TPT SciGirls ITEST

Evaluation Year 3

Educator Case Studies

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Background and Purpose
In Year 3 of the SciGirls ITEST Strategies grant, these case studies of participating educators were created from multiple data sources: portfolio reflections during the fall PD, end of PD survey, observations and interviews in April 2018. Each case study describes the setting (from greatschools.org), the value of the experience to the educator, the effects on them, a sample lesson using the SciGirls strategies, and the effects on their students. Note that the numbers are keyed to participants so some numbers are skipped because of missing data. There are 24 case studies which includes teachers and counselors.

Case Study 2
Setting
The setting is a suburban public school, grades 9-12 with 2,086 students. Most students at this school are performing at or above grade level. The school has a 92% graduation rate. Disadvantaged students at this school are performing better than other students in the state, though this school may still have achievement gaps. Demographics at this school are: 81% white, 6% Asian, 6% black, 5% Hispanic; 16% are low income. High school science test scores show an achievement gap based on income: the percent proficient in science courses form non-low-income students was 81% and 59% low income. Percent proficient in math were: 68% non-low-income, 38% low income.

Value to the Educator
The class the educator focused on was a biology test review for 10th grade students. The focus for the PD was on how to locate role models and work with them in the classroom and develop focused instruction for the students as a new strategy for engaging them in the lessons.

- *For the first time ever in our science department, I will be introducing the CER method (Claim,*
- *Evidence, Reasoning) to have students analyze a lab that we conducted in class today*
- *(Monday, October 9th).*
- *My team of Honors Biology teachers decided to include a new 'environmental stewardship' component to our curriculum this year. During the Fall and Spring trimesters, students are required to complete 1 to 2 hours of environmental stewardship volunteer work. I partnered with three different organizations to set up four volunteer opportunities, including the Dakota County Parks system (in conjunction with Minnesota Conservation Corps), Friends of the Mississippi River, and the City of Rosemount.*
- *Over the next week and a half there will be two Service Learning Project opportunities for students to choose between. I do a very good job at implementing team-based POGIL activities, but I need to diversify the methods and strategies that can keep my curriculum student-focused.*

Effect of the PD on educator
This educator reported increases in use of all the SciGirls strategies (see tables below). The course was very supportive of this individual focus. The class was especially helpful for helping her develop ways to engage all of the students and design more open-ended projects that would help promote student creativity and encourage choice.

- *POGIL – using this in the class is a good way to help the students engage in conversation and group work for collaboration. Try and do one type of collaboration activity once a day.*
- *The career research project was a choice. Really struggled with how to develop these and really struggle with how to get open-ended labs or activities. Learning goals in mind, it is hard to imagine how to design an experiment.*
- *Quick formative assessments give individual feedback. "Reality check, you are not ready." Talk with students about their process and learning. Having 40 students makes it very difficult to have a connection with the students. Using Schoology and being able to message them to come and see me or leave them a message is a good and emerging way.*
- *Definitely got me thinking more about utilizing critical thinking in the students. CER (claim, evidence, reasoning). Helping students utilize this helps them to be better critical thinkers. Going through these conscious steps has helped me think about how to teach the students. I located this through SciGirls and it will spread through the school.*

This educator showed gains in use of the SciGirls strategies, especially role models, as shown in the tables below.

Culturally Awareness and Relevant Learning
Biggest takeaway - It's important to provide students options and/or prepare a diverse array of lessons and activities. Role models can play an important role in helping students see themselves as scientists.

Mean for 7 Indicators	Before	After	Gain
Strategies for culturally awareness and relevant learning	7.4	8.7	1.3

Role Models
Biggest Takeaway – It's important to choose a diverse group of role models to help all students see themselves reflected in professional scientist roles. Give students an opportunity to engage in discourse and/or interview role models.

Mean for 7 Indicators	Before	After	Gain
Role Models	2.7	7.7	5.0

Student-Focused Instruction
Biggest Takeaway – Student-focused activities improve student learning and motivate students to participate.

Mean for 12 Indicators	Before	After	Gain
Student-Focused Instruction	7.2	8.2	1.0

Thoughtful Respectful Communication
Biggest Takeaway – Students need guidance and training as they develop interpersonal communication skills.

Mean for 11 Indicators	Before	After	Gain
Thoughtful Respectful Communication	8.6	10	1.4

Promoting Student Creativity

Biggest Takeaway – Student creativity can be encouraged through many different types of activities and opportunities with different time requirements.

Mean for 11 Indicators	Before	After	Gain
Promoting Student Creativity	8.0	8.7	0.7

Critical Thinking

Biggest Takeaway – I need to spend more time thoughtfully grading student work to provide feedback to better encourage critical thinking. Additionally, my team of teachers and I need to integrate newer and more diverse activities, such as CER and POE.

Mean for 12 Indicators	Before	After	Gain
Critical Thinking	6.6	8.8	2.2

SciGirls Lesson Described and Observed

The lesson for the day was a review for the upcoming biology test on HIV and viral infections. The large class size and physical arrangement of the room made any collaboration or sharing very difficult and so the review was arranged around a traditional model with some built-in activities to help the students.

- Built in discussion with the students in pairs
- Topic covered was a review for the upcoming test and covered HIV and sexually transmitted diseases.
- Used Kahoot app to help students review and made the game available for the students after the class if they wanted to review more for homework.

Effects on Students

While the class observed had little to show in the way of effects on students, the teacher was quick to share other stories where she felt there was a great effect.

- *Developed a connection with research students from the U of M to be guest speakers with the class and aligned themselves to be interviewed. The result was developing a poster. Encouraged students to interview experts in the field as part of their exploration. Had one scientists come into class to talk to the students in the past but nothing very often. Really wanted to get the students engaged with what they learn in class related to the real world and bring in people that can model this behavior for them. Through the volunteer opportunities, the students are exposed to some great role models and mentors. Also, working with the volunteer core is also a great mentor and role model for students. In the winter trimester, did the connection with the role models with the U of M genetics program. Did Skype interviews (students prepared questions ahead of time) and then talked to them. Students gave immediate feedback and felt it was an amazing opportunity. Near-pear was an excellent opportunity for the students.*
- *Work to keep the girls grouped together based on research. More interested from the girls. The girls seem to be more active in the class and more confident. More than just a SciGirls strategy but a good practice. Girls have shown an increase in grades from earlier in the year to the end of the year.*
- *I think it was immensely meaningful for my girls (and boys!) to see what leaders and careers in ecology look like and to see both men and women representatives.*

Case Study 3
Setting
The setting is a suburban public school, grades 9-12 with 2100 students. Most students at this school are performing at or above grade level. Disadvantaged students at this school are performing better than other students in the state, though this school may still have achievement gaps. Demographics at this school are: 70% white, 10% Asian, 7% black, 7% Hispanic; 17% are low income. High school science test scores show an achievement gap based on income: the percent proficient in science courses form non-low-income students was 80% and 57% low income. Percent proficient in math were: 78% non-low-income, 43% low income.

Value to the Educator
The class the educator focused on was IT Exploration for grades 10-12 students because it was a new class and probably more interesting to boys. The focus for the PD was on how to locate role models and use them in the classroom and how to attract more girls. The educator used role models and is recruiting girls for this elective class in ninth grade English and Social Studies classes. She wrote:

- *This is the main reason I am taking the course. Need to provide students with real life application and role-models.*
- *To allow my students to gain a better understanding of career paths available to them after high school.*
- *I want to incorporate more real-life experiences and information into my course. There are so many different areas in IT that this will allow the experts to be the teachers for a day.*
- *I believe there are so many different areas of focus in IT that I do not want to limit the students in their studies. By providing them one day a week to work on what they are most interested in, they have a real "buy in" and commitment to their projects.*

Effect of the PD on educator
This educator reported increases in use of all the SciGirls strategies (see tables below). The course was very supportive of this individual focus. The class was especially helpful for discussing ideas, then trying things, and discussing how they went. She wrote:

- *I feel that I have definitely moved to a higher level over the last couple weeks. I am feeling more comfortable reaching out to role models and continue to keep in touch for future opportunities.*
- *I feel that I have moved to exemplary due to the number of opportunities I have and will be offering my students in the area of role models. I have also developed relationships with these role models now and will be able to reach out in the future.*
- *Students will be able to hear from the professionals in the industry which will hopefully increase their interest in IT and STEM career areas.*

This educator reported strong gains in all the SciGirls strategies as shown in the tables below.

Culturally awareness and relevant learning
Biggest takeaway - Being aware of my own behaviors, assignments, and language that can either encourage or discourage you.

Mean for 7 Indicators	Before	After	Gain
Strategies for culturally awareness and relevant learning	5.7	10	4.3

Role Models
Biggest Takeaway – FabFems

Mean for 7 Indicators	Before	After	Gain
Role Models	3.7	10	6.3

Student-Focused Instruction
Biggest Takeaway – I don't have to know everything.

Mean for 12 Indicators	Before	After	Gain
Student-Focused Instruction	4.9	10	5.1

Thoughtful Respectful Communication
Biggest Takeaway – Give time for students to respond

Mean for 11 Indicators	Before	After	Gain
Thoughtful Respectful Communication	6.7	10	3.3

Promoting Student Creativity
Biggest Takeaway – My focus for a peer leader visit was on questioning and she showed me I don't give enough wait time.

Mean for 11 Indicators	Before	After	Gain
Promoting Student Creativity	6.8	10	3.2

Critical Thinking
Biggest Takeaway – Allow them to challenge themselves

Mean for 12 Indicators	Before	After	Gain
Critical Thinking	5.8	10	4.2

SciGirls Lesson Described and Observed
I created what I call, Genius Hour, in which students choose and design their own learning experience on a topic of their choice. I grade them on their interest and focus, not on whether they succeed, so they will take some risks. For this project, they can choose to work alone or with others. I let them decide. They work one period a week in the media center.

The evaluator observed the Genius Hour where students worked alone or in groups (their choice one period a week for six weeks (trimester) in an area of interest.) Projects this year including, programming using Raspberry Pi, designing web pages using HTML, programming in Arduino, diagnosing and fixing an iPhone, learning 3D printing, learning a photo editing program, and investigating cybersecurity. During Genius Hour, students were very focused on their projects. Four students worked individually (2 males, 2 females), while the others worked in groups of two to four. Interaction within the groups was focused on the task, respectful, and

interdependent. They were asking questions, exploring options, and listening to each other's ideas.

Effects on Students

Exposing them to role models was huge. We talked about who it was, read a brief overview, and came up with questions ahead of time. I contacted several mentors on email but didn't hear from everyone. We had, Jenelle Hibbard (engineer for Target), who talked about the jobs she'd had, stepping stone jobs, interests, education, and career plans. We also had Angela Olson talk on the distribution process, marketing and IT. Students sent thank you notes. I was surprised at how specific they were. They wrote about how what the role model had affected them: "You really opened my eyes" and "I hope I can contact you" Having contact with role models at this age level it is so huge. It helps the girls see the possibilities for STEM careers.

Case Study 4

Setting

The setting is a suburban public school, grades 9-12 with 1,917 students. Most students at this school are performing at or above grade level. Disadvantaged students at this school are not performing as well as other students in the state, though this school may still have achievement gaps. Demographics at this school are: 59% white, 9% Asian, 17% black, 12% Hispanic; 35% are low income. High school science test scores show an achievement gap based on income: the percent proficient in science courses form non-low-income students was 68% and 31% low income. Percent proficient in math were: 59% non-low-income, 21% low income.

Value to the Educator

The class the educator focused on was the student presentations on astronomy topics of their choosing. The students were 11th graders. The focus for the PD was on building in role models, and helping students to develop positive attitudes.

- *I noticed that the area I had the most room for growth was the use of role models in instruction.*
- *I want to spend some time specifically calling out those attitudes and getting students to reconsider how they think of themselves.*
- *Our district has placed us in a "Thinking Math" training module. Throughout this training we are being directed to remember ten principles of teaching mathematics. One of the principles is to keep math in context, which really ties nicely with the culturally proficient strategies in this course.*

Effect of the PD on educator

This educator reported increases in use of four of the six SciGirls strategies (see tables below). The course was very supportive of this individual focus. The class was especially helpful for reviewing his own practice and preparing for teaching his new class.

- *I'm not sure that I shifted all that much through this activity. Part of the issue is that I need to make these changes in a long- term fashion. In order to shift, I need to make these things part of how I instruct. I'm just not there yet.*

- *I don't know if I moved up the rubric as this is something I try to plan and implement regularly. The difficulty I'm facing is in teaching this "new" course is coming up with the contextual ideas in a timely manner.*
- *Would have liked to work with someone who teachers a similar topic as me. When setting goals and instructional strategies it would have been helpful to talk to another content specific teacher to sit and talk with. Establish a goal that would have been the same (shared) would have helped to get things aligned. Don't need to be sold on the strategies, need to be informed on how to do a better job implementing them in the courses.*
- *Big take away is to be intentional in what I am doing and that the strategies align with the goals.*

This educator showed gains in the use of the SciGirls strategies, especially role models, as shown in the tables below.

Culturally awareness and relevant learning

Biggest takeaway - I think the biggest takeaway was to be intentional about the strategies being used, make them aligned to the learning outcomes, and be conscious about the people presenting information and how they present information.

Mean for 7 Indicators	Before	After	Gain
Strategies for culturally awareness and relevant learning	5.3	6.6	1.3

Role Models

Biggest Takeaway – There are a large number of role models to use and a variety of ways to include them. I just need to be intentional about looking for relevant opportunities to include them.

