions and defining problems
Developing and using models
Planning and carrying out investigations
Analyzing and interpreting data
Using mathematics and computational thinking
Constructing explanations and designing solutions
Engaging in argument from evidence
Obtaining, evaluating, and communicating information
Understanding
Teaching

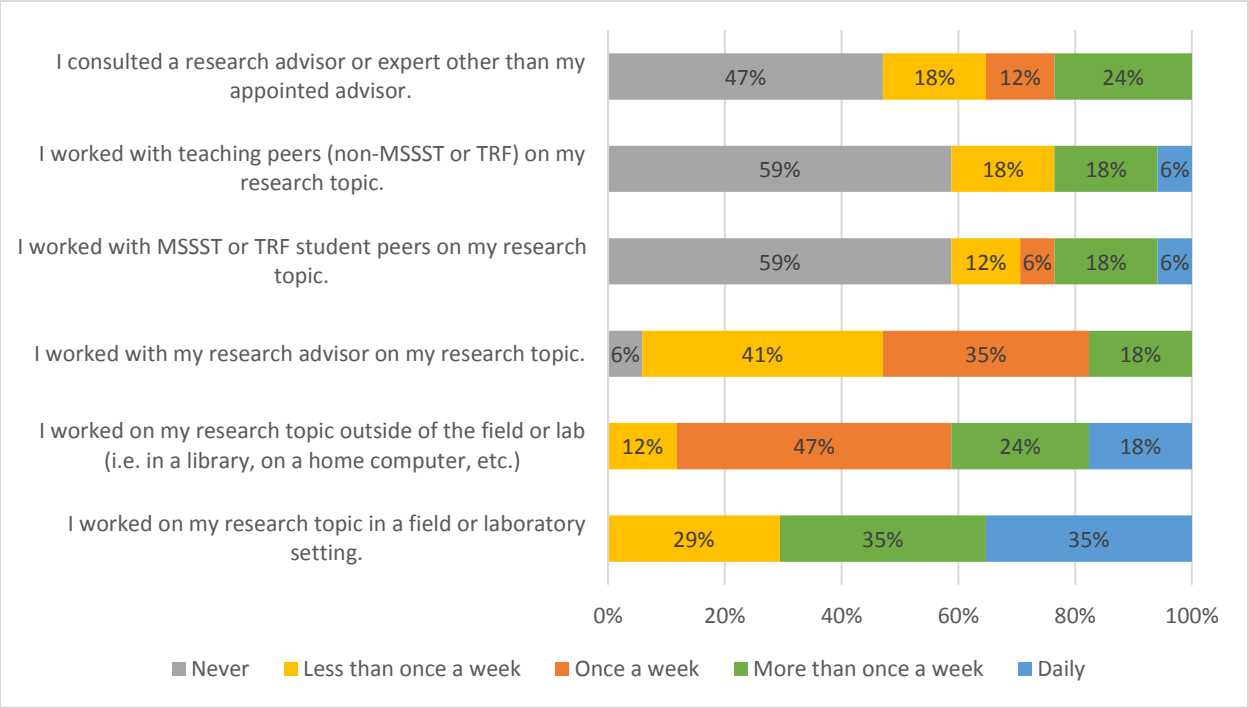
Where did your summer research experience take place?

Answer	Bar	Response	%
In a field setting		3	15.79%
In a laboratory setting		7	36.84%
In both a field and laboratory setting		9	47.37%
Total		19	100.00%

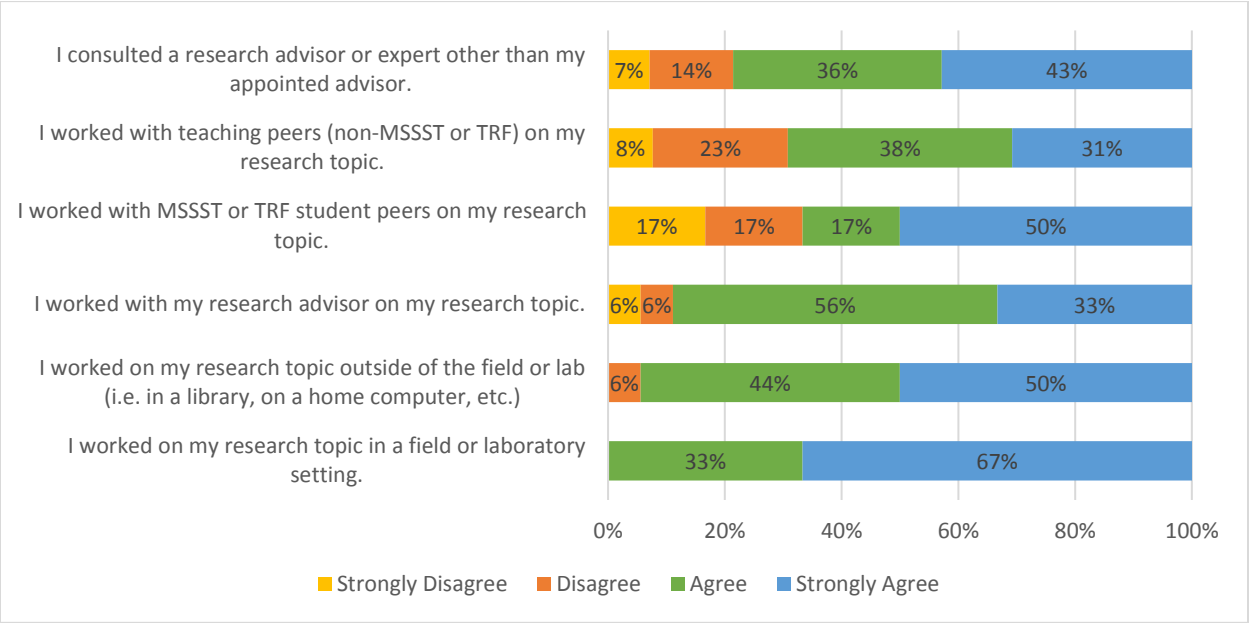
Please rate the frequency and value of the following experiences you may have had as a part of this summer research experience.

			Count	Percent	Totals
I worked on my research topic in a field or laboratory setting.	Experience Frequency	Never	0	0%	
		Less than once a week	5	29%	
		Once a week	0	0%	
		More than once a week	6	35%	
		Daily	6	35%	Count = 17 % = 100
	The Experience was Valuable	Strongly Disagree	0	0%	
		Disagree	0	0%	
		Agree	6	33%	
		Strongly Agree	12	67%	Count = 18 % = 100
I consulted a research advisor or expert other than my appointed advisor.	Experience Frequency	Never	8	47%	
		Less than once a week	3	18%	
		Once a week	2	12%	
		More than once a week	4	24%	
		Daily	0	0%	Count = 17 % = 100
	The Experience was Valuable	Strongly Disagree	1	7%	
		Disagree	2	14%	
		Agree	5	36%	
		Strongly Agree	6	43%	Count = 14 % = 100
I worked on my research topic outside of the field or lab (i.e. in a library, on a home computer, etc.)	Experience Frequency	Never	0	0%	
		Less than once a week	2	12%	
		Once a week	8	47%	
		More than once a week	4	24%	
		Daily	3	18%	Count = 17 % = 100
	The Experience was Valuable	Strongly Disagree	0	0%	
		Disagree	1	6%	
		Agree	8	44%	
		Strongly Agree	9	50%	Count = 18 % = 100
I worked with my research advisor on my research topic.	Experience Frequency	Never	1	6%	
		Less than once a week	7	41%	
		Once a week	6	35%	
		More than once a week	3	18%	
		Daily	0	0%	Count = 17 % = 100
	The Experience was Valuable	Strongly Disagree	1	6%	
		Disagree	1	6%	
		Agree	10	56%	
		Strongly Agree	6	33%	Count = 18 % = 100
I worked with MSSST or TRF student peers on my research topic.	Experience Frequency	Never	10	59%	
		Less than once a week	2	12%	
		Once a week	1	6%	
		More than once a week	3	18%	
		Daily	1	6%	Count = 17 % = 100
	The Experience was Valuable	Strongly Disagree	2	17%	
		Disagree	2	17%	
		Agree	2	17%	
		Strongly Agree	6	50%	Count = 12 % = 100
I worked with teaching peers (non-MSSST or TRF) on my research topic.	Experience Frequency	Never	10	59%	
		Less than once a week	3	18%	
		Once a week	0	0%	
		More than once a week	3	18%	
		Daily	1	6%	Count = 17 % = 100
	The Experience was Valuable	Strongly Disagree	1	8%	
		Disagree	3	23%	
		Agree	5	38%	
		Strongly Agree	4	31%	Count = 13 % = 100

Experience Frequency



Value of Experience



Please rate the extent to which you feel the time provided in the summer research experience (e.g. research and mentor hours) was sufficient to complete your goals.

Answer	Bar	Response	%
Extremely Insufficient		0	0.0%
Somewhat Insufficient		4	22.2%
Somewhat Sufficient		6	33.3%
Extremely Sufficient		8	44.4%
Total		18	100.0%

Please describe how the structure of the summer research experience supported your ability to conduct scientific research.

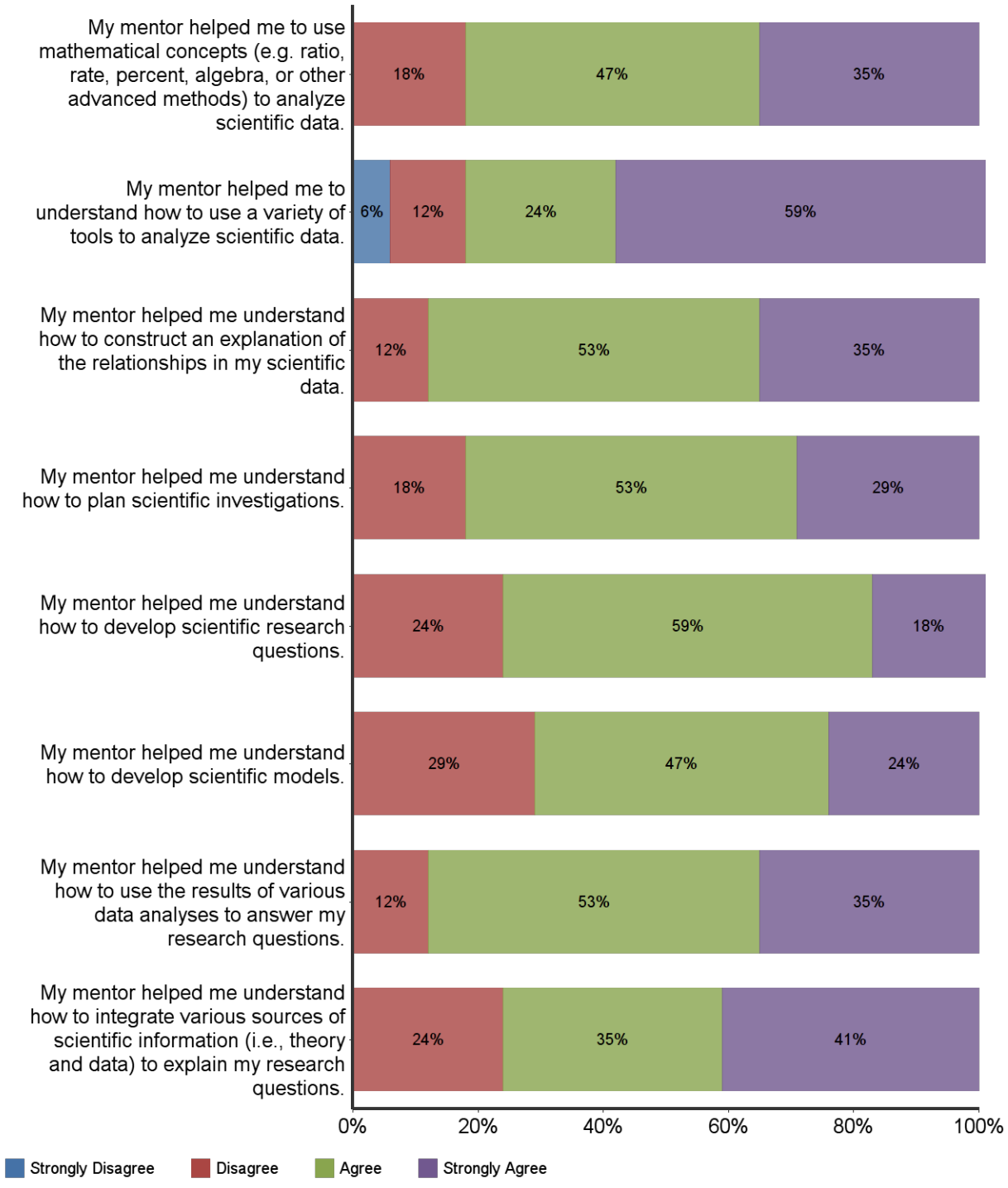
I worked on Theoretical Quantum Physics with [redacted] at the University of Utah. We met semi-frequently and collaborated over Skype/email on a regular basis. [redacted] showed me how to use resources to teach myself the foundations of quantum mechanics. He gave me a solid plan which was to read up on a concept, like Linear Combination of Atomic Orbitals, and use books, Wikipedia, and other scientists to understand what we already know about atomic bonding. This was incredibly difficult because the math was beyond me at first. [redacted] insisted that I just keep practicing problems, one after another, until the math starts to become easier to understand. It is only by understanding the math that I can truly start to see what is happening on the quantum level. We did so much background work, and [redacted] did his best to help me learn how to teach myself this stuff, but at this point my math is still not at the right level to be of any meaningful help with his research project on the chirality of electrons near grapheme. We will not give up, though! I am still working on trying to bring my knowledge of quantum up to the place it needs to be to help with the project. [redacted] and I plan to collaborate throughout the rest of 2016, and I'll keep improving and working hard in order to be of some use to him. I learned that research is REALLY tough work, and you have to spend a lot of time thinking trying to figure stuff out. Thinking is not enough, however, because nobody will ever write a research grant for "thinking"... I also have to write down stuff and keep track of my progress in order to prove myself and collaborate effectively with others. Now I'm much more well versed in quantum theory and have documentation to back it up. Keeping meaningful notes is such a huge part of research, and something that I had overlooked in the past.
I learned a lot about direction and microscopy techniques, I learned the value of lab trials before field trials, and I learned how in field trials many factors will be difficult to control.
Firstly, if it wasn't in the summer none of us would have been able to do this research because we would have been teaching. Secondly, being at the U of U put us in close contact with many scientists that we could research with.
I spent time both is a classroom setting learning about the different research projects and in the lab doing some of the experiments.
I was able to work in a lab and in the field. I was exposed to a wide range of scientific research.
The research I did was up in the mountains and down in the inner city. Although I can not take my students to the mountains, I can bring in some of the tools and equipment that I used and do a mock up with my students in the classroom. I could also create lesson labs that students can do in their yards or nearby parks.
I was able to attend the actual testing in May and spend my summer doing analysis.
I liked the latitude that we had as far as scheduling. On my project, it was sometimes difficult to complete tasks because the hours kept by the lab I was working in limited the time I could work. The lab wasn't open early or late sometimes and the people I was working with had other things they were doing and a schedule that we couldn't always work out.
Being invited to work with someone who was actively engaged in scientific research was a pretty precious experience for me because it was something that I wanted to do but didn't have the time or the knowledge to conduct the research on my own. I appreciated [redacted] patience with me as I adapted to the environment and learned skills from her that make me a better scientist. She taught me how to use a GPS and how to identify the species and locations that would be required to control the experiment and get accurate data. She taught me how to handle the materials and even introduced me to the difficult process of acquiring permission and working with federal and state and city agencies to make sure research fell within legal boundaries. I knew how the process worked, but had never actually been able to see it through. There is still so much to DO though. I could work with her on this type of work for the rest of my life and I'm sure we would never run out of questions to ask and data to collect and analyze. Really this was a life altering experience for me.