Mean for 7 Indicators	Before	After	Gain
Role Models	2.3	4.6	2.3

Student-Focused Instruction

Biggest Takeaway – Make sure to use a variety of strategies in instruction and make sure the strategies fit the outcomes.

Mean for 12 Indicators	Before	After	Gain
Student-Focused Instruction	7.5	7.8	0.3

Thoughtful Respectful Communication

Biggest Takeaway – Be intentional about using a variety of strategies and make sure they fit the learning outcomes.

Mean for 11 Indicators	Before	After	Gain
Thoughtful Respectful Communication	8.7	8.7	0

Promoting Student Creativity

Biggest Takeaway – Be intentional about using a variety of strategies and make sure they fit the learning outcomes.

Mean for 11 Indicators	Before	After	Gain
Promoting Student Creativity	8.7	8.9	0.2

Critical Thinking

Biggest Takeaway – Be intentional about using a variety of strategies and make sure they fit the learning outcomes.

Mean for 12 Indicators	Before	After	Gain
Critical Thinking	8.8	8.8	0

SciGirls Lesson Described and Observed

In preparation for the presentation, the students could have chosen to work independently or in pairs. They had to choose a topic where they were encouraged to "share some important information from their research." Presentations utilized a few slides and each student was given a reflection sheet that they used to score the presentations and record their thoughts about the work.

During the observations, a number of different strategies were observed in use in the classroom including offering hands-on open-ended investigations, personally relevant projects, collaboration, using creativity, and critical thinking.

Effects on Students

In one activity, the teacher had the students review a piece written by an unknown author. Then had students first semester work on a piece of text, they were asked to describe who they felt wrote the piece. "Students commented that history is written by the winners and most winners have been white European males. This was part of going through the projects in the SciGirls class."

- Discussions posted in Schoology
- Discussions posted in Schoology (comments shedding light on individual own perceptions of smartness and how the article made them think differently).
- Student notes, completed assignments.

Case Study 5

Setting

The setting is a public high school, grades 9-12 with 1200 students. Test scores at this school fall below the state average. This suggests that most students at this school may not be performing at grade level. In science 65% of white students are proficient in science and 43% proficient in math. The graduation rate is 93%. 21% of Hispanic students, and 15% of black students. Almost half (45%) of students are low-income. In science, 21% of low income students are proficient, compared with 59% of non-low-income students. In math, 27% of students are proficient, compared with 57% of non-low-income students.

Value to the Educator

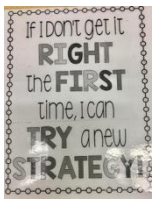
This educator chose creative thinking to focus on because she values it but rated herself low on the initial self-assessment. She has had some experience with student-focused instruction, but wants to enhance it.

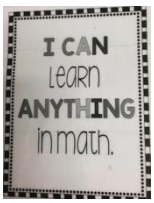
- *I feel like creative problem solving is a skill that is important in many academic fields.*
- *Student focused instruction was an area of focus for me last year during my formal observation period, and I made some good improvements. However, this year I have not been as cognizant of implementing these strategies.*

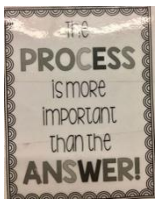
- *We have been learning how so many girls underestimate their abilities in areas of STEM. I want to find out more about the girls' mindsets in my class and provide opportunities for them to think differently about their abilities in math.*
- *I am choosing this focus area because it has been made clear in my learning this semester that relationships with role models can drastically improve girls' interest in STEM fields and careers.*

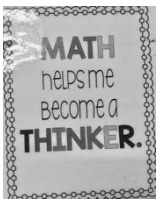
Effect of the PD on educator

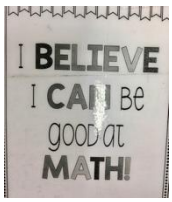
- *One way my practice will be forever changed is in incorporating role models. At this point in the process I am in the midst of planning a day for girls to meet and interact with various STEM role models. Despite the fact that they have not been able to meet these role models in person yet, I have been able to prepare students for this time by having them watch role model videos each week and discussing them afterward. The students look forward to this and are quick to remind me if I forget to show one at the beginning of a Friday class. Our discussions focus on pursuing passions and interests in your career, flexibility in career options, availability of programs, and more. I have even been fortunate enough to hear back from a few of the girls' parents about how their experiences this year have stirred an interest in math and technology and they are finding confidence in subjects where they had struggled in the past. This feedback coupled with the strong interests that the students are displaying tell me that incorporating role models, even at a basic level, can truly develop a more positive STEM identity for girls.*
- *During a lesson one of my colleagues collected data on active student engagement. The data showed that out of the 25 students who shared their work or ideas with the whole class, only 8 of them were girls. We brainstormed ways I can get more girls engaged particularly by increasing their comfort level by using more think-pair-shares, positive affirmations, and other best practices.*
- *The random name app has helped to hear more voices in the room. I have also improved on getting more students involved in homework checks and in supporting one another in their groups. We also completed a new group problem this year where students work together to "discover" the formula for the height of a projectile.*
- *I taped a growth mindset quote on each desk, and have been focusing on the process of learning - not simply the answer but all the different ways of getting there. Then, I collected data on students' confidence levels in regards to solving quadratics before, after a quiz, and then in the summative assessment. I showed students these outcomes and talked more about growth mindset and watch some role model videos that address this idea.*











This educator showed gains in use of the SciGirls strategies, especially role models, as shown in the tables below.

Culturally Awareness and Relevant Learning

Biggest takeaway - That culturally relevant teaching practices are just best practices. Previously, I struggled to define what this means in math.

Mean for 7 Indicators	Before	After	Gain
Strategies for culturally awareness and relevant learning	8.6	9.3	0.6

Role Models

Biggest Takeaway – How meaningful role models can actually be. Bringing in a panel of role models was a moving experience for me. It was wonderful to hear the girls' conversations and take-a ways.

Mean for 7 Indicators	Before	After	Gain
Role Models	2.6	8.4	5.8

Student-Focused Instruction

Biggest Takeaway – It's so fun to see what students design and create from PBL. It's a way to build relationships as well as engage!

Mean for 12 Indicators	Before	After	Gain
Student-Focused Instruction	8.1	9.5	1.4

Thoughtful Respectful Communication

Biggest Takeaway – My biggest takeaway was with Growth Mindset and how powerful it is for girls.

Mean for 11 Indicators	Before	After	Gain
Thoughtful Respectful Communication	8.6	9.9	1.3

Promoting Student Creativity

Biggest Takeaway – How powerful language can be in promoting creative problem solving. Additionally, rewarding multiple and creative methods more so than just a right answer.

Mean for 11 Indicators	Before	After	Gain
Promoting Student Creativity	8.3	9.5	1.2

Critical Thinking

Biggest Takeaway – That this is something I do very easily in Theory of Knowledge and considering how I can increase these methods and skills in my math and programming classes.

Mean for 12 Indicators	Before	After	Gain
Critical Thinking	7.8	8.9	1.1

SciGirls Lessons Described and/or Observed

Teacher uses smartboard to introduce a word problem that students then work on in their groups of three or four. The teacher circulates checking on their homework. The whole class discussed the word problem, then does another one. The schedule for the week was reviewed (since it was Monday). Students were positively engaged with each other in the groups and focused on the task.

- *I have students in groups for a quarter. I asked them who they want to work with so they have at least one person they chose in the group.*

- *I've been incorporating more confidence-building strategies, like allowing more creativity. Instead of having one project everyone does, I give them the parameters and they can choose.*
- *I've been seating the girls together more often. They seem to like that better.*
- *I had a really positive experience in the class. I liked getting ideas from the other teachers, hearing the facilitator's insights, reading the research. I had a lot of realizations throughout the course that will make me a better teacher, and a better parent of a girl.*

Effects on Students

- *I have been having role model video Fridays. One time I forgot and they asked for it. They always have lots to say about the videos because they learn things they didn't know before about careers, how to balance work and life, and the different things you can do in STEM.*
- *I've seen the girls be more confident in taking on challenges and the goals they are setting for themselves.*
- *I have seen that what appeals to my students is that math and science careers can incorporate other interests into their work. Having role models talk about that got their attention.*
- *I have even been fortunate enough to hear back from a few of the girls' parents about how their experiences this year have stirred an interest in math and technology and they are finding confidence in subjects where they had struggled in the past.*
- *Students have displayed strong interests in STEM role models, indicating that even at a basic level, we can truly develop a more positive STEM identity for girls.*

Case Study 7

Setting

The setting is a public charter school, grades 6-12 with 197 students. Most students at this school are performing at or above grade level. Disadvantaged students at this school are performing better than other students in the state, though this school may still have achievement gaps. Demographics at this school are: 76% white, 6% Asian, 9% black, 8% Hispanic. High school science test scores show a slight achievement gap based on income: the percent proficient in science courses form non-low-income students was 68% and 64% low income. Percent proficient in math were: 32% non-low-income, 27% low income.

Value to the Educator

This educator signed up to improve her knowledge/ability to engage students with STEM topics.

Effect of the PD on Educator

This special educator so-created a girls' group lunch activity for 20 students.

- *The goal was to provide a safe space for girls to meet and discuss ideas/questions. We spoke with students in small groups and one on one about potential ways to research STEM careers or areas of interest, and to incorporate them with independent projects. We reminded and talked with students about how our existing project process used at our school can incorporate SciGirls Strategies and topics in STEM. Students watched videos and invited a SciGirls Role Model to meet with our Girls Group. I have improved the use of Role Models and expanded my vision of what possibilities exist in STEM (as a non-science/math teacher).*

- *In an effort to generate excitement about SciGirls and women in STEM to the greater school population (including male students and our middle school population, as well), we took an idea that the course facilitator provided to us in her visit to our school in October. We had role model from one of the videos, Dr. Bridgette Shannon, because she is a local member of our community who works at 3M, one of our largest local corporations.*

This educator reported small gains in all SciGirls strategies. See tables below.

Culturally Awareness and Relevant Learning

Biggest Takeaway –Listen to students and take their feedback seriously.

Mean for 7 Indicators	Before	After	Gain
Strategies for culturally awareness and relevant learning	9	10	1

Role Models

Biggest Takeaway – Use them - frequently - and in many modalities.

Mean for 7 Indicators	Before	After	Gain
Role Models	9	10	1

Student-Focused Instruction

Biggest Takeaway – Reinforce the already existing student-focused curriculum at our school.

Mean for 12 Indicators	Before	After	Gain
Student-Focused Instruction	8	10	2

Thoughtful Respectful Communication

Biggest Takeaway – Create safe spaces for girls, especially girls of color, to gather and discuss ideas.

Mean for 11 Indicators	Before	After	Gain
Thoughtful Respectful Communication	9	10	1

Promoting Student Creativity

Biggest Takeaway – Encourage girls to expand their horizons and ask questions.

Mean for 11 Indicators	Before	After	Gain
Promoting Student Creativity	9	10	1

Critical Thinking

Biggest Takeaway – Reinforce the already existing critical thinking curriculum at our school.

Mean for 12 Indicators	Before	After	Gain
Critical Thinking	9	10	1

SciGirls Work

- *We chose role models at our first session to introduce the group to the context and background of SciGirls, and to show them the diversity of the field. We watched a number of the role model videos and discussed each one together. The girls selected the videos we watched and offered insights about what kind of STEM careers held interest for them.*
- *At this session we read an article about the company, Sephora, and how women are leading*

- *their tech departments. This scaffolded well after the role model videos and offered a more in-depth look at STEM roles in a company like Sephora, a store that most of them had visited at mall.*
- *The "Teachings of Grass," used the standard format for the scientific method: Introduction, Literature Review, Hypothesis, Methods, Results, Discussion, Conclusions, Acknowledgements, References Cited, but did so in a way that provided a fuller narrative of the data and challenged the narrow definition and conceptualizations of data.*
- *We hung intentionally vague posters throughout the building that contained QR codes to SciGirls role model videos. The only text on the posters included: #scigirls and key words tied to the content of the specific video that is linked on the poster (ex: #animatronicsrule #whydoweplay #makeyourownmakeup).*

Effects on Students

- *In addition to the open and fluid discussions that were had throughout this initial SciGirls Lunch Group session, we also had students write a brief reflection after the session and found that their responses addressed the fact that it was easier for some of us to identify men in STEM before identifying a woman in STEM.*
- *The group showed a high interest in both the Sephora and Bumble articles and were actively engaged in the discussion about both.*
- *Some of the girls responded that their idea of science did not change because they had already held a broad definition of science, but then went on to write a few ideas that explored the different insights from the reading. They were cognizant of the different cultural perspectives and how these perspectives influence the scientific method and science language.*
- *We hung them up a week ago, and I have seen students looking at the posters and asking peers/staff about them, but I have not yet seen any students actively scanning the QR codes.*

Case Study 8

Setting

The setting is a suburban public school, grades 9-12 with 1,583 students. Most students at this school are performing at or above grade level. Disadvantaged students at this school are performing better than other students in the state, though this school may still have achievement gaps. Demographics at this school are: 90% white, 2% Asian, 3% black; 22% are low income. High school science test scores show an achievement gap based on income: the percent proficient in science courses form non-low-income students was 59% and 33% low income. Percent proficient in math were: 54% non-low-income, 24% low income.

Value to the Counselor

The counselor focused on sharing what they were learning with the teachers they worked with to help them further develop their skills and practice. He talked about:

- *Largest part that is used in the vocational tec ed. Always collaborating between board and industry partners.*

Effect of the PD on Counselor

What is the focus of your individual growth around working with girls in your setting?

- *My primary goal was getting more female students in our skilled trades programs of construction, engineering, CAD, architecture, and manufacturing.*

This counselor reported sharing resources and ideas with colleagues and teachers that he supervises. He spoke about:

- Personally relevant projects - *Naturally did as a teacher. Also, the one that some of my staff struggle with the most. Hard to make it personally relevant to the students. Helping the teacher through personal connections with the teachers, wait for some stressors to bubble up and then they come to me and I then try and put into practice the strategies.*
- *The hard ones for many teachers. Skill trades classes for example as well as in STEM too. These areas struggle the most with it. It makes more sense to give kids a chance to "play" as a chance for them to think their way through and try and figure out what to do with it. I challenge our skilled trades to do this as well. Shop kids using scrap wood, culinary kids cooking what they want, lending library student projects. Watching the kids do these projects and see the process that the kids go through.*

This educator showed gains in use of the SciGirls strategies, especially role models, as shown in the tables below.

Culturally awareness and relevant learning

Biggest takeaway - Great examples and ideas. Mostly dealing with creating the connections with diverse cultural examples and promoting those in the classroom.

	Before	After	Gain
Strategies for culturally awareness	5	8	3
Relevant learning experiences	8	10	2

Role Models

Biggest Takeaway – This was also the primary focus of my work during this process. Creating a diverse data base of role models, speakers, instructors that could be utilized by CTE and STEM programs throughout the district.

Mean for 7 Indicators	Before	After	Gain
Role Models	7	9	2

Student-Focused Instruction

Biggest Takeaway – Was already well-versed in this aspect.

Mean for 12 Indicators	Before	After	Gain
Student-Focused Instruction	8	9	1

Thoughtful Respectful Communication

Biggest Takeaway – Some good additional ideas but nothing too groundbreaking if one is read up on recent best practices.

Mean for 11 Indicators	Before	After	Gain
Thoughtful Respectful Communication	6	8	2

Promoting Student Creativity
Biggest Takeaway – Was already a strength of mine, but not a strength of my staff. Started work on this but this is a much slower process.

Mean for 11 Indicators	Before	After	Gain
Promoting Student Creativity	8	9	1

Critical Thinking
Biggest Takeaway – Same as Creative thinking. I believe they have to go hand-in-hand.

Mean for 12 Indicators	Before	After	Gain
Critical Thinking	6	9	3

SciGirls Lesson Described and Observed
No observation was conducted.

Description from the post PD survey

- *Our best example was either our Female welding mentorship program or our Construct Tomorrow event. The goal was to have a more diverse group by race and gender. At the event, out of 16 trades unions, I believe all of them but 4 had either a female or a non-white representative of their union working with students. It was a huge success. Girls Welding is an afterschool club we started with 2 female welding mentors who take interested students and introduce them to the basics of welding to create a community project. This has been so successful not only for exposure but for females choosing skilled trades after high school*
- *couldn't formally impact this*
- *Worked with my staff at middle school and high school CAD/Engineering courses. Great success watching the teachers enjoy providing some freedom and seeing what students could come up with*
- *Same as above*
- *Same as above CAD/Engineering*
- *Wasn't able to truly implement this except for a few programs dealing with student engagement issues*
- *Always is a push on my staff so didn't change much here on this topic*
- *Had over 9 health occupations in our Allied Health; 12 industry visits; Mentor male and female in welding/manufacturing; Job shadow and interviews for students in other areas. Good success here*
- *I am more focused and feel I have more tools in the toolbelt to help my staff.*

Effects on Counselor
During the interview, he spoke about some examples of how the teachers he works with and their students were impacted by his experience. He saw changes in the nursing program and has been working with the local native American society on learning a trade and the opportunities in their school district.

- *Trying because it fits my model more than for many of the teachers. Change can be hard for those who have been teaching for a long time. I give them positive feedback when I see them stretching themselves and give them the positive recognition when they try*

something out of their norm or comfort zone. I see 80 – 90 % of my staff making some games. (18 staff)

- *Back to the free cook days. I see this in some of our graphics program and cooking programs doing things that look like creativity but are really mimicking and not being creative. This is a real challenge for some of the teachers. Inside of automotive is another good example. In construction there is not much room for creativity but they can use more collaboration and team work.*
- *Easiest in CTE. Usually the first time the students have had to apply their math or use what they have learned. You see their confidence grow while they use what they have learned and then find something they really excel at and grow. Getting the teacher to tie what they are doing is tied to what they have learned like technical writing, math, or engineering. Making the connections to these is important.*
- *Biggest draw for me with the SciGirls concepts. In this part of the state, it was a great way to make connections with students or color and making a career for themselves through school. Tied into engineering.*
- *Our staff is 100% white and that makes it more challenging. We have made some impacts but finding someone to come in is challenging because in our area there are few that are available or willing to come it.*

Lastly, he told a story about a new teacher in the culinary program and a teacher who has been working there for years.

- *Student run restaurant. One teacher is new and one has taught longer. They see their roles differently. The new chef has the students be creative and work to learn and explore. The senior chef does more of the traditional do what I do and say. The students have begun to not sign-up with the older chef because he is not connecting with the students. Helping him to see that engaging the students is more beneficial.*

Case Study 9

Setting

The setting is a public high school, grades 9-12 with 1600 students. This school is rated above average in school quality compared to other schools in the state. Four-year high school graduation rate is 94%. In science, 56% of white students are proficient compared with 7% black students and fewer low income students are proficient (33%) than non-low-income students (59%). Most students (90%) are white.

Value to the educator

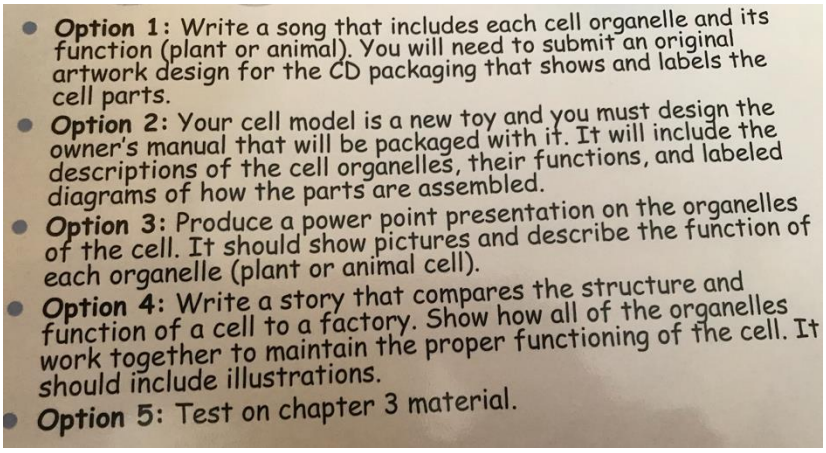
My aerospace class has only 25% female. I've been recruiting girls for this class, letting them know I think they can be successful. I need more strategies for building their confidence.

Effect of the PD on Educator

- *I purposely targeted equal numbers of boys and girls in questioning.*
- *We took a field trip to UMD Planetarium for girls.*
- *I created an assignment for cell research and design: After doing research on different types of cells, students created their own cells.*
    - *Identify whether your cell is a plant or an animal (no bacteria)*

- *Using image editing software, your own color diagram of the cell. Label all relevant cell organelles and parts.*
- *Your cell design will be graded on the labels, complexity, accuracy and effort*

- *An end of the unit assignment had choices, some creative, for students to choose from.*



This educator reported small increases in the SciGirls strategies as shown in the tables below.

Culturally awareness and relevant learning
Biggest takeaway - Finding specific female role models. Choice. Continued affirmation that anyone (girls) can do science. Encouragement.

Mean for 7 Indicators	Before	After	Gain
Strategies for culturally awareness and relevant learning	6.4	8.3	1.9

Role Models
Biggest Takeaway – I wasn't being purposeful in choosing female role models if I had a role model coming into the classroom. I am now.

Mean for 7 Indicators	Before	After	Gain
Role Models	5.4	6.0	1.5

Student-Focused Instruction
Biggest Takeaway – I have been trying to move the classroom towards 'student centered' vs. lecture.... it's improving and getting better.

Mean for 12 Indicators	Before	After	Gain
Student-Focused Instruction	7.3	8.2	0.9

Thoughtful Respectful Communication
Biggest Takeaway – I was purposeful in addressing females of different cultures in class, being careful about respecting cultural norms (American Indian, Muslim, etc.,) and tried to include inclusive cultural components in various parts of curriculum. For example, I found it super interesting that dyes, dice etc., originated in India....lots of discussion and fun.

Mean for 11 Indicators	Before	After	Gain
Thoughtful Respectful Communication	6.8	8.1	1.3

Promoting Student Creativity

Biggest Takeaway – Failure is how we learn. It's ok to fail. Failure is the first attempt at learning. Tried to stress this more.

Mean for 11 Indicators	Before	After	Gain
Promoting Student Creativity	7.4	7.9	0.5

Critical Thinking

Biggest Takeaway – Tried to use more discrepant events-especially as strong hooks and relevance to my teaching. Also, mindful of wait time, allowing the student to figure it out-if couldn't figure it out, return to the student later to clarify for understanding.

Mean for 12 Indicators	Before	After	Gain
Critical Thinking	6.8	8.0	1.2

SciGirls Lesson Strategies

- *I had students take post-it notes, write something positive about themselves, someone in class and privately give it to them. They gave them to me and I made sure everyone had a positive note.*
- *I have students collaborate on many activities. For example, we did a project on the human body and we discussed openly how we could engineer the human body to perform better.*
- *Students have choice. We do a learning inventory, students are aware of how they best perform, and in some cases are allowed open ended learning to show me their understanding.*
- *I try to use rubrics that emphasize a positive experience of what was done, rather than what wasn't done.*
- *We have a set of questions that are laminated. Students pair share specific questions during the course of study.*
- *I introduce role models through short video clips, a movie, and inviting a female guest into the classroom.*

Effects on Students

- *We had a toxicologist mom into 9th grade Environmental Science. They created questions ahead of time but also made up some other ones on the spot. They saw her as a role model since there are not a lot of women in that filed. She told them that it's important to the field to have women and that they can do it. They really enjoyed it.*
- *In biology when we studied the structure of DNA, we watched "Photo51," a movie about Rosalind Franklin who worked with Watson and Crick. She presented her work on crystallography and they were in the office. They figured out the structure of DNA. She wasn't recognized when they were. We had a lot of discussion about why she was not recognized. That provoked a lot of discussion. They each wrote a summary of the most intriguing ideas in the movie. They wrote about her not getting credit. They loved it. It was super engaging. It followed the progression of her life.*

- *When I gave them choices on the organelles project (described above), the girls chose more artsy projects, like songs and poetry. They really seemed to enjoy being creative.*
- *I started grouping the girls together and they seem to be more involved, consult each other, and get more done than when they work with the boys.*

Case Study 10

Setting

The setting is a suburban public school, grades 9-12 with 1,756 students. Most students at this school are performing at or above grade level. Disadvantaged students at this school are performing better than other students in the state, though this school may still have achievement gaps. Demographics at this school are: 91% white, 3% Hispanic; 2% Asian, 1% Black and 12% are low income. High school science test scores show an achievement gap based on income; the percent proficient in science courses form non-low-income students was 71% and 45% low income.

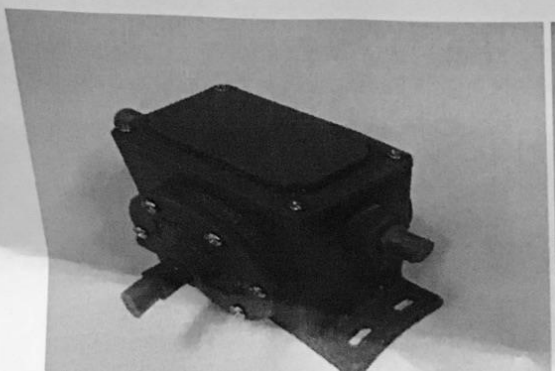
Value to the Educator

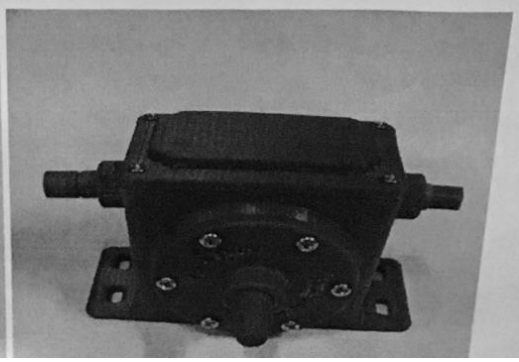
This educator teaches 9-12 Career and Technical Education classes. The goal in taking the class was to understand why there are not many females in Tech Ed.