We looked at carbon and nitrogen isotopes in fingernails from students at our high school. We did not know what to expect but our results indicate some interesting results between those who eat school lunch and those who don't. Our lesson plan is to extend this research over time with more students. We feel pleased that our topic is relevant to our school and our students and our lesson plan will be published to other teachers at our school and district.
The topic and timeline was open to the individuals and their mentors. This made it much easier for me to schedule research times around professional development and so forth. In addition, having multiple areas of study was beneficial.
The entire research team was very helpful in helping me run samples, answer questions, map the sites, etc. I was left to my own devices to analyze the data using a program I was not familiar with and felt my time was wasted. I did learn from that experience that your data doesn't always make sense.
It was nice to be out in the field collecting data and then being able to work with my mentor through the data after it was collected- so I would know what to look for and how to interpret it.
The flexibility of when to conduct the research was important. I also appreciated the opportunity to continue working on the project at home after the field component was completed.

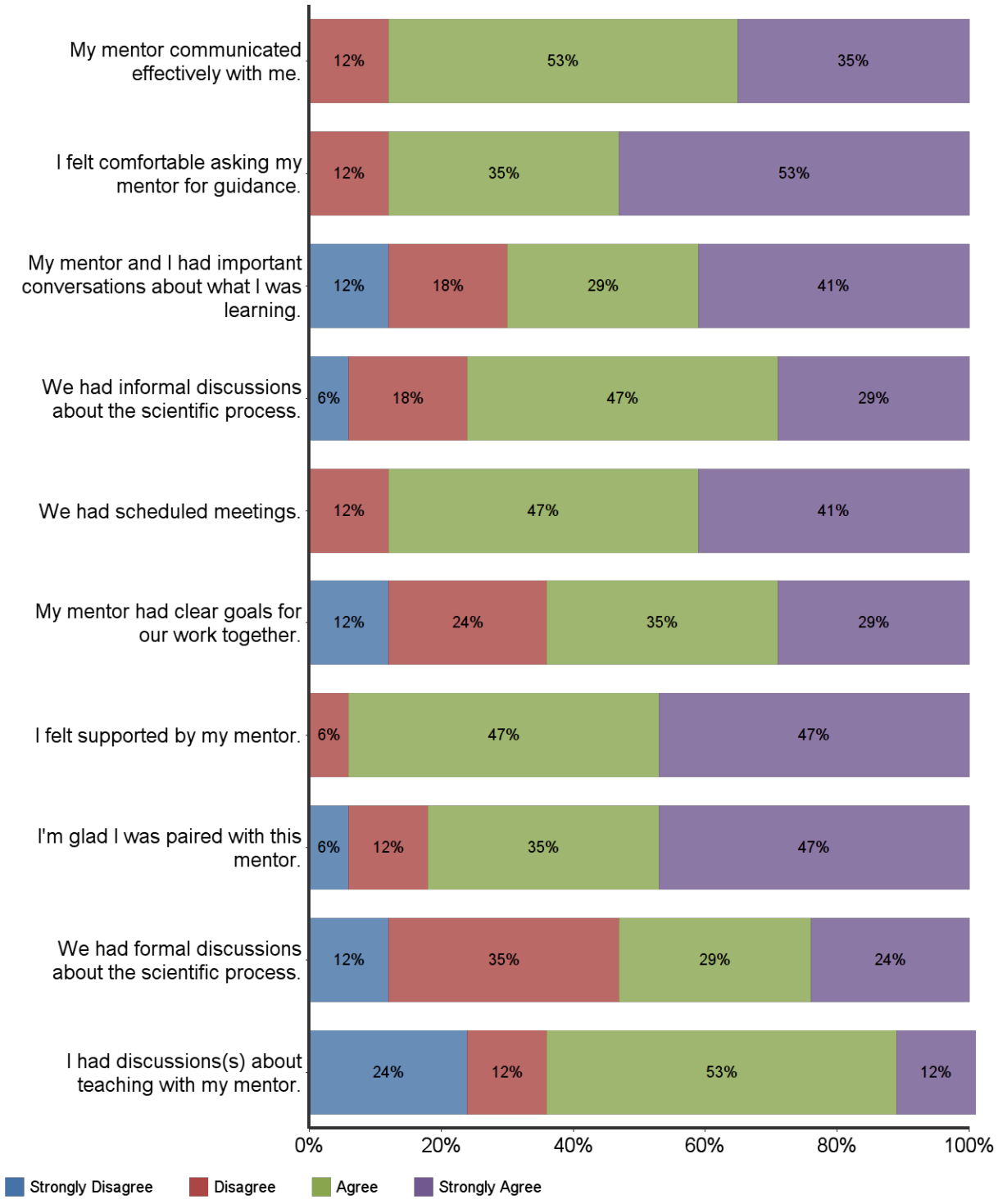
What could have improved your experience?

I know my mentor did his best with his lack of time and my lack of quantum mechanics knowledge, but I wish there was a way he could have given me a rundown of the math specifically aimed at his project so I could take more time doing actual data analysis and theoretical research. I feel like too much of my time was spent with me struggling to learn the math behind quantum mechanics. That struggle was educationally meaningful though because I learned so much by the end, including how difficult it is to learn things without a teacher. It seems like that is what research is: Learning things without a teacher.
It was great. A lot of mice died for science and to my knowledge I have no new diseases.
The only thing I can think of is maybe having another MSSST or TRF student working with me.
More time would have been helpful. I would have liked to start my research project the summer before so I could maximize my experience.
More structure on planning events. The Students we were working with were great but we were not a high priority for them. There was litte stucture to the schedule to get the most out of the experience.
Working with other teachers-having a partner
Better understanding of what was expected of me, and also a bit more heads up on what the project involved before I had agreed to work with the professor.
If I was working with someone else. My data analysis was self driven; I could have used the support of someone else.
I just need a little more time because of the conflicts. But it was a really great learning experience.
Nothing.
No real improvements needed to make for a better experience.
I thought the structure of this program was extremely well organized. Every course taught us not only new content but new strategies as well. For example, the field ecology helped us read statistics and scientific papers. Our last course helped us practice our presentations. [redacted] is very dedicated to our success. I am thrilled with my experience in the program.
My mentor really did not understand his role or really the program at all. He did not actually have a project in place when we first met with him. This delayed us immensely. It was rather frustrating. Also, I was part of a geochemistry group because the biomedical one was potentially not going to pan out. I thought there would be more chemistry based on what I heard about the project - which as mentioned above was not really planned yet. That was not the case. I knew and know so little about geology that the project was intimidating - not the field work, but the comprehension - and not enjoyable. Geology is not my favorite. branch. Most certainly it is my least favorite. My peer was knowledgeable in geology and in field work with geology, which caused me to feel more inferior in a way. I would have liked to experience this first, authentic research experience with content in which I was familiar so that I would have been more comfortable.
More explicit instruction on how exactly to analyze the data. Rather than "just start graphing and looking for patterns."
More background information in regard to the field I was doing my research in.
I am satisfied with the experience I had. It was a typical for the program I believe, but of value to me.

Please rate the extent to which you disagree or agree with the following statements about how working with your mentor (e.g., advisor, supervisor, etc.) helped you to understand the Next Generation Science Standards (NGSS).

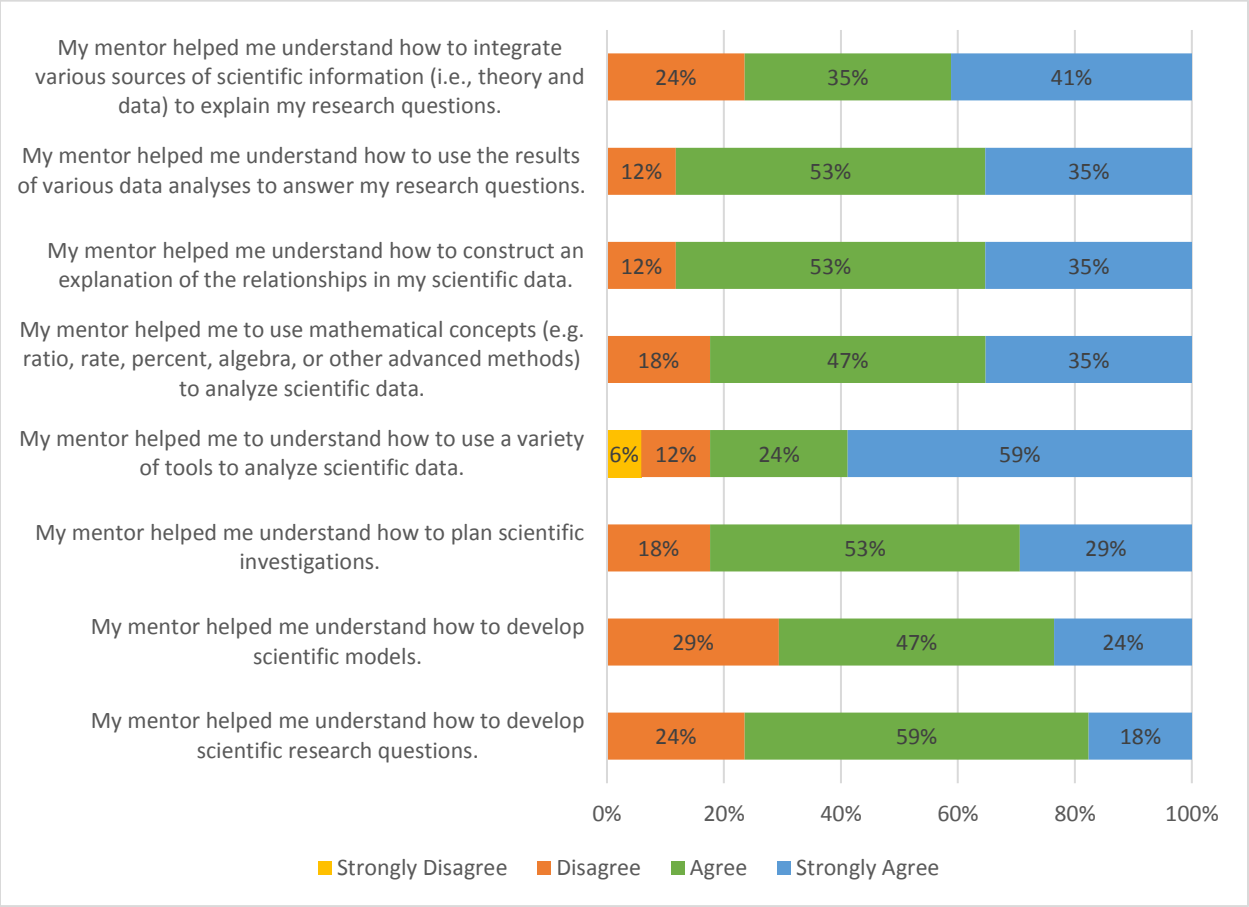


Please rate the extent to which you disagree or agree with the following statements about working with your mentor (e.g., advisor, supervisor, etc.).