Effect of the PD on educator

- *We used SciGirls videos: Denise the welder, Cynthia the carpenter and Jonette the traffic engineer. Other videos we used were; Japanese flower artist who applies scientific principles in observing the life of a flower; Walt Braithwaite, African-American engineer for Boeing; This Old House apprentice diaries showing three different people learning the construction industry.*
- *In engineering class, we had individual discussions with students regarding their drawings of brainstorming ideas for a puzzle cube project.*
- *In my metals class, students self-assessed their first three projects then met with me to discuss their reasoning and talking about ways they could improve for next time.*
- *We showed the growth mindset videos, and discussed what they saw, thought, and if they feel that way. Then they completed an academic reflection worksheet about the work they have done for a particular class, assignment or project.*

I enjoyed this project because it was fun to create the gearbox on solidworks then print it off. I think it is really cool how you can take something from the page of a book and make it physical. The one challenging aspect was doing all of the multi-views for the parts of the gearbox but with slow methodical effort you can get it done.





- *In architecture class, students had to design a house using a rubric and get feedback from a current homeowner on the design. Once the design was approved on paper, they built it digitally.*

Example of rubric criterion:

Working Triangle ☐ Traffic Pattern ☐ Thermal Mass ☐ Other ☐

Excellent 10 – 7 points The loft has excellent layout of design, uses a thermal mass properly, the kitchen has a perfect working triangle, and the traffic flow throughout the loft is excellent.	*Good 6 – 4 points* The loft has good layout of design, uses a thermal mass properly, the kitchen has an incorrect working triangle, and the traffic flow throughout the loft is poor.	*Poor 3 – 0 points* The loft has poor layout of design, uses a thermal mass improperly, the kitchen has an incorrect working triangle, and the traffic flow throughout the loft is poor.

Girl can choose who they work with. They generally prefer to work together.

This educator reported some gains in all SciGirls strategies and big takeaways. See the tables below.

Culturally awareness and relevant learning
Biggest takeaway - Good to have discussions with students.

Mean for 7 Indicators	Before	After	Gain
Strategies for culturally awareness and relevant learning	7.0	7.7	0.7

Role Models
Biggest Takeaway – When we watched the video the students didn't talk about who the video was about but more about the task or job that they were doing.

Mean for 7 Indicators	Before	After	Gain
Role Models	6.6	7.7	1.1

Student-Focused Instruction
Biggest Takeaway – By giving very clear and exact expectations the students will understand what you want and expect.

Mean for 12 Indicators	Before	After	Gain
Student-Focused Instruction	6.9	7.6	0.7

Thoughtful Respectful Communication
Biggest Takeaway – By the students having clear instructions they will know what to have a discussion on and will stay on task.

Mean for 11 Indicators	Before	After	Gain
Thoughtful Respectful Communication	7.9	8.6	0.7

Promoting Student Creativity
Biggest Takeaway – Teach the students to ask many questions.

Mean for 11 Indicators	Before	After	Gain
Promoting Student Creativity	6.5	7.5	1.0

Critical Thinking

Biggest Takeaway – Problem Based learning is a fantastic way to learn because it takes multiple ways to learn to solve a problem.

Mean for 12 Indicators	Before	After	Gain
Critical Thinking	5.5	7.0	1.5

SciGirls Lesson

Virtual design project: Project Based Learning

The students worked in small groups to solve a hands-on problem. They worked on a solution that they had thought of. They were able to tackle different approaches while going through the design process. During the project the students had peer assessment and check offs with me to keep them on track. This is an example of making the projects more personal.

Effects on Students

- *When students watched the role model videos, they were really into it. They wanted to discuss jobs they had not seen or done before. They were really interested in the person, more than the job they were doing. They said they were not interested in some jobs because they were too physical, dirty, or how.*
- *In the welding class in the past, students were not very critical about their welding projects, they would just put a score and didn't put much thought into it. After some explanation about the welds' quality and craftsmanship, the students starting thinking more deeply about the process and the welds improved because of that.*
- *In the Intro to Engineering Design class, the students' self-assessments of their puzzle cube projects averaged 7-8/10. After meeting with the students individually and discussing way they could improve their drawings, students completed another round of drawings and averaged 8-9 out of 10.*
- *In the mosaic project, students could use any material they wanted and any design. Several students created non-traditional projects, like a base that was mushroom shaped and was a bug hotel, or a student who tiled a box. The result overall was a lot of unique projects that showed the students' creativity.*

Case Study 11

Setting

The setting is a suburban public school, grades 9-12 with 1,917 students. Most students at this school are performing at or above grade level. Disadvantaged students at this school are not performing as well as other students in the state, though this school may still have achievement gaps. Demographics at this school are: 59% white, 9% Asian, 17% black, 12% Hispanic; 35% are low income. High school science test scores show an achievement gap based on income: the percent proficient in science courses form non-low-income students was 68% and 31% low income. Percent proficient in math were: 59% non-low-income, 21% low income.

Value to the Educator

The class the educator focused on was an introduction to molarity in chemistry with grade 11 students. The PD focused on increasing girls' interest in STEM, incorporate role models into the curriculum, and developed more student focused lessons.

- *I wanted to find out why my junior and senior girls were interested in STEM and how/when they got interested.*
- *I realize that I don't incorporate role models enough into my curriculum, especially ones that look like my students. When we are looking at the history of chemistry, most of the time it is white males that have been given the credit.*
- *A large goal for me last year and this year is how can I make my lessons more student focused instruction. I have found that my students discover concepts with guidance, they have a better understanding with the concepts. It also gets them to take ownership of their learning.*
- *When working with my fellow chemistry teachers about building interest in our curriculum, we discussed how students don't see a connection to themselves and scientists/ the subjects. We talked about how we could incorporate more people of color and women into our lessons.*

Effect of the PD on educator

This educator reported increases in use of all the SciGirls strategies (see tables below). She felt that the course was very supportive of her individual focus. The class was especially helpful for delivering information to students, role models, and critical thinking. She wrote:

- *Since I felt like I wasn't even on the self-assessment rubric when we started, I feel like I have at least moved into the novice category. In the role model exemplary category, in this activity, I have given my students an opportunity to see diverse role models in the curriculum but I haven't offered numerous opportunities yet.*
- *For the critical thinking module, I think I have moved from the novice category to the proficient category. While I create a challenging learning environment that exemplifies critical thinking capacities, I don't think I do it as often as I should. I also need to work on more student voice (in allowing them to have a say in their assignments). I do analyze my daily curriculum and try to incorporate student engagement daily.*
- *From where I was at the beginning of SciGirls to now, I feel like I have grown in how I am delivering information to my students. For role models, it is challenging to get physical people to come into my classroom to talk and relate it to content in class.*

This educator showed gains in use of the SciGirls strategies, especially role models, as shown in the tables below.

Culturally awareness and relevant learning

Biggest takeaway - I realize that this is something that I need to keep working on. I need to make sure that I am aware of all my students cultural backgrounds and how they are different than my own.

Mean for 7 Indicators	Before	After	Gain
Strategies for culturally awareness and relevant learning	3.3	6.1	2.8

Role Models

Biggest Takeaway – I realize the importance of role models to my students. They have to realize that people like them can and are being successful in the STEM field. I struggle with fitting role models into my every day classroom but with my Women in STEM club, we have had many different types of role models come in and speak. I have also found that I don't have to devote a whole day's lesson to a role model but sharing different methods, such as a bell ringer or

offering additional readings to students to learn about people who are in the STEM field. I am also working on a database of my former students who are going into STEM fields so they can share their stories.

Mean for 7 Indicators	Before	After	Gain
Role Models	3.7	7.9	4.2

Student-Focused Instruction

Biggest Takeaway – Before this class, I was already doing quite a bit of student-focused activities in my chemistry class. I teach AVID and many of these techniques are in our AVID curriculum so I transfer them to my chemistry class. I also try to have multiple different learning styles in every lesson. I find this is the best way for students to learn.

Mean for 12 Indicators	Before	After	Gain
Student-Focused Instruction	4.5	6.3	1.8

Thoughtful Respectful Communication

Biggest Takeaway – I try to make an environment as inclusive as possible. While I know there is always areas that I can work, I have gotten feedback from students that state they really like that about my class.

Mean for 11 Indicators	Before	After	Gain
Thoughtful Respectful Communication	6.1	7.0	0.9

Promoting Student Creativity

Biggest Takeaway – This is an area that I need to improve on. I struggle with promoting creativity in my classroom because I struggle with seeing that in chemistry. But I also realize that if students aren't creative then how is anything new going to be discovered.

Mean for 11 Indicators	Before	After	Gain
Promoting Student Creativity	5.6	5.8	0.2

Critical Thinking

Biggest Takeaway – Critical thinking is important for students to be able to do but I have to be better at teaching the skill. This forces students to think beyond the right answer, which is so important. I need to find ways to do this in my class more.

Mean for 12 Indicators	Before	After	Gain
Critical Thinking	4.8	5.8	1.0

SciGirls Lesson Described and Observed

During the Bell Ringer activity teacher walked the class and watched the students working. She was able to see that there was any issue with one question in particular and addressed it with the group. There were 9 groups of 4 students each. They were mixed. One group was all girls (1), some mixed (7) and one all boys. Some student groups were more talkative than others. The single groups of boys were the most vocal. General atmosphere of respect in the class that was evident as a habit. She also utilized the POGIL (processed oriented guided inquiry learning) as the students further explored molarity.

- *We are an AVID school so college prep is a big part. We use a lot of the strategies with these kids.*

- *Hands-on activities are challenging in chemistry. Working with middle school teachers to get this to be more of a habit with the students.*
- Use creativity; preferred learning styles - *This is the most difficult for me because of chemistry. The students seem to just want the correct answer all of the time.*

Effects on Students

- *When I first started SciGirls with role models and atomic theory. Found 5 woman that were involved in chemistry around the turn of the century. The girls asked why the woman scientists they saw were not getting credit for their achievements. They asked if there were more woman out there. The three girls also added three additional woman scientists. They went out of their way to seek out new moan in science and add them to the list of scientists working in chemistry. From their conversations they are very interested in STEM and have joined the woman in STEM club. One interested in biomed.*
- *Have students doing group work in class. POGIL activities. Teaching them specific roles and getting them to have roles helps them be more engaged. In the past, we just gave it to them and assumed they would know and work together. It has really helped all of the students work together. We still go over the rules and remind them how to work in groups. After one of the classes in the SciGirls I went back to the classroom and thought about using it and changed how I interacted.*

Case Study 12

Setting

The setting is a suburban public school, grades 6-12 with 2077 students. Most students at this school are performing at or below grade level. Disadvantaged students at this school are not performing better than other students in the state. Demographics at this school are: 5% white, 59% Asian, 22% black, 12% Hispanic; 91% are low income. High school science test scores show an achievement gap based on income: the percent proficient in science courses form non-low-income students was 26% and 14% low income. Percent proficient in math were: 58% non-low-income, 32% low income.

Value to the Educator

The class the educator focused on learning about polygons. The focus for the PD was on how to locate role models and use them in the classroom and how to attract more girls. The educator used role models and is recruiting girls for this elective class in ninth grade English and Social Studies classes.

- *Desmos Activities to develop critical thinking. I created a project where students used rate of change to investigate the diversity in the Saint Paul Police Department. Students had the choice to look closer at racial and gender demographics, and compare them to the demographics of Saint Paul as a community.*
- *In both of my math classes, I am implementing self-paced learning in a blended learning environment- students move through folders and develop skills at their own pace.*
- *I used a Desmos activity this week to help students discover the solutions to systems of equations.*

- *Hosted Amy Brendmoen, a local female city councilperson during our first unit of Algebra. Students were invited to submit questions and engage in conversation around the topic of whether Minnesota should raise the Minimum wage.*
- *Was passionate about projects and this type of learning and math is a way to get students to engage with the world around them. Constantly doing this. Mostly because of SciGirls and my principal encouraging me to do this. Worked with the students to design and develop action figures and use math to develop the ratio. The creativity and the desire for relevance was there but SciGirls has improved.*

Effect of the PD on educator

This educator reported increases in use of all the SciGirls strategies (see tables below). Of particular note was the large increase in the use of role models with her students. She was pleasantly surprised how accessible they were and how willing they were to talk to her students.

- *Although some students were frustrated by the additional aspects of critical thinking and desired more easily answered questions, many persevered and were excited about what they were able to accomplish, with no noticeable difference between students of different genders.*
- *This was the cycle I found it hardest to improve on. Although I think much of the promotion of a growth mindset is related to an instructor's personal tone and demeanor with students, I also recognize the importance of explicitly teaching communication and growth mindset.*
- *As a result of learning more about the importance of role models, I have made a more in*tentional effort to find ways to connect my young women with role models in the field.
- *Desire to have students collaborate has always been there but having strategies was difficult. SciGirls gave me specific ideas to help make that happen. Gamification is being used with the students – playing King of Tokyo – work online and enter points and then play face-to-face that has been able to get students to collaborate to get to a certain level and make it. They have been helping others and further develop their monster.*
- *Geometry lends itself to discovery. The challenge is getting the structures in place to help them achieve. Using open-ended exploration to help students discover and come to an understanding. Understand the struggle to achieve and use models and explorations to build understanding. This is often very challenging. Students have not been trained to learn.*

This educator showed gains in use of the SciGirls strategies, especially role models, as shown in the tables below.

Culturally awareness and relevant learning

Biggest takeaway - Hearing how other teachers are doing this, sharing perspectives and ideas. Realizing that culture is far bigger than just race.

Mean for 7 Indicators	Before	After	Gain
Strategies for culturally awareness and relevant learning	6.3	7.3	1.0

Role Models

Biggest Takeaway – How willing and accessible role models can be! I had many positive experiences and will continue to use these strategies!

Mean for 7 Indicators	Before	After	Gain
Role Models	1.3	5.4	4.1

Student-Focused Instruction

Biggest Takeaway – Planning is so important for success - this isn't something you can 'wing'

Mean for 12 Indicators	Before	After	Gain
Student-Focused Instruction	4.4	5.3	0.9

Thoughtful Respectful Communication

Biggest Takeaway – Setting up the class culture and expectations up front is very important.

Mean for 11 Indicators	Before	After	Gain
Thoughtful Respectful Communication	7.7	8.1	0.4

Promoting Student Creativity

Biggest Takeaway – Many students will rise to the occasion and want chances to express themselves creatively!

Mean for 11 Indicators	Before	After	Gain
Promoting Student Creativity	6.4	6.8	0.4

Critical Thinking

Biggest Takeaway – I was struck by how hard this is for students, but also how important it is. We must keep trying!

Mean for 12 Indicators	Before	After	Gain
Critical Thinking	4.3	5.2	0.9

SciGirls Lesson Described and Observed

The 90-minute class focused on polygons while employing a number of different learning techniques and styles. Students started by going "Tech off" and talking about what they knew about polygons and sharing with others. The class time proceeded with periods of "tech on" and "tech off" to produce a flow of engagement and creativity.

Lots of collaboration times - Having students work in their class project groups. Students working with each other with "anonymized" names to help them be more open with response. "Elbow partners" to discuss the quick questions from the lesson. Using the student wheel to choose a student and then asking them to talk about what some else in their group said about it. Students were clearly comfortable working in groups with different classmates and on different activities.

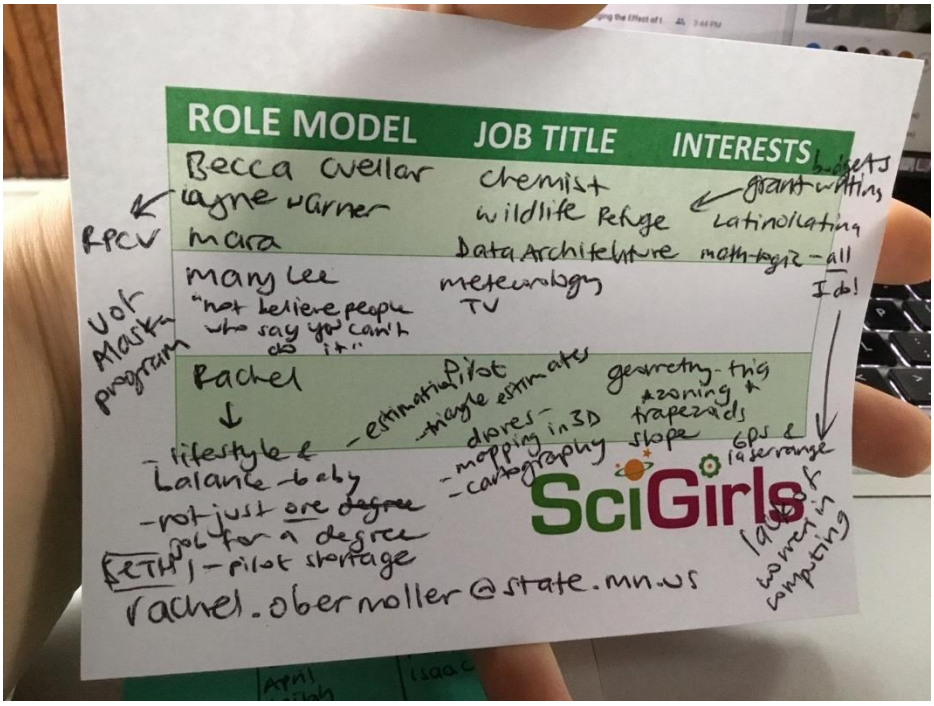
- *When a student asked "what are we going to do with quadrilaterals this year," the teacher was able to make it relevant for them in relationship to what they were going to be doing more in the future.*
- *Students had the ability to ask any questions they felt were relevant to their task and discovering the shape. Letting the students know ahead of time that they are going to be asked to respond out to the group and what the expectations were. Lots of use of technology to engage all of the students and make it possible for them to learn both at their own pace and check their understanding throughout.*

- *Quick with positive and specific feedback. Offering students multiple opportunities to get the best scores they can. Working directly with students to help them understand. Referring directly to student's questions and efforts to discover the shape their partner was describing. "Seeing lots of great math vocabulary coming out. That is great." Sharing out examples of great vocabulary that the students used during the game.*
- *Helping students engage in a variety of ways. Anonymous worked could help the students feel more comfortable with their discussions. Very active and engaging for multiple learning types. The paper/non-technology part was another way to help the more visual and kinesthetic learners as well as visual with the notes and information contained within it.*
- *Talked about who the scientists were associated with the quote of day – Katherine Johnson. Related that to the film Hidden Figures to help the students make a connection to her.*

Effects on Students

Students in this class were very comfortable with the rapid pace and use of both technology and non-technology learning environments. All of the students seemed to be engaged and active throughout the entire time. The students had the opportunity to work creatively and engage with other students they felt comfortable with.

- *Young man who struggles on an IEP and going to college is a big issue for him. Did a project with systems of choices and trying to determine if college was worth it. Compared all of the parameters mathematically. At the end, got a panel together and brought in a SciGirls presenter. For him to have the change to research and think about careers that interest him and not just going to college. Could literally see him light up and talk to the SciGirls more. This completely changed his attitude and direction.*



Case Study 13

Setting

The setting is a suburban public school, grades 9-12 with 2100 students. Most students at this school are performing at or above grade level. Disadvantaged students at this school are performing better than other students in the state, though this school may still have achievement gaps. Demographics at this school are: 70% white, 10% Asian, 7% black, 7% Hispanic; 17% are low income. High school science test scores show an achievement gap based on income: the percent proficient in science courses form non-low-income students was 80% and 57% low income. Percent proficient in math were: 78% non-low-income, 43% low income.

Value to the educator

This educator teaches 9th grade, Earth and Physical Science & 9th grade AVID.

My goal in taking this course was to provide addition resources and opportunities to my AVID 9 students in the STEM fields. AVID is an elective course that students are chosen based on a few criteria. Students in AVID meet any or all of the criteria listed: first generation college student, underrepresented minority in college, have strong academic skills but need more support through the AVID elective to take more rigorous coursework, and may represent a gap in socioeconomic status. As part of the AVID elective it is my job as the elective teacher to teach these students' academic skills to help them in more rigorous classwork. I also provide additional coaching on how to be a successful high school student. I take my role as a teacher a step further as I introduce to my students to opportunities that help them define who they are as a learner, who they want to be when they leave high school and help them explore possible ideas for their future after college. Through the GETAS Program, I was able to focus on bringing in more opportunities and information to help my female students dream about careers in the STEM fields.

- *I want my AVID girls to have more STEM experiences and see women in STEM fields so then can envision themselves with a future path in STEM careers.*
- *My administration is super supportive with increasing STEM experiences in any program in our school. They know I am interested in STEM experiences for girls as they put me in touch with this course. I enjoyed talking with everyone in my class. All the educators bring so many experiences and connections to different STEM related topics and ideas.*
- *Trying to make learning about rocks fun.*

Effect of the PD on the Educator

- *I used a few videos from the postcard on FabFems (galactic scientist) to connect our history of Astronomy Unit to Current scientists.*
- *Introduce rock cycle with a Rock song and dance around the room with an air guitar to gain interest.*

This educator reported increases in use of all the SciGirls strategies (see tables below).

Culturally Awareness and Relevant Learning

Biggest takeaway - I really liked getting the books about women in Science. I am able to use the small articles to engage and add interest to many different topics I cover in my class.

Mean for 7 Indicators	Before	After	Gain
Strategies for culturally awareness and relevant learning	3.6	7.4	3.8

Role Models

Biggest Takeaway – I loved the FabFems website. I was able to get 2 guest speakers from the area. My classes loved the ladies from FabFems. I will definitely use this resource again.

Mean for 7 Indicators	Before	After	Gain
Role Models	2.0	8.7	6.7

Student-Focused Instruction

Biggest Takeaway – I am going to try and make my questioning tactics friendlier for girls to answer. I had noticed I let the boys often dominate the question answer periods in class. So, now I pay closer attention to the girls getting opportunities to answer as well.

Mean for 12 Indicators	Before	After	Gain
Student-Focused Instruction	2.1	5.8	3.7

Thoughtful Respectful Communication

Biggest Takeaway – I changed the set-up of my classroom desks to allow more pair-share opportunities in class. Students seem to discuss more.

Mean for 11 Indicators	Before	After	Gain
Thoughtful Respectful Communication	4.5	7.1	2.6

Promoting Student Creativity

Biggest Takeaway – I started using Epic FAILs (First, Attempt, In Learning) and celebrating it, Now, kids yell out 'EPIC FAIL'

Mean for 11 Indicators	Before	After	Gain
Promoting Student Creativity	3.5	9.2	5.7

Critical Thinking

Biggest Takeaway – I plan on using the Engineering and design loop to promote problem-based learning. I will be trying out different methods for grouping student to help student push each other's critical thinking.

Mean for 12 Indicators	Before	After	Gain
Critical Thinking	3.2	7.7	4.5

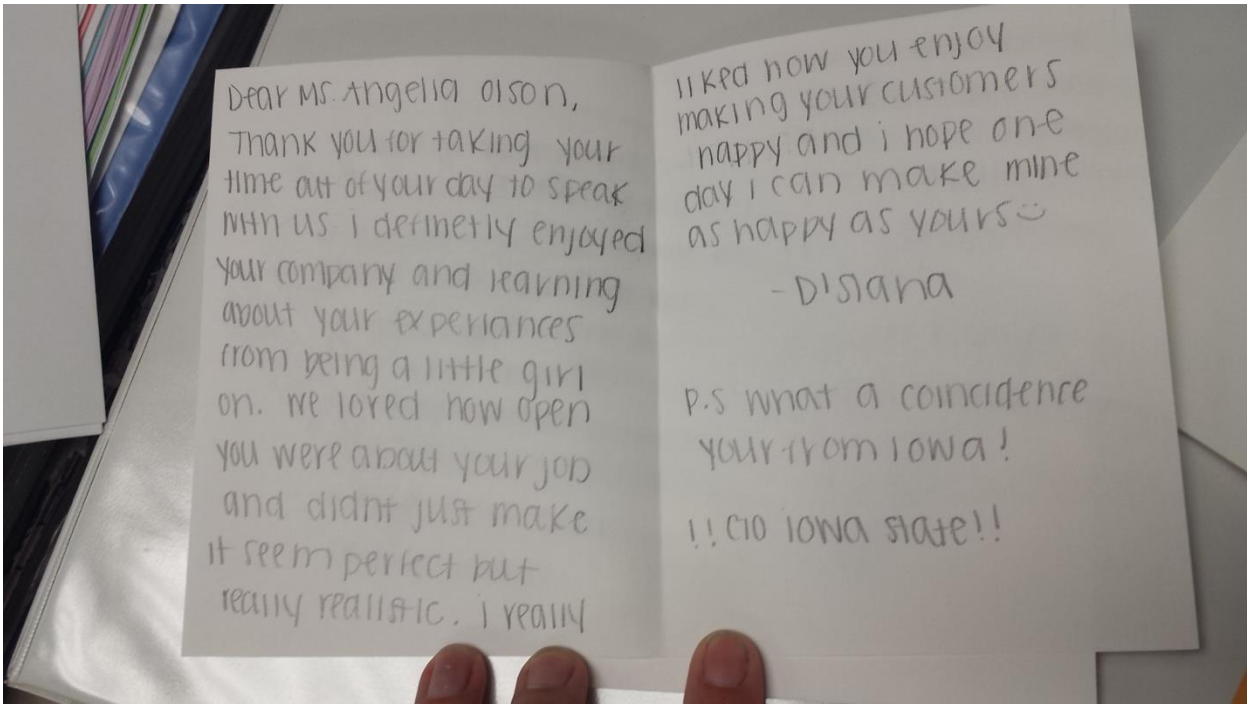
This educator reported that the class was a perfect way to take the time to focus on learning and planning.

- *I used a few videos from the postcard on FabFems (galactic scientist) to connect our history of Astronomy Unit to Current scientists.*
- *I introduced the rock cycle with a Rock song and dance around the room with an air guitar to gain interest.*
- *We already have more guest speakers lined up from the FabFems. I plan to use more women in the history of chemistry and physics units.*
- *Since I had such success in my AVID class with the Fam FEMs. I decided to reach out and use some of the little video clips of female engineers, scientists, and mathematicians in my on-level Earth/Physical science class. During our unit on the history of Astronomy I used one of the videos on a Galactic scientist, Mairanne Takayama. Instead of just presenting on Aristotle, Ptolemy, Copernicus, I added in Marianne's video clip about*

what she does with the stars and telescopes. I had two girls ask "how can I get a job like that? And can we visit the telescope she uses?" Previous years this unit on the History of Astronomy felt boring to even me as an educator. Now, I feel I was able to engage more of my students and therefore, if was more exciting for me to teach. I plan on using these video clips from SciGirls in my History of Chemistry unit as well later this school year.