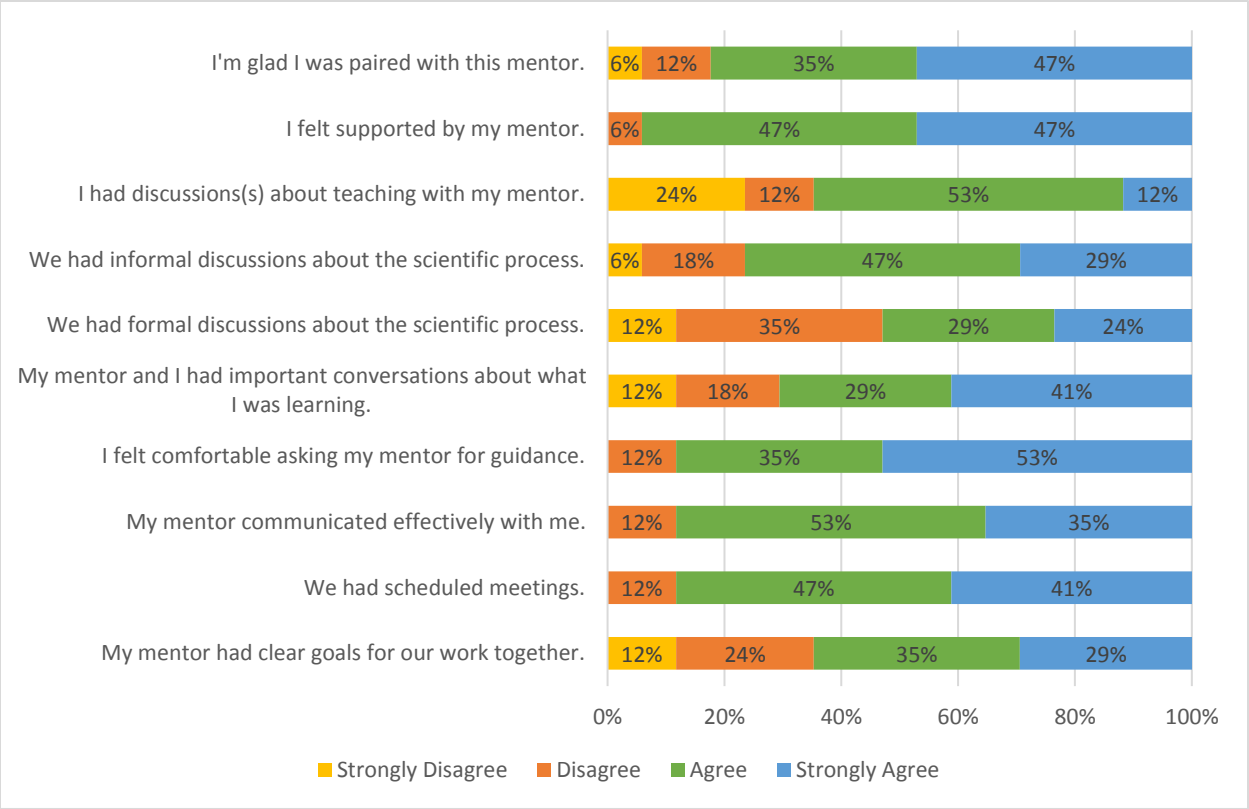


Mentoring

Mentoring and NGSS



Working with Mentor



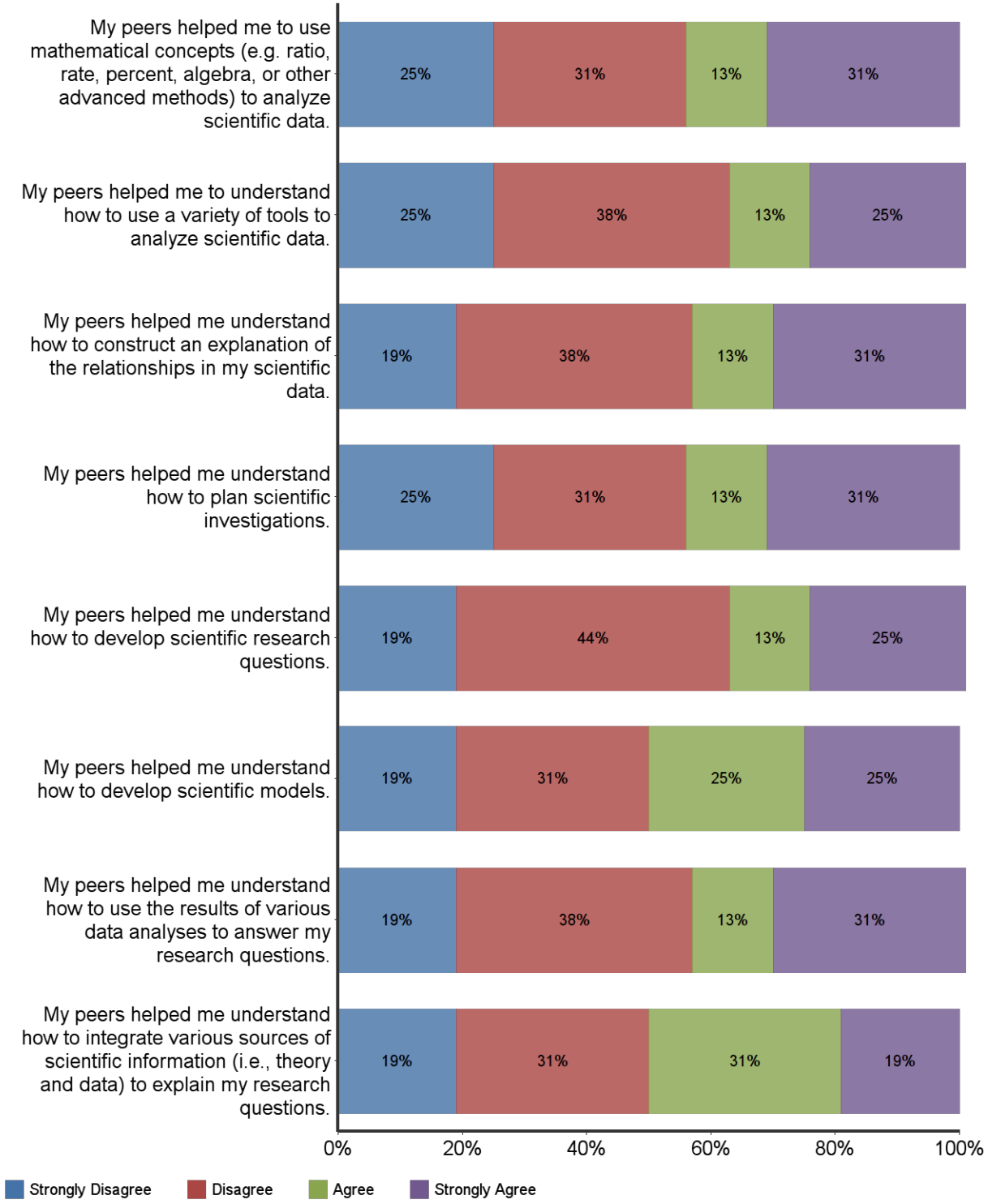
What was most useful aspect of working with your mentor?

He is a brilliant person, and has a great [redacted]work ethic, something I could learn a lot from. He is legendary in his problem solving skills, and we have talked about an outreach program where he might help some of my students focus and hone their problem-solving skills with the goal of entering a (possibly international) competition.
I felt very included in the lab and was asked to participate in lab meetings, etc.
Her expertise in the genetics field.
Very knowledgeable about the research subject. It was cool being involved in the research process and learning about the lab processes.
To see what was going on in the labs at the University.
mentor was very encouraging
Having someone with so much experience in the field, but also being able to shere ideas about presenting things in the classroom to our students
He was extremely supportive and willing to work with me.
She was very open to allowing me choice, but was also very good at directing me when I was lost.
she was very willing to act as a teacher and lead scientist. She was very giving.
My mentor would take the time to explain problems that occurred and reasons for what I was seeing with the data collected. She allowed me to work through problems I would encounter and try to solve them on my own.
[redacted]was full of enthusiasm and support for our ideas.[redacted]was great at helping us understand our data and schedule our time in the lab.
He was very positive and had a genuine desire to help me with my assignment.
He responded to my emails quickly.
Their ability to describe what we were looking at in terms I could understand,
I think [redacted]passion for his project and for science education were the most useful aspects of our partnership. It was encouraging in regard to the research and in my endeavors as an educator. Secondly, having consistent and open communication about the project was very useful.

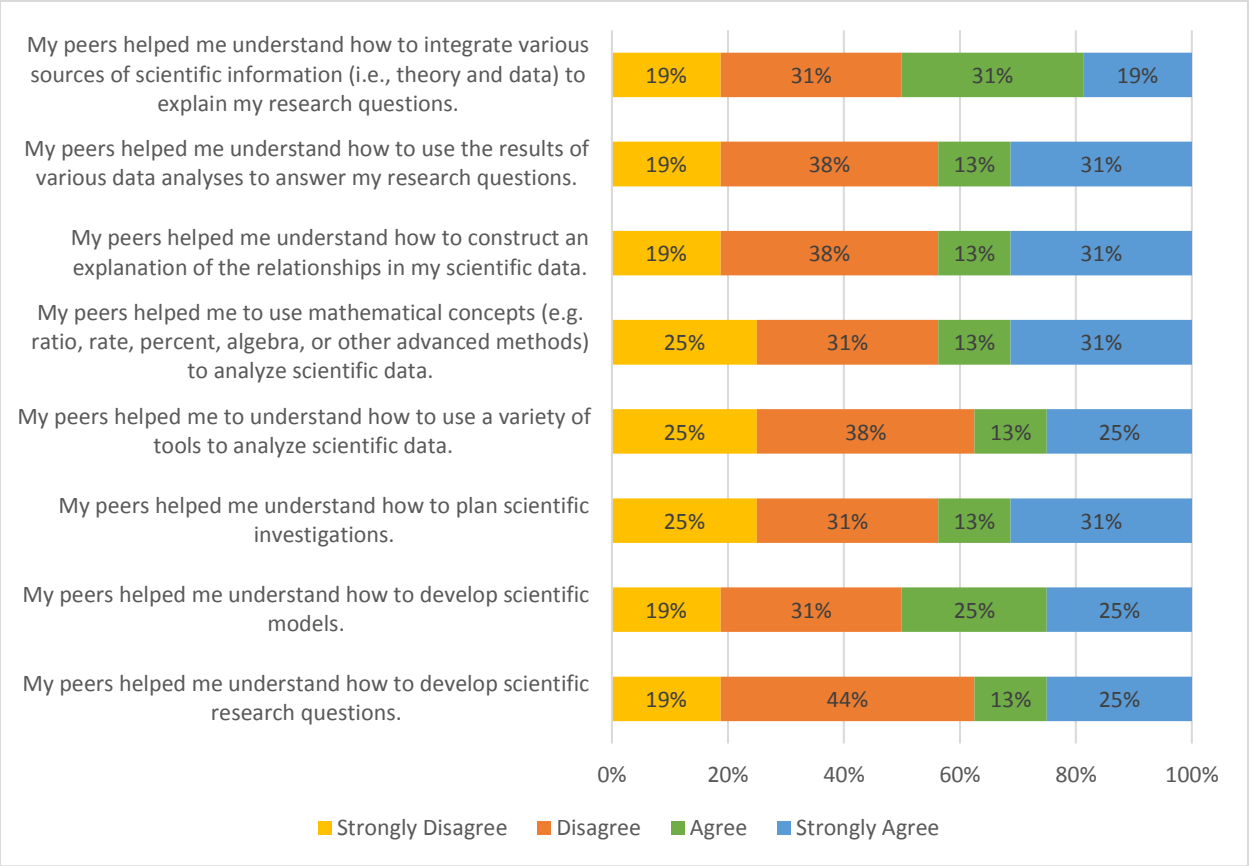
What, if any, were the challenges to successfully working with your mentor?

Just our schedule. He was out of town for a month, as was I, and they were different months. This cut the collaboration time in the summer down quite significantly since I was unable to access much of anything from China.
I felt as though I went into my project not as prepared as I should have been. She helped me define a problem that mathced my new teaching assignment and helped me change my direction when things didn't worked out as planned.
My doctoral student I was paired with was absent several days during the summer, which posed some problems but most were worked around easily with phone communication.
physically keeping up with her. I swear she is part mountain lion. :)
Nothing. They are very busy and there is no direct benefit to them, but nonetheless, they were very patient and helpful.
No real challenges. When my mentor was out of town there was another professor available to answer questions.
He was uninformed of the requirements for TRF. He ended up having us work on a research project from another faculty member who was out of town. We were delayed so late that even at this point we have only collected data yesterday. (This being the very end of August.) The analysis and lab experiences have thus not occurred, if they will at all. It was very disorganized.
I could have used a framework to work within.
availability of mentor
Trying to fit schedules together or get communication about what was going on. They started formal meetings while I was still teaching at the High School.
Scheduleing and summer vacations

In addition to working with your mentor, please rate the extent to which you disagree or agree with the following statements about how working with your program peers (other MSSST or TRF students) helped you to understand the Next Generation Science Standards (NGSS).