Effects on Students

- *All the students produced an original assessment of their own knowledge about the standards on rocks.*
- *All the students produced notes on what they learned about from the videos and made a graphic organizer to organize what they learned from each video on that astronomer's contribution to astronomy.*
- *The students came up with really great questions on their FabFem and were very interested in the speaker.*
- *Both speakers were great and both agreed they would come back and speak again in future years. In fact, have one of them coming back to help with another project later this school year. The best part about having the speakers was the total engagement from my female students. My quiet shy Somali girls asked as many questions as my extrovert girls.*
- *On the field trip to U of M, many of my students asked questions about STEM. For example, "Where is the building that a dentist might be in for classes?" I also heard one of my girls get really excited about visiting the campus and she started jumping up and down saying "I totally want to go here!" I left beaming with excitement as I could start to see the excitement in my students faces about the possibility of going to college.*



Case Study 14

Setting

The setting is a public charter school, grades 6-12 with 197 students. Most students at this school are performing at or above grade level. Disadvantaged students at this school are performing better than other students in the state, though this school may still have achievement gaps. Demographics at this school are: 76% white, 6% Asian, 9% black, 8% Hispanic. High school science test scores show a slight achievement gap based on income: the percent proficient in science courses form non-low-income students was 68% and 64% low income. Percent proficient in math were: 32% non-low-income, 27% low income.

Value to the Educator

This educator signed up to gain practice in cultivating and facilitating creative and interdisciplinary STEM participation for girls.

Effect of the PD on Educator

This special educator co-created a girls' group lunch activity.

- *The on-boarding of this class/program was challenging and confusing. The beginning of the school year is often hectic and demanding, and it was especially so this year as we tried to recruit girls to participate, get parent permissions and pre-surveys, find time and space to meet with the group, and get acclimated to the online component. Because our school uses a nontraditional model, getting set up at the start of the year was much more labor intensive than if we had a traditional science class in which we could administer surveys and parent permission all at once.*
- *We a role model come in from one of the videos, Dr. Bridgette Shannon, because she is a local member of our community who works at 3M, one of our largest local corporations. Dr. Shannon also piqued interest from our lunch group girls because she mentioned that she previously worked at a cosmetics company and stated in the video that she enjoys making her own natural cosmetic products at home.*
- *The goal was to provide a safe space for girls to meet and discuss ideas/questions. We spoke with students in small groups and one on one about potential ways to research STEM careers or areas of interest, and to incorporate them with independent projects. We reminded and talked with students about how our existing project process used at our school can incorporate SciGirls Strategies and topics in STEM. Students watched videos and invited a SciGirl Role Model to meet with our Girls Group. I have improved the use of Role Models and expanded my vision of what possibilities exist in STEM (as a non-science/math teacher).*

This educator reported gains in two of the SciGirls strategies. See tables below.

Culturally Awareness and Relevant Learning

Biggest Takeaway –The readings could be improved.

Mean for 7 Indicators	Before	After	Gain
Strategies for culturally awareness and relevant learning	10	10	1

Role Models

Biggest Takeaway – Role model visits are really valuable. We knew this, but it was a good reminder that it is worth the extra logistics and planning.

Mean for 7 Indicators	Before	After	Gain
Role Models	8	10	2

Student-Focused Instruction

Biggest Takeaway – Our school is very student-centered. It was insightful to hear the questions that students had for our role model visit. They get right to what is real in ways adults often don't.

Mean for 12 Indicators	Before	After	Gain
Student-Focused Instruction	8	10	2

Thoughtful Respectful Communication

Biggest Takeaway – Our students are great at this. We also discuss the cultural biases of growth mindset.

Mean for 11 Indicators	Before	After	Gain
Thoughtful Respectful Communication	10	10	0

Promoting Student Creativity

Biggest Takeaway – The role model videos helped expand their ideas about STEM and STEM careers.

Mean for 11 Indicators	Before	After	Gain
Promoting Student Creativity	10	10	0

Critical Thinking

Biggest Takeaway – Reading Braiding Sweetgrass and reading about businesses with women leaders both lended well to productive critical conversations.

Mean for 12 Indicators	Before	After	Gain
Critical Thinking	10	10	0

SciGirls Work

The girls read an excerpt from Ebony & Ivy: Race, Slavery, and the Troubled History of American Universities by Craig Steven Wilder and discussed eugenics and the role of racist science, particularly related to women's health, in white supremacist society and education, particularly medical education. They could connect this with Henrietta Lacks and racial and gender disparities in medical treatment. They were asked to choose 1-2 points and delve deeper into that specific point and discuss why and how this is relevant to them in regards to being: women/girls, people of color, Native American/Indigenous, LGTBQ, of differing socioeconomic status, documented/undocumented. We provide multiple options for providing input/sharing. They could free write or draw. There was an optional group share out. Sci Girls did not prompt changes because our learning was already designed to encourage these strategies. However, Sci Girls did provide the impetus to create our Sci Girls group, cultivate the space, and take the time to schedule the activities, which the girls all enjoyed a lot.

Effects on Students

The girls lunch group provided a safe space for them to discuss STEM careers. In addition to the open and fluid discussions that were had throughout this initial SciGirls Lunch Group session, we also had students write a brief reflection after the session and found that their responses

addressed the fact that it was easier for some of us to identify men in STEM before identifying a woman in STEM. A few students also touched upon the fact that they were unaware of exactly how broad and vast the STEM field is, as they commonly think of science in more "traditional" means (scientists in a lab, medical doctors, computer technicians, etc.). Another insightful part of the discussion involved students questioning exactly what "qualifies" as a STEM career - students wanted to know if, for example, sound technicians, digital artists, or digital documentary filmmakers could be considered as STEM professionals. We had full group attendance.

The group showed a high interest in both the Sephora and Bumble articles and were actively engaged in the discussion about both. They clearly understand many aspects of the company already because they interact with it both in-store and online. They were interested in the different kinds of jobs at Sephora that are behind the scenes but instrumental in the company's success, such as web marketing, digital access, and tech support. They knew less about the Bumble app, which makes sense, but were interested in how the founder had taken on the industry after she had dealt with sexism and harassment at Tinder and was told she would not succeed. The Bumble article also led to a brief discussion about the vastly documented problem of sexism in Silicon Valley and within the tech world, and several of our students were able to identify other specific situations they had heard about pertaining to the challenges that women and people of color who work within the industry face (sexual harassment at Uber, the Google engineer's internal anti-diversity memo came up).

The group answered writing prompts before and after reading the chapter in Braiding Sweetgrass. The pre-writing asked that they describe and define science and the scientific method. The post-writing asked them if their ideas about science and the scientific method were changed or influenced by the chapter, or not. Some of the girls responded that their idea of science did not change because they had already held a broad definition of science, but then went on to write a few ideas that explored the different insights from the reading. They were cognizant of the different cultural perspectives and how these influence the scientific method and science language. We purchased multiple copies of the book, and so the students can continue reading the book independently and/or create a project out of it, possibly replicating the book's way of using the scientific method.

The role model posters we made provided another access point for all students in our building to engage with us about gender equity in STEM fields. They also provided a reminder to students in our group to continue thinking about the topics we discussed in group and to share information/insights about the group with other students who might be curious (about the posters or just SciGirls in general).

Case Study 16
Setting
The setting is a suburban public school, grades 9-12 with 1,756 students. Most students at this school are performing at or above grade level. Disadvantaged students at this school are performing better than other students in the state, though this school may still have achievement gaps. Demographics at this school are: 91% white, 3% Hispanic; 2% Asian, 1% Black and 12% are low income. High school science test scores show an achievement gap based on income; the

percent proficient in science courses form non-low-income students was 71% and 45% low income.

Value to the Counselor
This educator is a counselor.
My focus is to work with our teachers to create respectful and inviting opportunities for girls to continue taking STEM courses.

Effect of the PD on Counselor
- *Gender issues are often pushed to the side because we do not want to call attention to difficult conversations or show bias. SciGirls Connect has given me strategies to show adults and students that we can all work together for the greater good. I believe data drives programs and when we continue to show the gender difference by numbers; it gives us a starting point to have courageous conversations.*
- *The Women in STEM event that I helped to coordinate proves that girls are excited about STEM when they can see it first hand and the endless job opportunities. The girls heard from women in the community and enjoyed hands-on projects to learn more. This event allowed girls to have open conversations and gain confidence to continue to be their own unique self.*
- *I did a focus group with girls about what they liked about their STEM classes and why they thought more girls didn't take them. They loved the challenge and the interesting content. They said other girls didn't want to be seen as geeky, didn't like the behavior of the boys, or didn't feel supported by the teacher. These are things I can talk with the teachers and other girl students about in the future.*
- *This counselor reported gains in all of the SciGirls strategies.*

This educator reported large gains in all of the SciGirls strategies. See tables below.

Culturally Awareness and Relevant Learning
Biggest takeaway - Being reminded of our own biases and stepping back.

	Before	After	Gain
Strategies for culturally awareness	2	8	6
Relevant learning experiences	1	9	8

Role Models
Biggest Takeaway – I love that there are people willing to come in and talk to students. Also, to have them be engaging. One of the hardest things is to find a good speaker.

Mean for 7 Indicators	Before	After	Gain
Role Models	1	9	8

Student-Focused Instruction
Biggest Takeaway – Allowing students to control their own experiences.

Mean for 12 Indicators	Before	After	Gain
Student-Focused Instruction	1	7	6

Thoughtful Respectful Communication

Biggest Takeaway – Providing a safe place for all learners and giving girls the opportunity to grow without penalty.

Mean for 11 Indicators	Before	After	Gain
Thoughtful Respectful Communication	2	8	6

Promoting Student Creativity

Biggest Takeaway – Allowing more students to shine in a different way.

Mean for 11 Indicators	Before	After	Gain
Promoting Student Creativity	1	8	7

Critical Thinking

Biggest Takeaway – Answering a question with a question. It is a true strategy.

Mean for 12 Indicators	Before	After	Gain
Critical Thinking	1	7	6

SciGirls Activities

- *I was able to meet individually with students and through a small group with grades 9-12.*
- *I was reminded of our own biases and stepping back.*
- *I love that there are people willing to come in and talk to students. Also, to have them be engaging. One of the hardest things is to find a good speaker.*
- *We have been focusing on allowing students to control their own experiences.*
- *I try to provide a safe place for all learners and to give the girls the opportunity to grow without penalty.*
- *We have been trying to find ways to allow students to sine in a different way.*
- *A good strategy is to answer a question with a question.*

Effects on Students

- *Confidence, experiences and role models are just a few of the strategies I have been working on to promote a positive learning environment for Girls in STEM courses.*
- *I have been able to see girls open up and show their passions.*
- *I have seen my own biases and how my experiences control conversations. I was able to see that when I am being all inclusive sometimes I do not provide the extra opportunities for girls to connect. I noticed that I was trying not to single groups out but instead I did single out girls because they did not participate as much as boys. I also saw during our girls support group that the girls were uncomfortable being singled out and did not need the group. I think back to the ones that did not attend and feel that those were the ones we should have been meeting with. Some girls already have the confidence and role models and show no difference in a class with more boys. Looking forward, I hope to have more girl groups to not only support but starting conversations of change. I will work with them to break down the gender barrier and support them when they are the only girl in a male dominated course.*
- *I worked with girls who are excited about their STEM courses to make a video that directs that energy towards other girls in a registration video.*

Case Study 17

Setting

The setting is a private 9-12 high school in St. Paul with 1300 students. Most students enroll in college (96%). The school is 52% male and 48% female, with 25% students of color. Average math ACT score is 27; average science ACT score is also 27.

Value to the Educator

This teacher teaches ninth grade science and engineering.

- *My goal is to get the girls more interested in science and make them see that they can do all the engineering things that the boys do.*
- *I chose role models and student-focused instruction to focus on, because I think they go together. I want to start adding role models into the class more, but I want them to be a diverse group of people. I have a pretty diverse group of students and I feel they will feel more of a connection to a wide variety of role models.*
- *I am having a really hard time getting students to start activities and to think without asking what to do or how to do it. I am very interested in getting my students into a routine so that they will know what to do and when to do it. My class is already student focused with the projects we do and the problem solving that is involved, but I can't seem to get the students to do anything without asking me how first and then continuing to ask me questions every two minutes.*

Effect of the PD on educator

- *I had a speaker from 3M come to visit, her name is Stephanie Mann. I have also showed the following videos: Cynthia Aguilar, Rachel Gitajn, and Caroline software engineer.*
- *The ENVoY strategies are working well. It's harder for me now to remember to not answer their questions about directions, and to point to the part they need to read or to redirect their behavior. It's a process that gets easier the more I do it, but sometimes I forget and the kids notice and some will try to take advantage, so I have to be careful to make sure I don't keep re-explaining directions, but instead re-direct. Next year I think I would break up the POGIL more and stop at certain points to make sure everyone was on the same page.*
- *I used the role model assignment:*
    - *Pick a link from the list below*
    - *Pick a role model to watch or an article to read*
    - *Answer the following questions related to the role model: What is the person's name? What type of engineer or scientist is this person. What skills does this person use on the job? What do you have in common with this role model? Does this job sound interesting? (positives and negatives). List at least four other questions you would like to ask this person in order for you to understand the job better?*
- *I've gotten more successful structuring group work with clear direction about the process and what they can ask me about, that they get one grade so they need to agree on what they turn in, putting the steps they need to go through on the board and referring them back to it when they ask a question or seem lost, and letting them work on same gender groups (the girl groups work together to go over the task, make a plan and work through it; some of the boys want a lot of guidance).*

This educator reported gains in all of the SciGirls strategies. See tables below.

Culturally Awareness and Relevant Learning

Biggest Takeaway – Just to be aware that culture is important and try to incorporate it any way that I can.

Mean for 7 Indicators	*Before*	*After*	*Gain*
Strategies for culturally awareness and relevant learning	*4.9*	*5.9*	*1.0*

Role Models

Biggest Takeaway – It is very help for the girls to see women in science.

Mean for 7 Indicators	*Before*	*After*	*Gain*
Role Models	*1.4*	*4.1*	*3.7*

Student-Focused Instruction

Biggest Takeaway – I already do a lot of student focused activities, but I think I got out of it how to make them more accountable. Not so needy.

Mean for 12 Indicators	*Before*	*After*	*Gain*
Student-Focused Instruction	*2.8*	*4.5*	*1.7*

Thoughtful Respectful Communication

Biggest Takeaway – Just get the kids to share their ideas more and critique each other's ideas in a positive way.

Mean for 11 Indicators	*Before*	*After*	*Gain*
Thoughtful Respectful Communication	*7.1*	*8.2*	*1.1*

Promoting Student Creativity

Biggest Takeaway – Kids need time to process, but it is hard when giving them time sometimes leads to chaos.

Mean for 11 Indicators	*Before*	*After*	*Gain*
Promoting Student Creativity	*4.9*	*6.7*	*1.8*

Critical Thinking

Biggest Takeaway – Critical thinking is a process that takes time and patience.

Mean for 12 Indicators	*Before*	*After*	*Gain*
Critical Thinking	*5.1*	*6.3*	*1.2*

SciGirls Lesson

Students designed a light up artwork/project/toy that uses programming and Arduinos, and breadboards. They worked in pairs. The task was open ended and the students had a few specifications for things that need to be incorporated. There were several ways of reaching it by using different codes and components. The students worked at their own pace and could use any of the coding things they had learned to design their project. They got more points for adding more components to their project. The students have to take all the knowledge they learned with the basics in electricity and how to use Arduinos to create a project that does something. The students watched a SciGirls video on computer programming. The design of this project was open ended and made the students responsible for their own success.

Effects on Students

- *I tried out ENVoY strategies with a basic activity called the lab equipment scavenger hunt. I explained that I was not telling them the answers, but providing the resources for them to find the answers. I used a very authoritative tone and gave out a reference sheet and the activity sheet. Then I let the students pick a partner. I had a cart full of lab equipment and the students had to match it with a description on the activity sheet. I had a little different tone as I walked around to*
- *each group to see if they were getting the concepts, and they were asking some good questions. I didn't give any answers, but I did point to the reference sheet and redirected the students to the directions. The ENVoY strategies worked really well for this activity and the students were very engaged and spent a lot of time looking up answers instead of asking me every question.*
- *The students were put in groups to do a POGIL (Process Oriented Guided Inquiry Learning) on significant figures. I chose the groups randomly and the students were assigned questions to work on in the packet. The POGIL is supposed to be self-guided where the students explore diagrams and come up with conclusions about significant figures. The students did a really good working in their groups and I redirected to the directions when students had questions and I used different voice tones as I walked around to different groups and it went well. They also did better when they had to present answers and made sure that everyone in their groups understood the answers they were writing down. They still asked content type questions, but I had a lot fewer questions about what to do. As I went around to each group to answer questions I would ask other members in the group first to make sure no one already knew the answer. The students picked up on it really quick and wouldn't call me over unless everyone one in the group agreed they needed help.*
- *The students were put into groups of their choosing. They could work in groups of 2-3 people. They were to design a catapult to launch a candy corn and a candy pumpkin as far as it could go. They could only use popsicle sticks and rubber bands. The groups ended up mostly homogenous just by the choosing of the students. They worked pretty well together and from my observations had some very good conversations. The girls also seemed more willing to share ideas with each other. They were willing to try any idea that was suggested in their group and they really seemed interested in beating the boys. There was a prize for the group that made their candy go the farthest while using the least amount of materials. The boys ended up winning the challenge in both classes, but the female groups were close behind. The girls also seemed more open to suggestions. The boys seemed very focused on whatever idea they started with and didn't really want to change it.*
- *The students were doing a lab where they had to find the density of different blocks. This time the groups were set up as homogenous gender groups. My classes don't have a lot of girls in them, so one class had one groups of girls and another had two groups of girls. The rest of the groups were all boy groups. The all-female groups worked well together. They seemed to talk more about what they were doing and shared ideas with each other about how to make it more effective. The all boy groups also worked well. There were a few groups that had a really hard time getting the work done, because they were too distracted by other groups. I think next time I'm going to try to better arrange the boy groups. I think the boys also work well together but need a little more guidance so they don't have distractions.*

Case Study 19

Setting

The setting is a 9-12 public high school in a suburban area with 2200 students. The school has a 96% graduation rate. In science, 87% of white students are proficient, compared with 50% of black students, and 57% of Hispanic students. In science, non-low-income students (86% proficient) outperform low income students (56% proficient). In math, 79% of white students are proficient, 50% of Hispanic students, and 37% of black students are proficient. In math, non-low-income students (80% proficient) outperform low income students (46% proficient). Students are 76% white, 6% Hispanic, 6% black and 9% Asian.

Value to the Educator

This educator teaches ninth and tenth grade math and chose to focus on growth mindset, cooperative groups, role models, specific feedback. *I believe that getting out of my home and work environment and going to an objective space allowed me to think outside the box. Knowing I'm there for 3 hours, going to make the most of it, allowed me to go places I wouldn't ordinarily go. A free space with food. It's my night out.*

Effect of the PD on educator

- *The PD reminded me that role models activities are a worthwhile piece of student learning, and it is worth the time it takes to present videos, create videos, and bring in role model speakers to interact with students. I attended the role models dinner and met six role models Then I prepped students by doing a "matching of faces to careers" first with my own friends and family, then with historical mathematicians and finally with role models I used some role model videos as follow-ups to the role model matching. Students made flipgrid videos about the living mathematicians they interviewed from a contractor to engineer and an insurance claims analyst. Then I had a live role model come and share her story with each of my classes this fall.*



- *I keep my SciGirls seven handy... and, I look at the FaceBook group regularly. I also go back to the online workspace weekly because it has so many great resources. It's invaluable to have a collection of resources that I can trust – that I didn't have to look for. I've been able to share resources from there with my colleagues.*
- *I intentionally ask, "What do you notice? What do you wonder?" 3-4 times a week because I want to get them into the habit of pausing, thinking first, then sharing. I want them to be focused so I am more intentional in giving directions.*
- *In the past 3 months, there are more strategies and resources I have used that will remain engrained in my teaching repertoire than in my 20+ years of teaching math. As*

many strategies and resources are often short-lived in this career, I am pleased to say that I believe those from this experience will embed themselves and grow in years to come.

- *As I enter my classroom each day, I used to think about getting through all the slides in my lesson and making sure I show students the "tricky" parts of each problem so they can "see" how to solve more effectively. I now really stop and think about how I can better serve students with questions that aren't quickly answered by the teacher. I also am becoming more comfortable leading students toward a "struggle space" where they can feel the sometimes uncomfortable feelings of not knowing exactly how to solve a problem and/or not seeing the precise path to the "answer."*

This educator reported gains in all the SciGirls strategies as shown in the tables below.

Culturally Awareness and Relevant Learning
Biggest Takeaway –Strategies for classroom conversation - helping the conversations stay on task but also stay engaging within the groups

Mean for 7 Indicators	Before	After	Gain
Strategies for culturally awareness and relevant learning	5.9	7.6	1.7

Role Models
Biggest Takeaway – How important the other voices are to students - in person is even better. I love the realization that girls need to see themselves in the career and can often fulfill this by just hearing stories from other women in math and science.

Mean for 7 Indicators	Before	After	Gain
Role Models	3.1	8.6	5.5

Student-Focused Instruction
Biggest Takeaway – Intentionally planning the different learning strategies used each week so that I don't fall back into old habits of just lecturing

Mean for 12 Indicators	Before	After	Gain
Student-Focused Instruction	5.3	6.8	1.5

Thoughtful Respectful Communication
Biggest Takeaway – My own modeling of the thoughtful respectful communication is just as important as students practicing

Mean for 11 Indicators	Before	After	Gain
Thoughtful Respectful Communication	6.1	8.4	2.3

Promoting Student Creativity
Biggest Takeaway – The culture around mistakes is key... I love the brain science connections! Communicating the reasons why with students helps with the buy-in as well because they are so used to mistakes being a bad thing and also something to avoid.

Mean for 11 Indicators	Before	After	Gain
Promoting Student Creativity	4.8	7.5	2.7

Critical Thinking

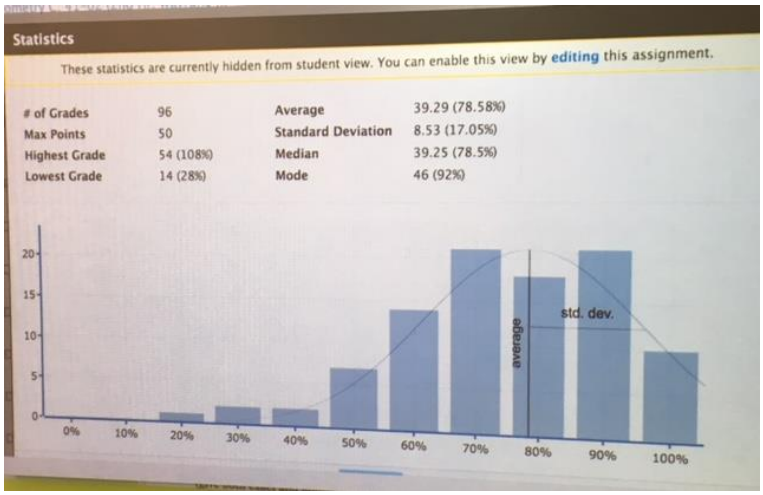
Biggest Takeaway – Struggling is a necessary space to work through to learn.

Mean for 12 Indicators	Before	After	Gain
Critical Thinking	3.9	7.3	3.4

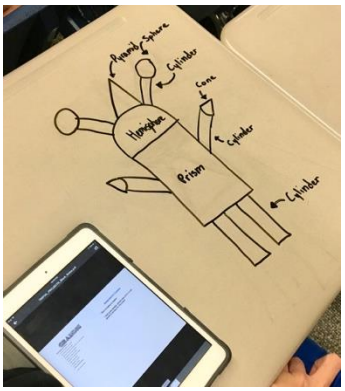
SciGirls Lesson

For a tinfoil project, the students were asked to cover a 3-dimensional surface with tinfoil (build, calculate, order tinfoil, cover with tinfoil). Working in teams, they brainstormed ideas, then, came to a consensus on an idea. This hands-on project allows teams to come with their own creative structure and make it. They received a rubric and checked-in daily in an online journal. Their surface area calculations have an error analysis sheet to earn lost points back

What do you wonder?) and see where their performance fell. The students were very interested in the graph and scored their own tests in order to see where their scores were on the graph.

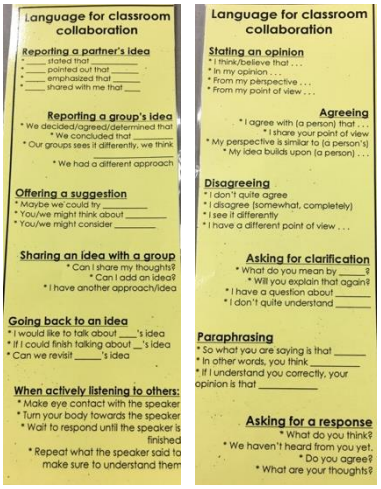


Then they worked on a project to use at least five solids and 13 shapes to build a "Tin Man" and calculate the surface area. In groups, they brainstormed ideas for including all the shapes, chose a design, discussed who would bring which materials in, and made a plan. The majority of the students were engaged most of the time in the task.



Effects on Students

- *The students were very engaged with the role model videos and in person visits.*
- I got collaboration strategies from the English teacher and taped them on the desks last fall. The groups go so much better at the strategies, I took them off. *The class has moved into a culture of discussion since the beginning of the year.*
- Options for learning and seeing the impact of individualized feedback is soooooo beneficial for these girls. It was interesting to me that the girls noticeably stayed more focused on math engagement than boys. It's interesting also to note that these same girls are outperforming the boys, again, noticeably! They seemed more comfortable in having a follow-up conversation with me too.



Case Study 20

Setting

The setting is a 9-12 high school in a suburban area with 1700 students. About half of the students are white (58%), 15% black, 13% Asian, and 9% Hispanic. In science, 75% of white students are proficient, 60% Asian, 35% of Hispanics, and 39% Black. In science, 48% of low income students are proficient compared with 73% non-low-income. In math, 73% of white students are proficient, 52% Asian, 25% of Hispanics, and 30% Black. In math, 36% of low income students are proficient compared with 74% non-low-income.