Working with Peers



Please use the space below to provide additional comments or feedback about your summer research experience.

I enjoyed and valued my experience. I do wish I had worked with a peer.
I will continue to work with my professor for a few more months and will also follow up as she continues her research
I really feel bad. I was very excited about this experience, but the timing with the mentor and the content did not line up for me. I still believe in the program and the philosophy. I am sad that it did not work out as it could have. In a way, I wish there were an opportunity to try again. Really, I did not even start. My mentor was so scattered that our first actual research experience happened in late August. I am not sure what is coming up. I am not sure what I am doing. It is a bummer.
Thank you so much for the grant money. I probably would have paid that amount to you. To learn and get paid is as wonderful as it gets.
I loved every minute of it. Can I do this next year? :)
I started my own project that I could take into the classroom.
The research experience was eye opening with all the problems encountered and had to solve as I did the research project. I will be able to share the research experience with my students and do a better job explaining the research process to my students. If would gladly repeat this research project in the future if given the opportunity. There are other teachers at my school who are interested in participating in a similar program.
This survey is getting so long it will no longer be reliable since many participants will start "christmas treeing" it in order to complete it. Might I suggest an abridged version next time/a percent complete bar to keep me motivated while I work through it.
It is nor over yet- some of the research is still on-going. Not sure about time commitment in the fall. Overall, a great experience! I wish it was longer!
I loved being involved with that graduate-level science, reading the most interesting things and doing really fun (extremely hard) math. I just really wanted to be in a lab running experiments collecting and analyzing data. That's not really how theoretical physics works, though. The theoretical physicists lay the ground work with a possible mathematical model to describe the physics, and the experimental physicists verify whether or not that model valid. To be of any use in theoretical physics, my math needed to be stronger. Math was my major in college, and I took a quantum mechanics course, and that still wasn't enough!! It's like I was missing a few years of graduate physics classes (like solid state physics) and I just felt useless. So if I had one wish, it would have been to take part in a mentorship where I could have a chance to DO experiments and analyze the data.

What additional support do you need to understand and apply the Next Generation Science Standards in your classroom?

Using models effectively. I at least know what models are now and why we use them, but I don't know if I can use them to prove anything.
More sample lesson plans are always appreciated.
I really just need to make cards with the cross-cutting relationships on them that students and I can see so that I can keep them in the front of my mind and remember to incorporate them.
Curriculum and supplies
See previous answer about Utah's lack of NGSS implementation.
I feel confident that I will teach my students scientific thinking, lab skills, collaboration etiquette so they will leave my class and have some notion of how to be a scientist! I am looking forward to our next TRF meeting because I assume we will be discussing this exact topic. I want to know what other science teachers are doing in their classrooms to incorporate the NGSS.
Practice, Practice, Practice
Hands on examples that I can use in my classroom.
I want to have as many opportunities to create lesson plans and to collaborate with others on making the new standards work effectively in our classrooms
I am going to need supplies and I would love to be able to find ways to integrate what I am doing in the field to my classroom. I just need to figure out how to do it! I need some clarity about the role of science fair in student learning and also about what kind of writing is necessary and appropriate for middle years. Full blown science research papers? Lab Reports? Presentations. I'm not sure where to spend my time.
Ongoing professional learning. The opportunity to share successes and challenges with other educators and professional scientists is so very useful in applying the standards.
I will continue to learn to become better at helping my students.
practice writing lessons

2016

MSSST and TRF Program Experience and Implementation

Survey Results

Utah Education Policy Center

January 2017

http://uepc.utah.edu/

MSSST AND TRF SURVEY RESULTS

JANUARY 2017

UTAH EDUCATION POLICY CENTER
THE UNIVERSITY OF UTAH

Introduction

The Center for Science and Math Education (CSME), at the University of Utah (U of U), received a Mathematics and Science Partnership Program (MSP) grant in 2015. The CSME used the award to implement a program that provided hands-on training for secondary science teachers. These teachers included students enrolled in the U of U Masters of Science for Secondary School Teachers (MSSST) program and a select group of pre-service and/or in-service teachers (Teacher Research Fellows). The goal of the MSSST and TRF program grant was to help teachers build capacity for implementing new Utah science standards.

The CSME asked Utah Education Policy Center (UEPC) to evaluate the MSSST and TRF program. The evaluation was designed around key program events. The first event was an all day workshop that occurred in October 2015, the second event was a hands-on summer research experience that occurred during summer 2016, and the third was a two day workshop in the fall of 2016. The final workshop focused on creating curriculum.

Following each event, evaluators administered surveys to participants. The October 2015 survey assessed the workshop and included pretest items. The summer 2016 survey assessed the summer research experience including understanding of science standards and working with research mentors. The survey that followed the fall 2016 workshop was administered in December 2016 and served as a posttest. Table 7 (see Appendix) provides detailed information about the content of each survey.

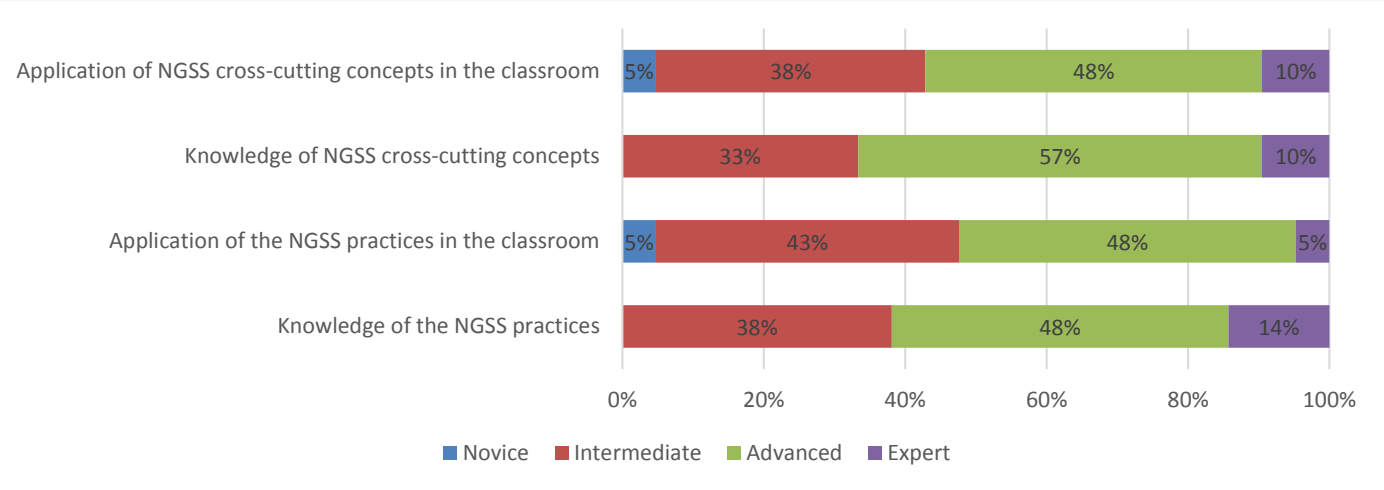
This is a summary of results from the December 2016 survey. It also includes comparisons with pretest items from the October 2015 survey. Table 1 provides the number and percent of survey responses.

Table 1. Survey responses by event and program involvement

	October 2015 Survey		December 2016 Survey		Matched responses	
Program Involvement	**Number of Respondents**	**Percent of Respondents**	**Number of Respondents**	**Percent of Respondents**	**Number of Respondents**	**Percent of Respondents**
MSSST	14	61%	12	57%	11	58%
TRF	9	39%	9	43%	8	42%
Total	23	100%	21	100%	19	100%

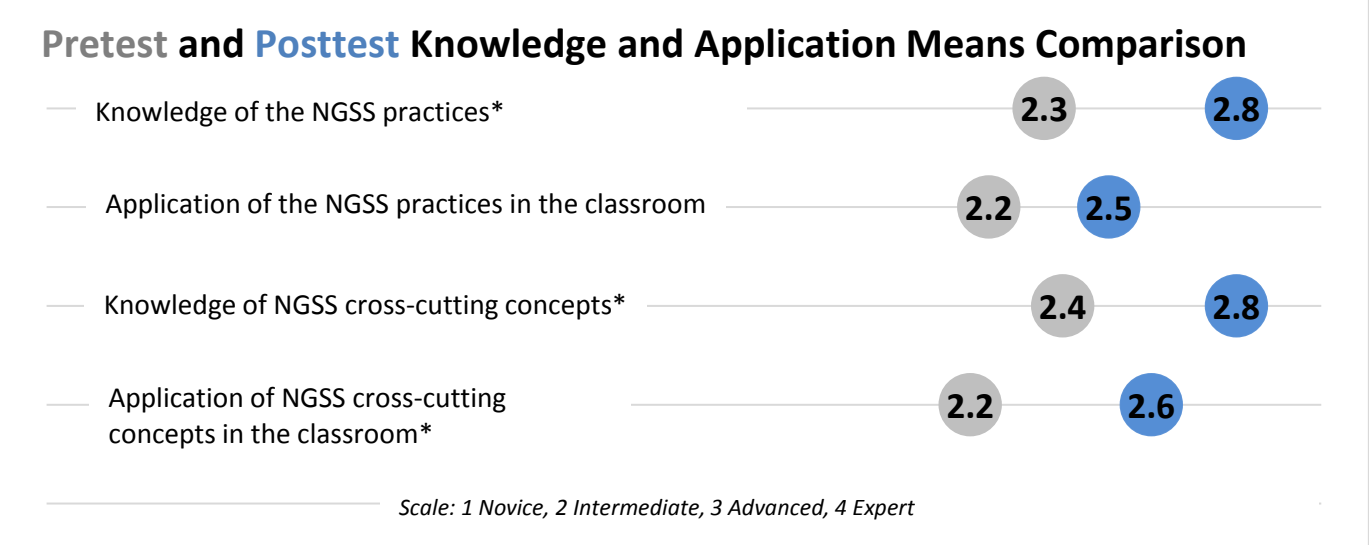
Results

Figure 1. Posttest Knowledge and Application of Next Generation Science Standards (NGSS)



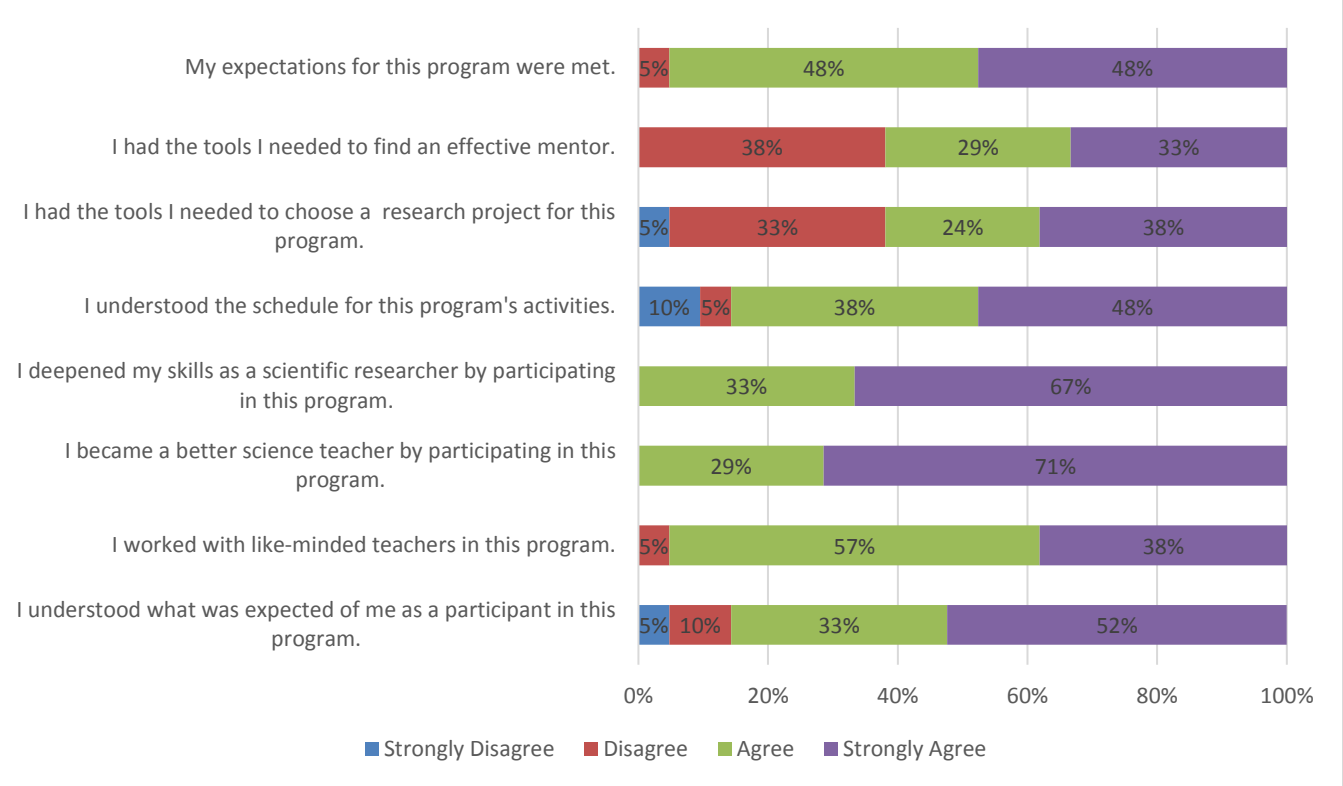
Source: December 2016 participant survey

Figure 2. Pretest and Posttest Comparisons of NGSS Knowledge and Application



Source: October 2015 and December 2016 participant surveys
*Pretest to Posttest mean differences were significant (Wilcoxon Signed Ranks Test p<.05).

Figure 3. Program Content



Source: December 2016 participant survey
Note: Pretest and Postest comparisons showed little change (see Table 8 in the Appendix for a comparison of pretest and posttest questions).

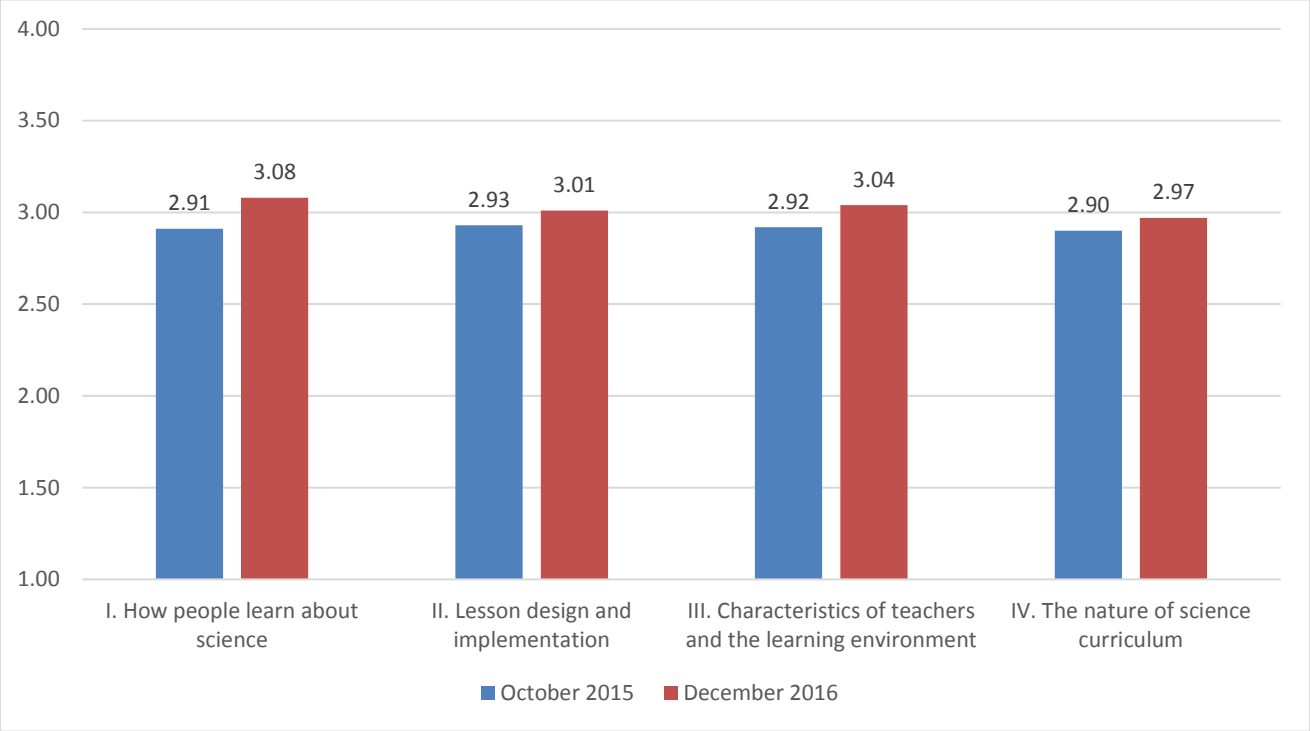
Table 2. Summary of open-ended responses regarding program content, organization, or overall experience

Themes	Comments
Positive Professional Development	I enjoyed the insight of the classroom instructors.
	The MSSST program is a great idea and I am incredibly thankful for it. As a biology teaching major it was hard to teach about earth science which is a part of my curriculum, but now I feel much more comfortable and am able to come up with better lesson plans because of the MSSST program.
	I have, as have so many others, attended conferences and workshops where a lesson of some sort was required at the end. Each time it was a joke. This was different because the new format was taught explicitly and then, immediately after we began working on it. I have been more resistant to best practice science teaching for a while now. I think that if I were not to have been a participant, I would still be so. I am quite happily surprised to see that I am more motivated to be a better teacher and actually apply what I know.
	The program was an excellent opportunity to apply some of the ideas of scientific investigation that I teach my students. My faculty mentor and the other faculty were helpful.
	Excellent program. All my expectations were met or exceeded. Courses were relevant, different and gave a solid understanding of Earth Science and science in general. Participating in science (research) and field work were the highlight.
	My teaching philosophy has been drastically altered by these experiences and the TRF workshop helped me learn how to use 3D methods in my class to make sure students are getting the same learning experiences. Thank you for this entire experience! For the first time, learning in my classroom makes more sense!
Support	I feel more connected to the scientific education community after this program

	I loved the research experience and the cohort set up. I would not have survived the program without that collegiality and support.
Future Plans	Wish I could do more and would love to help develop content and teach teachers how to REALLY teach.
Appreciation	Thank you for investing in me. I am very grateful for this experience.
Areas for Improvement	
Research Experience	The research experience needs to be more scaffolded. A list of professors should be provided that are willing to put the time/energy toward working with an inexperienced researcher as well as having a project that will match the timing of the program.
	There was little support and if I had not already done substantial research, I would not have understood what was going on at all during the research experience.
Workshop	The lesson plan at the end felt like a hoop, and not an authentic task.

Source: December 2016 participant survey

Figure 4. Pretest and Posttest Perceptions of Science Teaching



Source: October 2015 and December 2016 participant surveys[1]
Note: Pretest and Postest changes were not statistically significant (see Table 9 – 12 for item level responses).

[1]Survey items were adapted from: Sampson, V., Grooms, J., & Enderle, P. (2013). Development and initial validation of the Beliefs About Reformed Science Teaching and Learning (BARSTL) questionnaire. *School Science and Mathematics, 113*(1), 3-15.

Figure 5. Program Impact on Teaching

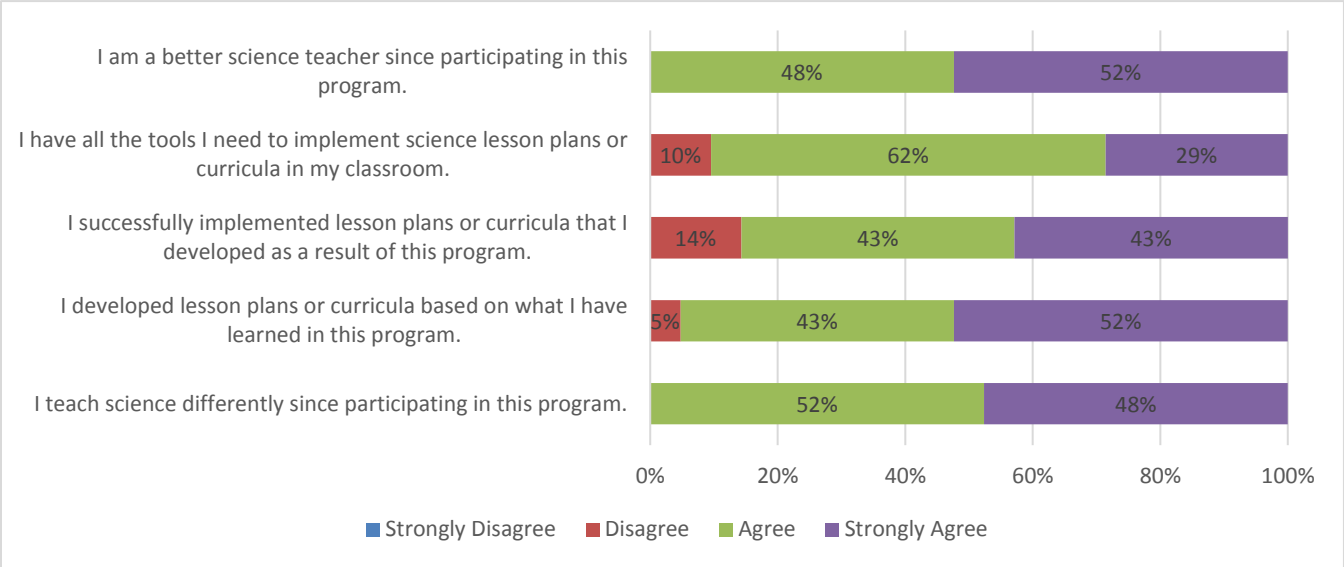


Table 3. Summary of Open-ended Responses Regarding Lesson Plans that Teachers Developed as a Result of Participating in the Program.

Themes	Summarized Responses: Please describe any lesson plans (i.e. projects, units, and curriculum) you have developed as a result of involvement in this program.
General Lesson Plan Designs	I am currently working on another 3D unit that is addressing the experimental design process and controlled experiments as well as preparing students for a conversation about phase changes, diffusion and osmosis.
	My biggest improvement is in the inquiry labs, and I've convinced some colleges to try four out.
	I changed the whole way I taught the Earth Science portion of my 8th grade curriculum.
	Everything that I do is based on real research and that comes from the knowledge and experience I gained from participating in this program.
	I have designed several professional learning courses for in-service teachers.
	I worked on standard 8.1.5 and 8.1.7. I created a storyline that I taught with complete episodes, I wrote a full lesson plan with a lab regarding phase changes for 8.1.5. I did a whole lesson on subatomic particles to help students understand why we care about the structure of the atom.
Topic Specific Examples	We worked on a lesson for the behavior of animals to show successful strategies are used in evolution through a variety of means.
	I have always taught atoms combine to make molecules and showed molecular formulas and had students' model molecules, but this time I introduced molecules by having students do electrolysis and notice that there were gases coming out of cold water. I had them observe and make inferences and then gave them the next episode which was about how to make water using oxygen gas and hydrogen gas and burning them, it was a video about the Martian movie, suddenly I had a few kids gasping as they began to realize that their experience in lab was BREAKING water molecules, they freaked out.
	I created a field trip with leading questions in a geology class. I created chemistry/literacy lesson and a chemistry unit in a chemistry class. I am about to write lesson plans for my final project.
	Lewis structures, how seismic waves teach us about layers, piece together Utah's geology using strata, bubble gum measuring lab.

	We had this awesome lesson with rubbing alcohol and an ice cube. The observation of phase changes - evaporation and melting respectively - was completely different this year as they actually felt the endothermic nature of the changes. The students first tried to explain where the alcohol went and then why it was cold.
	Storyline lesson plans, one on genetics and one on density of earth layers and chemical composition.
Pending Transitions	Lesson plans are in the process of being rewritten to NGSS standards
	I designed a lab on the last day of our meeting which was really awesome! I will be using it later this year, but I have high hopes for the outcome. I focused on patterns and modeling as the primary cross-cutting concepts
Unexpected Outcomes	The surprising thing was that out of this came an understanding of the role of energy in chemical change because they saw the energy in every example and recognized it. They also began to really understand how properties of a substance change when atoms combine as well.

Table 4. Summary of Open-ended Responses Regarding Successes Integrating NGSS or Cross-cutting Concepts into Teaching.

Themes	Summarized Responses: Please describe your successes integrating the NGSS or cross-cutting concepts into your teaching.
Student change	I am really focusing on helping students to CONSTRUCT explanations instead of regurgitating them.
	Students are becoming more aware of the wording for the CCCs and have started to use them in class, "I see a pattern".
Student focused teaching	I have always used hands on experience, but this way of teaching has given more purpose to those experiences and is forcing me and my students to deal head on with their misconceptions.
	The process of modeling and experimentation is also becoming a major component of my classroom as students ask questions and I guide them through experiences to find answers.
	This was valuable because I realized that providing my students with the just the right amount of supporting knowledge along the way acts like a framework allowing them the opportunity to fill in the gaps through discovery, investigation and exploration
Adoption of new teaching techniques	NGSS helps define and explain the objectives in vocabulary which helps
	The best success is when I start with an NGSS performance expectation that matches with the Utah secondary science core. This focuses my teaching and ensures that I am including a cross-cutting connect with a practice and core idea.
	With this experience I had a different focus that allowed me to step back and determine what I could provide my class in order to deliver authentic learning by way of discovery. So the research aspect provided me with the understanding of just how relevant the SEPs and CCCs are to building knowledge through exploration of concepts. More specifically, I was able to take my experiences and build curriculum that reflected similar thought processes that I went through as I was investigating something new and trying to make sense of it.
	The workshop on the last day was extremely powerful to me. It taught me how to teach authentically based on phenomena in a carefully plotted storyline with distinguishable episodes, while integrating the SEP's and CCC's throughout.
	I have really enjoyed using the posters that were provided, and it allows me to point out the cross cutting concepts as they are presented in my curriculum.

Table 5. Summary of Open-ended Responses Regarding Challenges Integrating NGSS or Cross-cutting Concepts into Teaching.

Themes	Summarized Responses: Please describe your challenges integrating the NGSS or cross-cutting concepts into your teaching.
Teaching transition challenges	Developing an inquiry model from direct instruction roots so that the concept is discoverable before specifically taught
	It takes a large amount of prep to correctly craft a good lesson that incorporates NGSS in a thoughtful way.
	Changing the way I present information to incorporate the focus of the CCCs has been difficult for me.

Resource Availability Challenges	It is difficult to find simple, real data (charts, tables, etc.) to have the students to use to find patterns or make connections when studying something that may be difficult to do actual experiments on. A database of graphs and charts would be SO great (organized by each standard/strand.)
	Not all concepts connect to an inexpensive hands-on experience since money and equipment are often unavailable
Support Challenges	My school would not integrate the new standards this year. I anticipate our challenges be 1-gathering the supplies we will need 2-getting buy in from other teachers to focus on science skills as well as content 3-having the time to plan mostly all new lessons 4-having the time to come up with good, mastery-based assessments
	That teachers around me aren't up to date on NGSS so my PDs are very elementary
Student Transition Challenges	One of the largest challenges was the students. Some were very resistant to learning through experience and observation. Multiple students requested to be told the answer or to have notes. It wasn't that they did not enjoy the lesson; they did not want to feel uncomfortable in their lack of knowledge. It was more an issue of patience and ego than of academics.
	Main challenge is getting students to feel comfortable in an environment where they are expected to develop ideas with others instead of in isolation.
	It takes time. I have been working with NGSS for years now and it is brand new to students- but the great thing is that once students start being exposed to the CCCs in lower grades and I continue their exposure- students will feel much more confident with them and all that they encompass.
	Because this is new, it is challenging for students since some of the cross-cutting concepts were new terms to students initially

Table 6. Summary of Open-ended Responses Regarding Needs for Improving Science Teaching

Themes	Summarized Responses: What could help improve your science teaching that was not addressed in this program?
Resources	Data base of usable information.
	I wish I had more hands on easy to use tech like that for all of my students.
	Even better templates for the planning phase and more examples of effective lessons.
	More time to review my current curriculum and look at ways to integrate more of the cross cutting concepts.
Supports	The monthly cohort sessions could be used more to collaborate on ways to use new material learned in the classes and apply it to our teaching. It's a great opportunity for collaboration that I don't believe was utilized enough.
	How to help fellow teachers see the vision of 3D science learning.
	Also, having a 3D science mentor assigned from the beginning. I don't feel like I received any support in order to begin my research or guide that introductory process.
Further PD	How to integrate technology
	A rigorous statistics class specifically dealing with research papers. Types of tests and precise paper writing language class.
	A class about the new SEEd standards that goes beyond the SEEd standards so that we can teach kids who ask or are ready for a higher level. In this class it's a great use of time for teachers to be able to interpret the new standards together because many things can be interpreted differently and sometimes kids miss out on learning something they should because a standard is hard to interpret.
	I need to develop better methods for checking for understanding.
	Assessment for three dimensional science- maybe in Seminar.
	When letting students run unique and individual labs it takes certain skills as a teacher and I think we could have used more instruction on how to facilitate this.
	I would also like to know more about connecting a brief introduction to a concept to a discovery-based lab and how that works in actual class rooms.

Appendix

Table 7. MSSST and TRF Evaluation Design and Survey Content

	Evaluation Instruments		
	MSSST and TRF Survey October 2015	**MSSST and TRF 2016 Summer Teacher Research Experiences Survey**	**MSSST and TRF Experience Survey December 2016**
Survey content			
BARSTL	Pre-assessment		Post-assessment
NGSS Competency	Pre-assessment		Post-assessment
NGSS Standards - Understanding		Retrospective Pre-Post	
NGSS Standards - Ability to Teach		Retrospective Pre-Post	
Program content (expectations for training, schedule, tools provided)	X		X
Program facilitation (workshop facilitator rating or mentor ratings)	X	X	
Program organization (frequency and value of meetings)		X	
Reasons for participation	X		
Curriculum development			X
Teaching impact			X
Formative - Additional support or training needed	X	X	X

Table 8. Survey Content Comparison of Pretest (October 2015) and Posttest (December 2016) Questions

Pretest Survey Questions	Posttest Survey Questions
I know what is expected of me as a participant in this program.	I understood what was expected of me as a participant in this program.
I expect to work with like-minded teachers in this program.	I worked with like-minded teachers in this program.
I expect to become a better science teacher by participating in this program	I became a better science teacher by participating in this program.
I expect to deepen my skills as a scientific researcher by participating in this program.	I deepened my skills as a scientific researcher by participating in this program.
I know the schedule for this program's activities.	I understood the schedule for this program's activities.
I have the tools I need to begin researching potential projects for this program.	I had the tools I needed to choose a research project for this program.
I have the tools I need to begin finding a potential mentor.	I had the tools I needed to find an effective mentor.
What I learned today matches my expectations about this program.	My expectations for this program were met.

2016 BARSTL Results

These tables present the 2016 results of the 32 questions from the Beliefs About Reformed Science Teaching and Learning (BARSTL) instrument.[2] The BARSTL organizes sets of questions to measure four specific subscales of instructor perceptions of science teaching. These are: a) how people learn about science, b) lesson design and implementation, c) characteristics of teachers and the learning environment, and d) the nature of science curriculum.

Table 9. BARSTL Subscale I. How people learn about science

How people learn about science	Strongly Disagree	Disagree	Agree	Strongly Agree
Students develop many ideas about how the world works before they ever study science in school.	0%	0%	25%	75%
Students learn in a disorderly fashion; they create their own knowledge by modifying their existing ideas in an effort to make sense of new and past experiences.	0%	25%	45%	30%
People are either talented at science or they are not, therefore student achievement in science is a reflection of their natural abilities.	55%	45%	0%	0%
Students are more likely to understand a scientific concept if the teacher explains the concept in a way that is clear and easy to understand.	5%	10%	70%	15%
Frequently, students have difficulty learning scientific concepts in school because their ideas about how the world works are often resistant to change.	0%	20%	60%	20%
Learning science is an orderly process; students learn by gradually accumulating more information about a topic over time.	5%	30%	55%	10%
Students know very little about science before they learn it in school.	35%	55%	10%	0%
Students learn the most when they are able to test, discuss, and debate many possible answers during activities that involve social interaction.	0%	0%	55%	45%

Table 10. BARSTL Subscale II. Lesson design and implementation

Lesson design and implementation	Strongly Disagree	Disagree	Agree	Strongly Agree
During a lesson, students should explore and conduct their own experiments with hands-on materials before the teacher discusses any scientific concepts with them.	0%	25%	65%	10%
During a lesson, teachers should spend more time asking questions that trigger divergent ways of thinking than they do explaining the concept to students.	0%	25%	50%	25%
Whenever students conduct an experiment during a science lesson, the teacher should give step-by-step instructions for the students to follow in order to prevent confusion and to make sure students get the correct results.	10%	80%	10%	0%
Experiments should be included in lessons as a way to reinforce the scientific concepts students have already learned in class.	5%	35%	50%	10%
Lessons should be designed in a way that allows students to learn new concepts through inquiry instead of through a lecture, a reading, or a demonstration.	0%	5%	90%	5%
During a lesson, students need to be given opportunities to test, debate, and challenge ideas with their peers.	0%	0%	65%	35%
During a lesson, all of the students in the class should be encouraged to use the same approach for conducting an experiment or solving a problem.	25%	70%	5%	0%
Assessments in science classes should only be given after instruction is completed; that way, the teacher can determine if the students have learned the material covered in class.	35%	40%	25%	0%

[2] Sampson, V., Grooms, J., & Enderle, P. (2013). Development and initial validation of the Beliefs About Reformed Science Teaching and Learning (BARSTL) questionnaire. *School Science and Mathematics, 113*(1), 3-15.

Table 11. BARSTL Subscale III. Teachers and the learning environment.

Question	Strongly Disagree	Disagree	Agree	Strongly Agree
Students should do most of the talking in science classrooms.	0%	10%	60%	30%
Students should work independently as much as possible so they do not learn to rely on other students to do their work for them.	5%	75%	20%	0%
In science classrooms, students should be encouraged to challenge ideas while maintaining a climate of respect for what others have to say.	0%	0%	50%	50%
Teachers should allow students to help determine the direction and the focus of a lesson.	0%	30%	60%	10%
Students should be willing to accept the scientific ideas and theories presented to them during science class without question.	30%	65%	5%	0%
An excellent science teacher is someone who is really good at explaining complicated concepts clearly and simply so that everyone understands.	0%	42%	53%	5%
The teacher should motivate students to finish their work as quickly as possible.	5%	90%	5%	0%
Science teachers should primarily act as a resource person, working to support and enhance student investigations rather than explaining how things work.	5%	5%	70%	20%

Table 12. BARSTL Subscale IV. The science curriculum.

Question	Strongly Disagree	Disagree	Agree	Strongly Agree
A good science curriculum should focus on only a few scientific concepts a year, but in great detail.	0%	29%	62%	10%
The science curriculum should focus on the basic facts and skills of science that students will need to know later.	14%	33%	43%	10%
Students should know that scientific knowledge is discovered using the scientific method.	10%	33%	52%	5%
The science curriculum should encourage students to learn and value alternative modes of investigation or problem solving.	0%	0%	62%	38%
In order to prepare students for future classes, college, or a career in science, the science curriculum should cover as many different topics as possible over the course of a school year.	10%	76%	14%	0%
The science curriculum should help students develop the reasoning skills and habits of mind necessary to do science.	0%	0%	48%	52%
Students should learn that all science is based on a single scientific method: a step-by-step procedure that begins with “define the problem” and ends with “reporting the results.”	48%	43%	10%	0%
A good science curriculum should focus on the history and nature of science and how science affects people and societies.	0%	24%	76%	0%

2018

SEEd Swap Teacher Workshop Implementation

Survey Results

Utah Education Policy Center

January 2018

http://uepc.utah.edu/

SEEd Swap Teacher Workshop Implementation Survey Results

This report provides results from the SEEd Swap teacher workshop implementation survey. The purpose of this survey was to learn about participants' attitudes and teaching practices following a four day workshop conducted by the Center for Science and Mathematics Education (CSME) at the University of Utah in August 2017. This report includes all responses to quantitative and open-ended qualitative questions that were included in the survey. The Utah Education Policy Center (UEPC) administered the online survey from October 31 to December 4, 2017. The UEPC emailed a survey link to 57 workshop participants and received 35 responses.

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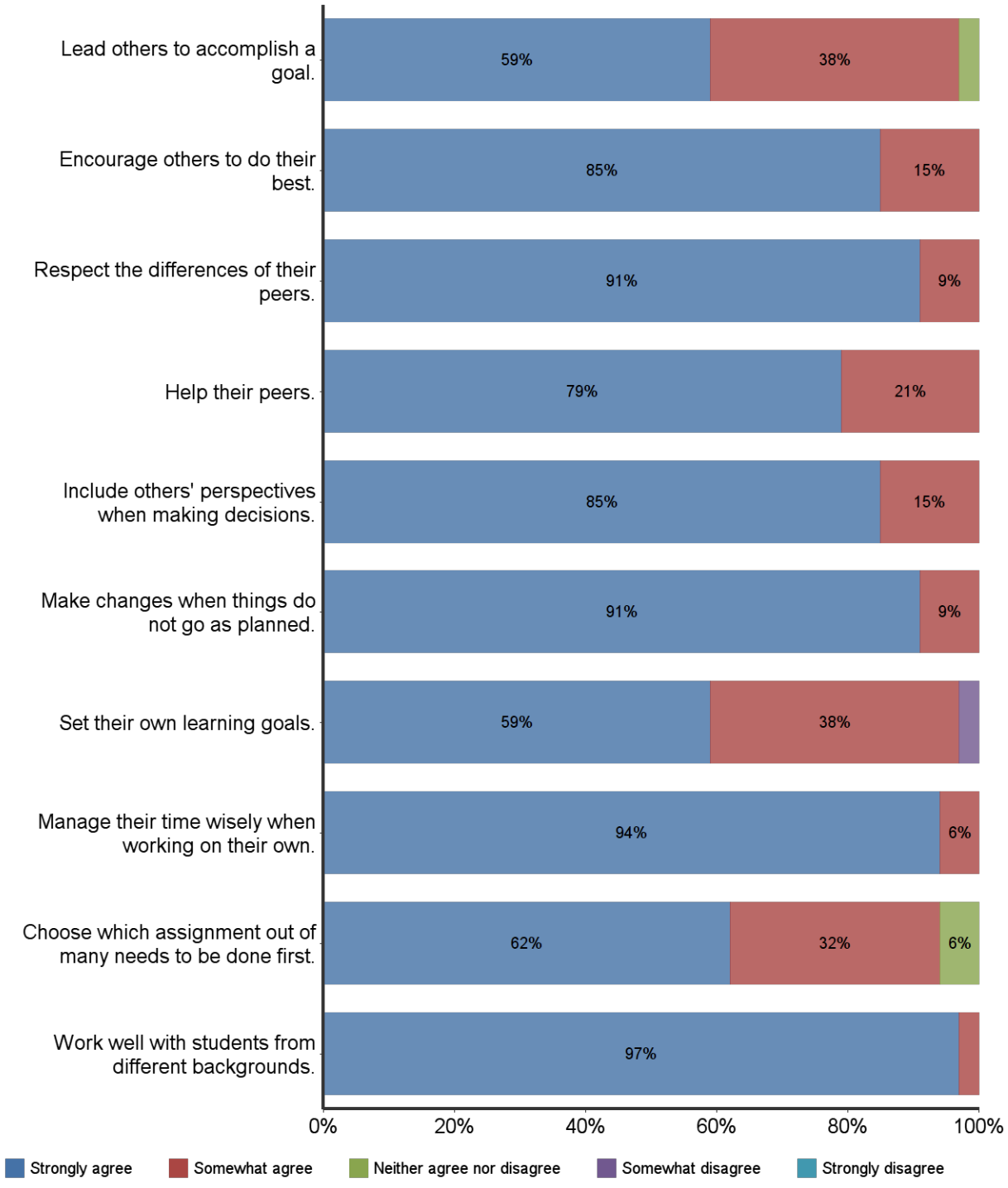
Please select your school district from the options below.

	Bar	Response	%
Alpine School District		1	2.9%
Canyons School District			0.0%
Davis School District			0.0%
Granite School District		12	34.3%
Jordan School District		10	28.6%
Murray School District		4	11.4%
North Summit School District			0.0%
Ogden School District			0.0%
Salt Lake City School District		2	5.7%
Uintah School District		1	2.9%
Weber School District			0.0%
Other		5	14.3%
Total		35	100.0%

Other
Legacy Preparatory Academy
Nebo
Charter - Legacy Prep
Nebo
charter

Please rate your agreement to the following.
"I think it is important that students have learning opportunities to..."



Please rate your agreement to the following.
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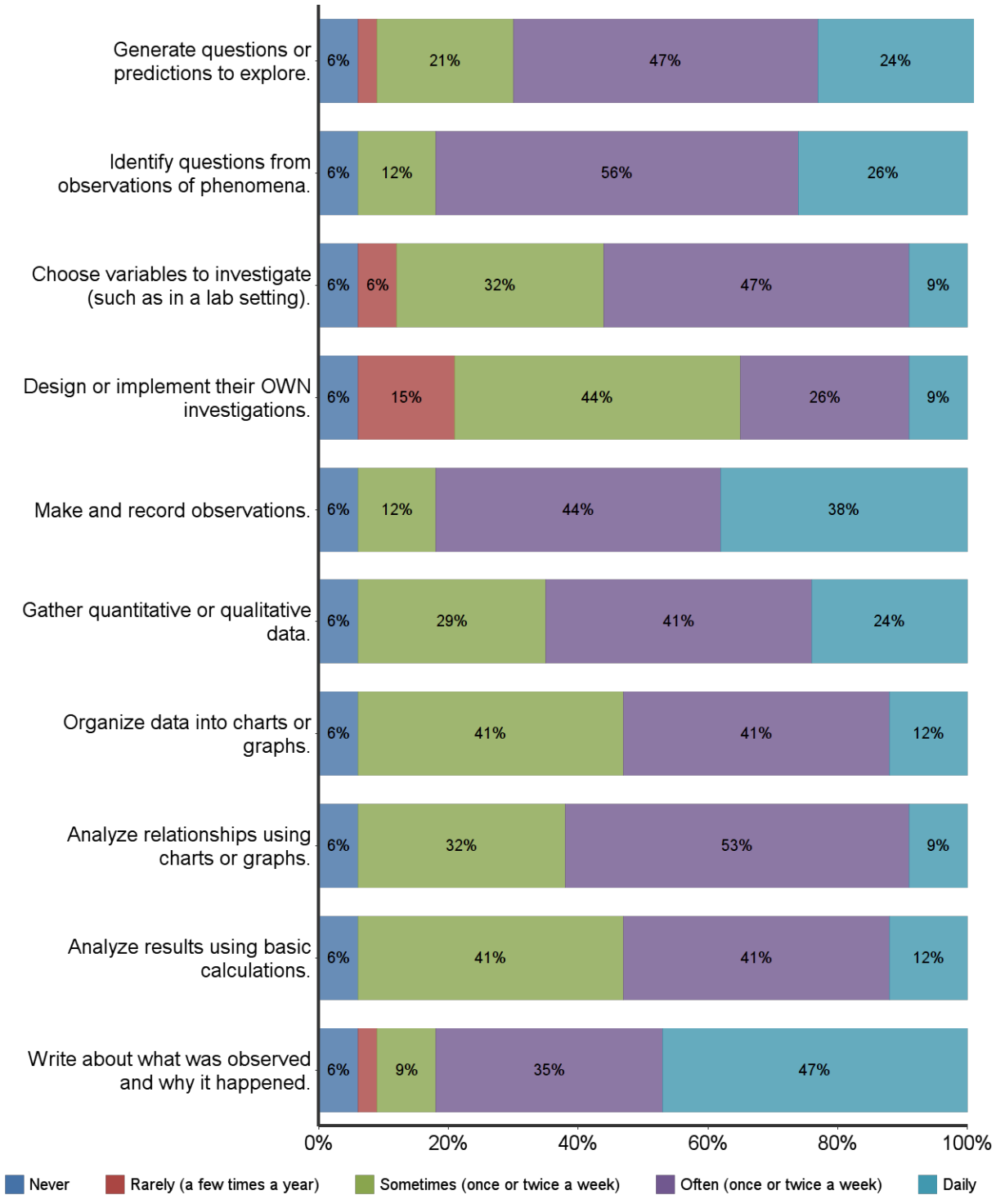

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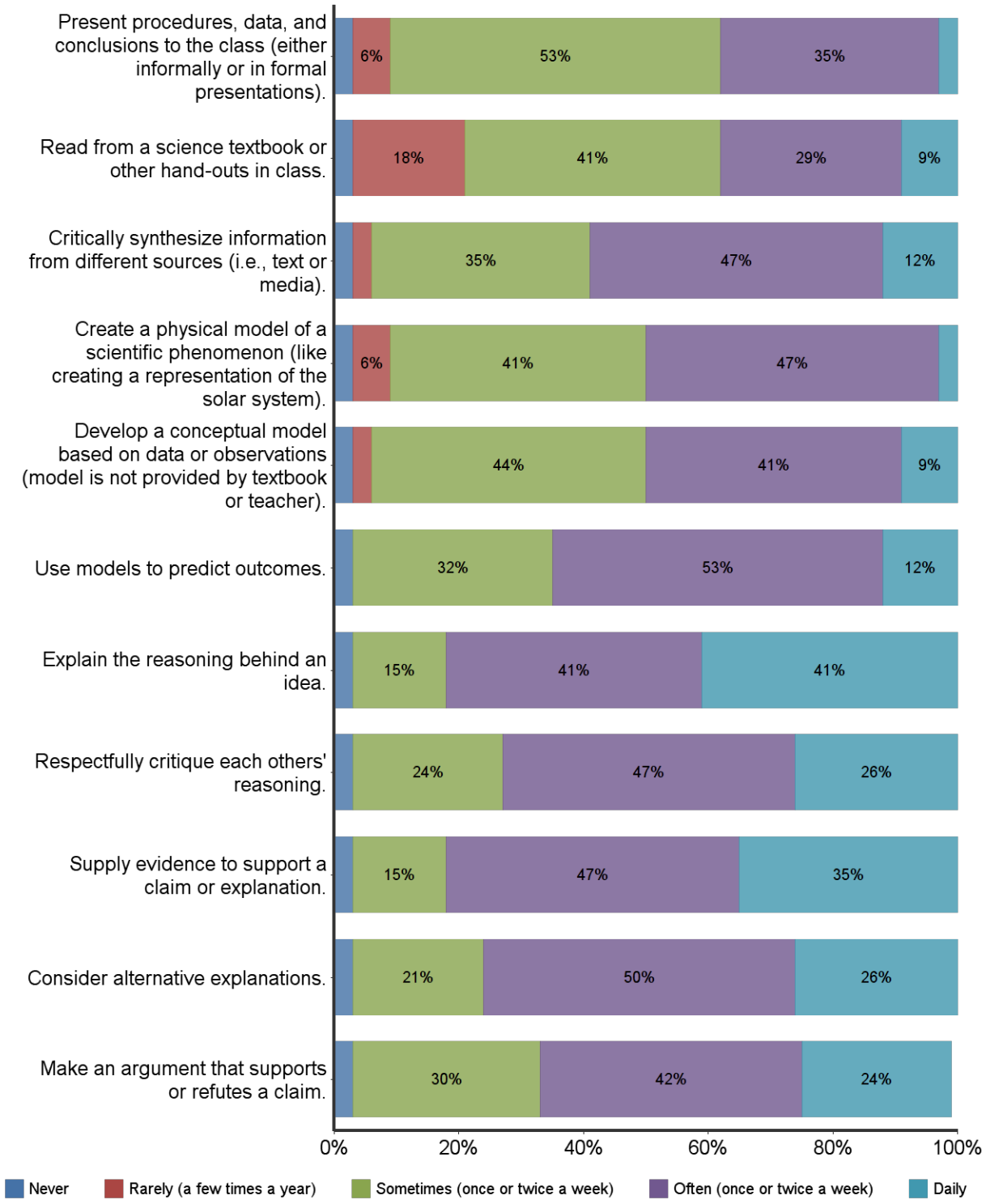
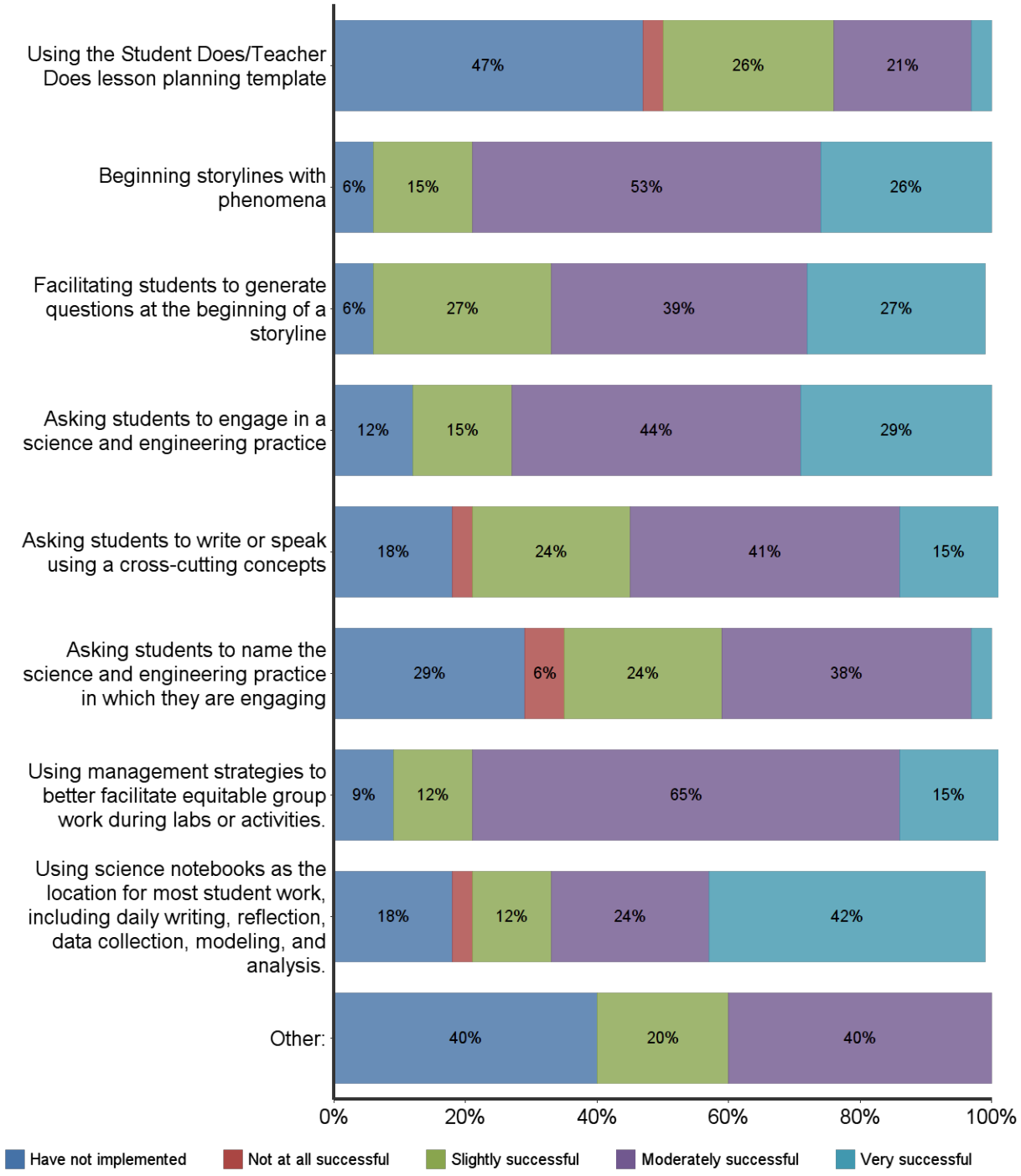


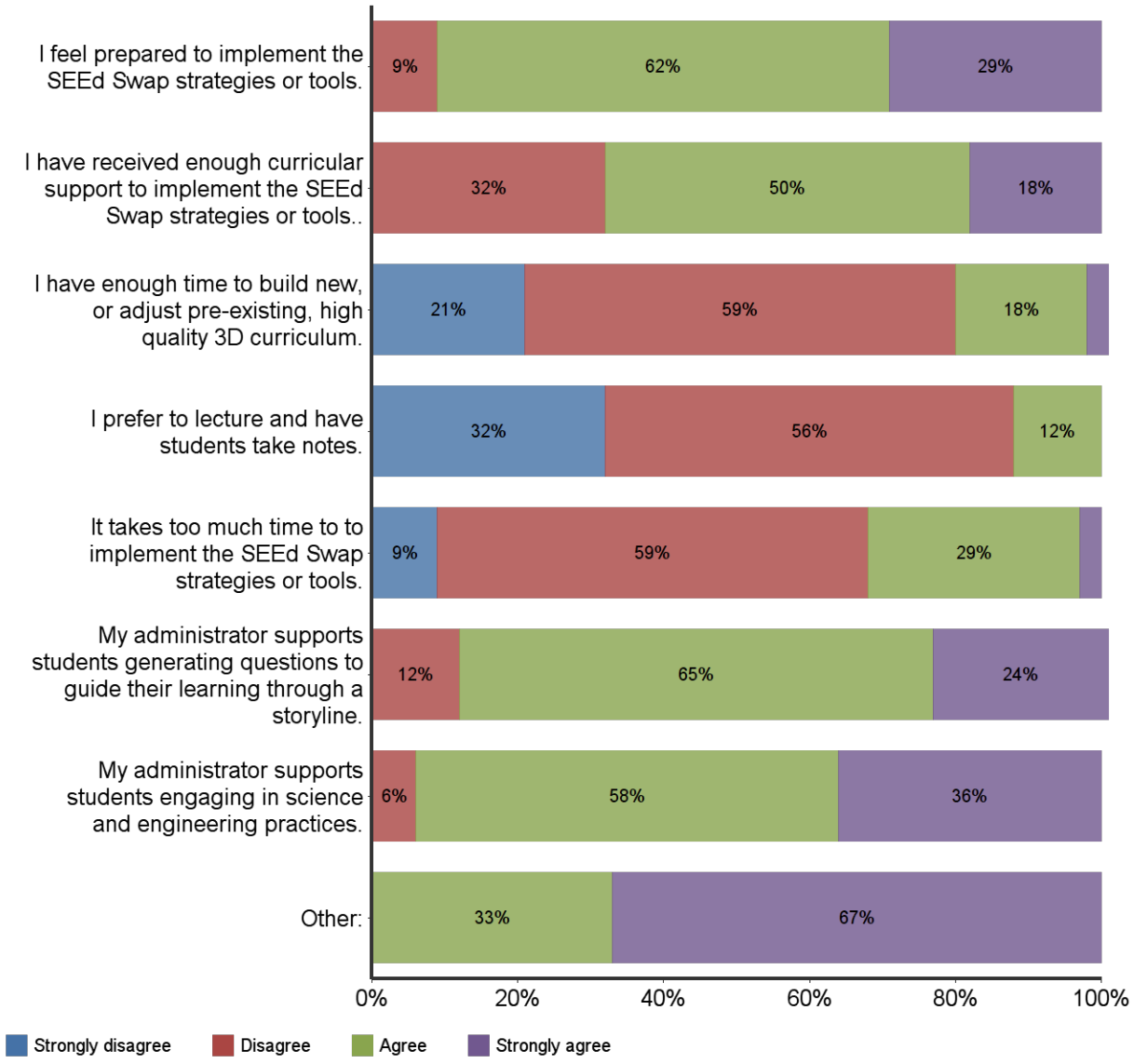
How successfully have you implemented the following SEEd Swap classroom strategies and pedagogical tools since you participated in the workshop?



Other:
Using a project-based, exploration assignment to engage students.
collegues

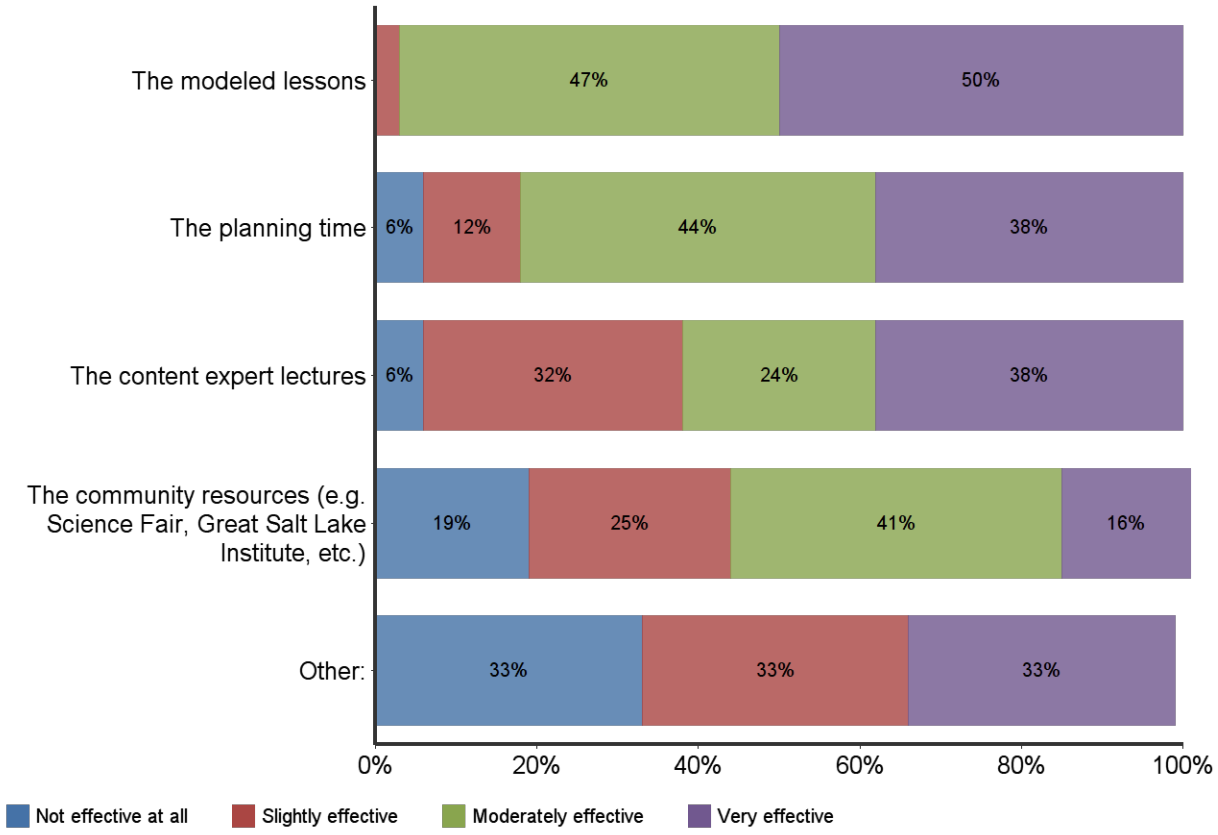
How do you know these strategies were successful? Please explain the data you have collected to determine success.
This is my first year of teaching, so I don't have prior data to compare it to. I am striving to use the strategies we learned at the workshop in my own teaching, though.
I am constantly asking students for feedback. Whether it's about pacing, the notebooks or some other aspect. They LOVE the notebooks and the pacing that we're going. I just keep forgetting to have them identify the CCC or SEP of the day - but I do try to when I do remember.
Data is collected in both the planning process (phenomena, prompts, etc...) and in student lab notebooks as they progress through lessons.
Everyday I have my students right in their science journals. At the end of every month I gather the journals and look through them to see how their work is progressing along with daily checks. At the end of every concept, I have students write down and share which cross-cutting Concepts we have used during the lessons as well as an explanation as to how they were used. I am very impressed with the understanding that the students have of not only the cross-cutting concepts, but also phenomena, observations, modeling, and analyzing of the information presented. I teach all 6th grade classes science this year. I have a wide variation of students with varying abilities. They all seem to have a better understanding of how the science concepts are presented then they have in the past.
Student feedback/replies, quiz scores and other assessments
When I monitor from team to team and when I listen and read their explanations when they are showing their models.
The students have been very engaged this year. They are asking questions. I am really loving the new 7th grade core.
By using journal we are able to constantly refer back to previous observations and questions to answer questions that come up later. Fantastic resource for the students to reflect on their previous impressions in comparison to later and possibly better developed ideas.
I am able to link back successfully to the original phenomena and the students often reference it when analyzing and interpreting later data. I also often have them work on questions in groups and we investigate questions they sticky note to my board. They have science notebooks that we do a majority of our work in.
I'm basing my success on whether or not I have been able to execute it or even figure out what I'm doing with this new way of teaching.
Well the notebooks themselves are my data. We have been working with them Daily and a couple of weeks ago complete an end of term grade for these. I was pleased to see that even the incomplete notebooks were still showing evidence of scientific understanding the use of the science and engineering practices.
-
Students are given a phenomenon to observe and are then required to write down what they observed, any questions they have, and to create a hypothesis about the phenomenon. Students have been successful in completing these tasks. Students have written down and asked many questions about the phenomenon and I have used that as a starting point for their learning experiences. Students are placed in groups in which there is a varying level of knowledge. This has helped students to work productively in their groups during labs and activities.
Because its the easiest to get in, in the time given it has been a great challenge to do much else. I have 30 minutes for science, but coming in from lunch takes about 5/7 minutes away for them to get adjusted and ready. Not enough time when districts require other things.
I have not started teaching science yet this year. I will do so in January.
Based on the assignments that I received and the collaboration in groups.
Students produce work that shows increased understanding of these strategies
I've collected and graded notebooks
I am seeing and feeling more engagement and excitement from the students than I have in previous years
Science journals
If it is successful, students show less confusion. I have seen accurate results.
I am merely reflecting about how much of the year so far I have been putting these strategies into practice in my classroom.
Assessments require use of SEPs, students can apply the SEPs to the material, students creat models almost everyday, class discussions with questions
Comparing myself to previous years and student engagement in lessons.
I compared my data with prior years and my students DOK is much higher using the new standards.
Students were engaged, participating and adjusting ideas and models as they gathered information.
Looking at science notebooks and their ability to create accurate models/ observing working together.
Students created a moto for this years science class. Why...What if...Let's do it. This tells me the students are using the phenomena being presented and using the enginering practices pushing their thinking to the next level. All students have a science notebook that is used for notes labs and models.
Student responses during class wide discussions, individual testing

To what extent do you disagree or agree with the following statements about your experiences implementing additional SEEd Swap classroom strategies or pedagogical tools in your classroom?



Other:
I could use a well organized menu of resources related to each part of the curriculum to choose from that suits my style of teaching.

How effective were the following SEEd Swap workshop components in improving your teaching practices?



Other:
This workshop gave me the best preparation for the new seed curriculums! And I attended 7 different workshops!
We didn't have very much planning time.
Other teachers

Would you recommend the SEEd Swap training to other teachers?

Answer	Bar	Response	%
Yes		31	91%
No		1	3%
Maybe because:		2	6%
Total		34	100%

Maybe because:
For some teachers, they might gel with the ideas from the Workshop. I love the idea and wish that I had more time to prepare lessons that way.
There were some good ideas

Please provide any additional comments about the SEEd Swap Teacher Workshop.
This program has dramatially changed the way I teach. I LOVED every bit of information I've received and I try my best to implement them in my classroom.
The SEEd Swap Teacher Workshop really helped me prepare activities and labs for this school year. Prior to this workshop I little to no clue on how I would implement the SEEd standards in my classroom. I am no confident that can implement the SEEd standards in my classroom and my students will benefit from the labs and activities that I designed.
I wish i had better background, I still am spending way too much time trying to learn the curriculum and what the expectations are. the districts test are not helpful either.
More time to learn from guided lessons.
Loved it, it was a great introduction to many teachers.
Very well done. Many good resources and great modeling of the strategies. Just having time to wrap my head around the implementation is my problem now. Maybe doing the training a little earlier in the year so that we had more time to implement?
Assessment
A great workshop. I just need more time to implement and practice, and maybe take another workshop.
My teachers were excellent.
It was SO helpful - and made me realize how prepared I really was and how many teachers in Utah desperately need this training!
Highly organized, on grade level, and the lessons are ready to rock without requiring excessive time to digest
We jumped all over the book. It would have been nice to fully experience one unit (or at least a sequence of lessons) instead of just skimming the surface of several units.
This training was the best I have received and helped me actually know what I was doing and implement phenomena based learning!! I would go back and do it again now that I have had a chance to try it for myself.
The lessons that were modeled and the use of the notebooks were extremely effective in implementing the new standards
Best professional Development I have ever been too! Amazing organization, example lessons, and experiences!
The modeled lessons were by far the most helpful. I still don't feel overly prepared to teach them, but the lessons are a huge help. They are the reason I would recommend this class.
Please continue to have these workshops!!!!!
I wish some of it were formatted differently. I need a little more hand-holding at first than we were given. I don't know if others started with a little more background on the new core than I did, but I felt like I was being asked to drink with a firehose.
Loved it!!!! I may not feel completely prepared to instigate SEEd standards this year, but before I went to the workshop this summer I felt like I didn't even know where to start or how to make the new standards happen. Give me the rest of this year teaching it and at least one (or more please) workshops like this one and I am going to feel very confident starting next year.