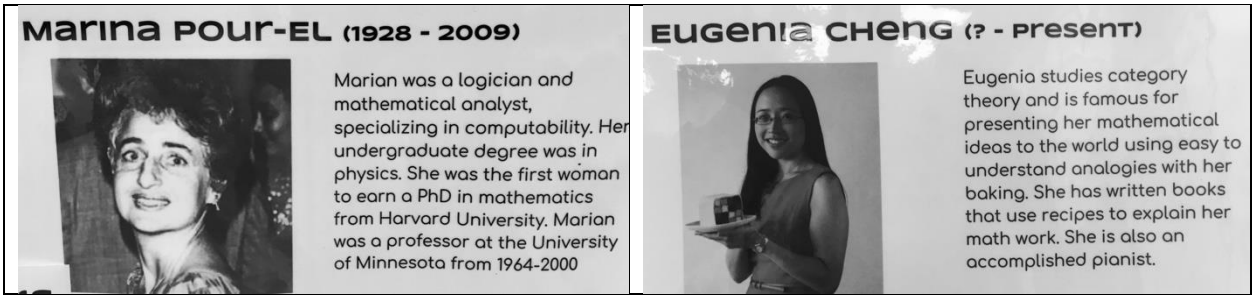
Value to the Educator

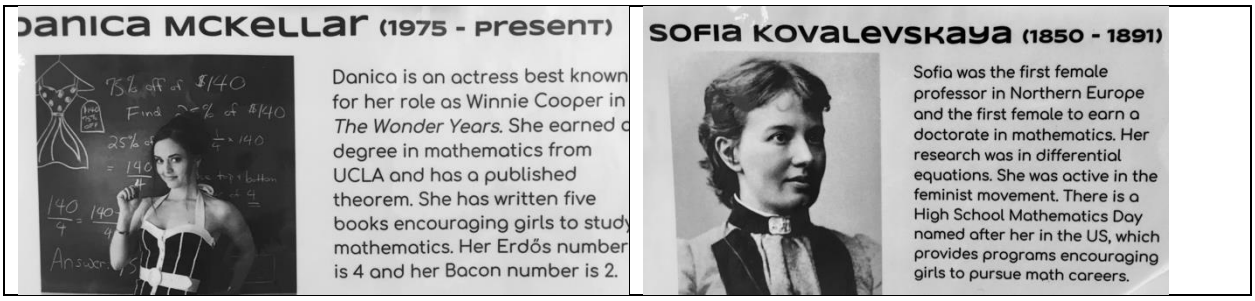
This educator teaches 11-12 AP Calculus and CIS Multivariable Calculus. The focus was on growth mindset, goal setting activities, and introducing role models.

- *I really enjoyed the in-class activities and the opportunity to share ideas with others.*
- *I would say that I found the experience to be a re-grounding in equity principles. Being open to learning new ways of doing things is the best strategy for success.*

Effect of the PD on educator

My practice with role models has undergone the most change. My only prior action in this area was to purchase a poster of Women of Mathematics to place next to the Men of Calculus. I created a display, "Mathematicians Can Be…" The other major change with Role Models is my implementation of Mathematician of the Week. See samples below.





The other area of growth in my practice is working with self-reflection and mindset. I did a lot of Mindset work five years ago when a cohort from my school took Jo Boaler's first online summer course. As we looked at specific strategies in SciGirls, I realized how much I had let that work lapse. I have added in some new reflection work for students to complete with both formative and summative assessments. I used to explicitly teach growth mindset and brain science. I have it added back in. In past years, learning about how their brains think and can be trained has been very helpful for many students

We did formal goal setting three times this school year. One round was after the next exam and a few days before parent conferences, so I could share their goals with their parents. Students wrote their own study plans for third trimester and the AP exam using a Google sheet or form that they added to after each round/week.

This educator reported gains in all the SciGirls strategies as shown in the tables below.

Culturally Awareness and Relevant Learning
Biggest Takeaway – I need to explicitly teach the soft skills too.

Mean for 7 Indicators	Before	After	Gain
Strategies for culturally awareness and relevant learning	5.1	6.6	1.5

Role Models
Biggest Takeaway – I didn't realize how important role models that my students can relate to were for their self-image.

Mean for 7 Indicators	Before	After	Gain
Role Models	3.1	5.6	2.5

Student-Focused Instruction
Biggest Takeaway – Giving explicit instructions first and using many of the same basic routines minimizes off task behaviors.

Mean for 12 Indicators	Before	After	Gain
Student-Focused Instruction	4.4	5.9	1.5

Thoughtful Respectful Communication
Biggest Takeaway – I need to ensure that everyone gets an opportunity to speak and be heard during class.

Mean for 11 Indicators	Before	After	Gain
Thoughtful Respectful Communication	6.5	8.1	2.6

Promoting Student Creativity

Biggest Takeaway – I need to provide more options for student creation of conjectures.

Mean for 11 Indicators	Before	After	Gain
Promoting Student Creativity	3.9	4.8	0.9

Critical Thinking

Biggest Takeaway – I need to give students more time to develop rigorous problem solving.

Mean for 12 Indicators	Before	After	Gain
Critical Thinking	5.8	6.8	1.0

SciGirls Lesson

Geometry Mandala Art Project. The goal of the project was for students to create their own mandala art using geometric constructions. They learned about several specific artists and geometers in the project introduction. Multiple construction techniques and geometric concepts were required to be included. The exact execution was up to the student. From their small groups, students separated into four learning stations to become experts with a specific construction (angle bisection, segment bisection, constructing a perpendicular through a point, constructing a parallel through a point). They returned to their groups and retaught the technique to their group members. Students then discussed how each of these techniques is used in a practice design. Multiple mandala examples were provided along with a discussion about cultural significance of mandala art. Students were able to create their own design to incorporate ideas important to them. The entire project was hands-on and open-ended. There were several basic criteria (include at least two of the construction techniques we have learned, include symmetry, final project at least nine inches in diameter). Multiple suggestions for inspiration were shared, but students were allowed to choose their own pathway.

- *I circulated throughout the classroom during work time praising interesting ideas, effort at precision, and persistent exploration.*
- *I met with each student about their project goals and was able to provide positive feedback on actions s/he had taken to bring the project to life.*
- *I am being more thoughtful about elevating student voice.*

Students were expected to plan out their design and to determine how to most effectively achieve their desired goals. Students became each other's mentors on the project.

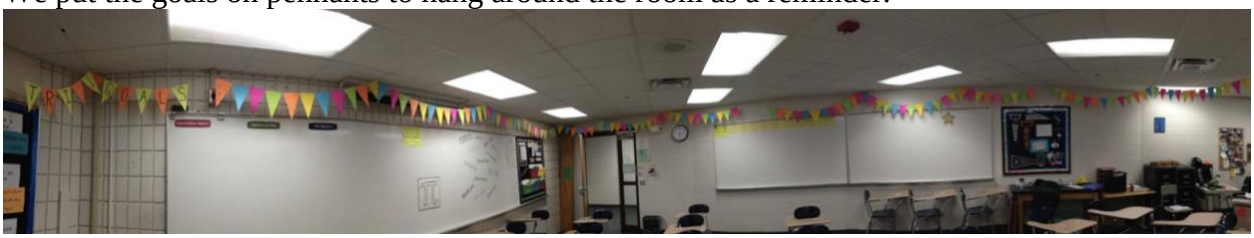
Effects on Students

My students look forward to Mathematician of the Week time, so much so that they requested we have it early when school would not be in session on Mathematician day. They are really engaged and ask interesting questions about the people that I have chosen.

After doing goal setting with students that focused on steps each student could take to direct their practice and preparation, students scored better on the next assessment than the prior year's peers. (87% proficient in 2017 vs. 73% proficient in 2016).

Moment of Silence for a Quick-Write
• What are the skills or qualities of a strong student?
Pair-Share: With your group create a list of characteristics that may help someone to learn challenging material.
Individual Reflection: Write a goal for yourself for the next unit. It should be an action that you can (hopefully will) take to improve your understanding of course concepts.

We put the goals on pennants to hang around the room as a reminder.



Case Study 22
Setting
The setting is a suburban public school, grades 9-12 with 1,756 students. Most students at this school are performing at or above grade level. Disadvantaged students at this school are performing better than other students in the state, though this school may still have achievement gaps. Demographics at this school are: 91% white, 3% Hispanic; 2% Asian, 1% Black and 12% are low income. High school science test scores show an achievement gap based on income; the percent proficient in science courses form non-low-income students was 71% and 45% low income.

Value to the Educator
The class the educator focused on was an introduction to engineering where the students were tasked with designing a simple machine with Lego and then using CAD to design their own piece that was then 3D printed. The focus for the PD was on developing the stills in the students to better understand collaborative work, offering and accepting feedback, and thinking creatively to solve a challenge.

Effect of the PD on educator
This educator reported increases in use of all the SciGirls strategies (see tables below). The course was very supportive of this individual focus. The class was especially helpful for reflecting on practice, thinking about developing new ways to engage students in critical thinking and building in collaboration. This educator showed gains in use of the SciGirls strategies, especially role models, as shown in the tables below

Culturally awareness and relevant learning

Biggest Takeaway – If a student's cultural background isn't validated in the classroom, they will not necessarily feel valued in the classroom and will often have a lower engagement level with peers and content.

Mean for 7 Indicators	Before	After	Gain
Strategies for culturally awareness and relevant learning	5.4	7.0	1.6

Role Models

Biggest Takeaway – That females are more likely to remain in a STEM program or career if they have a connection with a female role model.

Mean for 7 Indicators	Before	After	Gain
Role Models	2.9	6.4	3.5

Student-Focused Instruction

Biggest Takeaway – Control the content learned or the product of learning, but not both. This guarantees student choice no matter what the assignment.

Mean for 12 Indicators	Before	After	Gain
Student-Focused Instruction	3.8	5.5	1.7

Thoughtful Respectful Communication

Biggest Takeaway – Being intentional about teaching respectful behavior is going to be key to changing culture.

Mean for 11 Indicators	Before	After	Gain
Thoughtful Respectful Communication	7.5	8.8	1.3

Promoting Student Creativity

Biggest Takeaway – While I am good at permitting failure and helping students learn, I need to be more intentional with encouragement in general.

Mean for 11 Indicators	Before	After	Gain
Promoting Student Creativity	7.2	9.2	2.0

Critical Thinking

Biggest Takeaway – While I always want to provide constructive feedback, it often gets pushed to the back burner due to the time it takes outside of class. Often this is the feedback students value most and I need to treat it as such.

Mean for 12 Indicators	Before	After	Gain
Critical Thinking	5.8	7.5	1.7

SciGirls Lesson Described and Observed

The lesson was developed around the Lego piece design project. At the start of the class, the students wrote about things they would have liked to have done differently during the process and then shared their ideas with other students.

- The original project was a group one arranged around groups of 3 to develop an original Lego piece. Sharing ideas.

- Quick write about their innovation project to help generate ideas. The Lego piece was of personal interest as they designed it themselves
- The design of the Lego piece was open-ended for the groups and a hands-on process of engineering and design.
- Provided individual feedback on first project piece designs. Sharing out of ideas
- Encouraged one of the female students to share some of her ideas as a positive experience for her. Further developed the ideas for the class.
- After one group was given their designed Lego piece, they realized that it did not have a connector section and so would need to be redesigned. The group was directed to write out their reflections in the engineering journal.
- Sharing of ideas designed to help the students think critically about the design and engineering process.

Effects on Students

As stated earlier, the main take away for this educator was their personal reflection on their own practice in the classroom. Because of this, they were more active in looking for ways to help the students be creative, collaborative, and inventive. Students were given more open-ended assignments and when working in groups, they were often paired by gender and this was having a positive effect. The greater difficulty was in the auto repair class where the atmosphere was described as very "non-professional" and he was trying hard to change that, not just for any girls that might want to join the class but for the future of the boys as well.

- *In autos class the population is perhaps rougher (engaging in more inappropriate conversations). I had them do a self-assessment on professionalism. What was seen over the course of the term was 25 percent of the population being professional at the start of the year. Seventy five percent now seem to be acting professional during the class and in front of the teacher.*
- Engineering journal being used and can be a very personal record.
- Hands-on investigation on design and engineering principles.

Case Study 23

Setting

The setting is a 9-12 high school in a suburban area with 1700 students. About half of the students are white (58%), 15% black, 13% Asian, and 9% Hispanic. In science, 75% of white students are proficient, 60% Asian, 35% of Hispanics, and 39% Black. In science, 48% of low income students are proficient compared with 73% non-low-income. In math, 73% of white students are proficient, 52% Asian, 25% of Hispanics, and 30% Black. In math, 36% of low income students are proficient compared with 74% non-low-income.

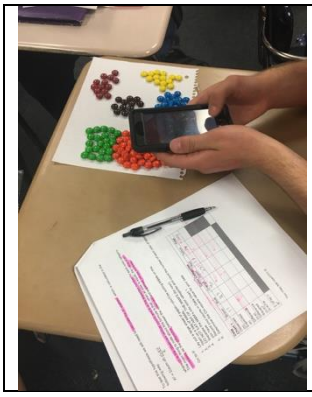
Value to the Educator

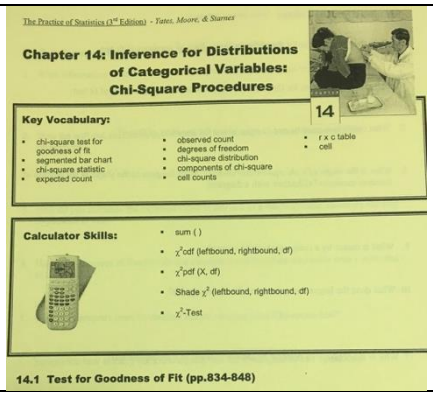
This educator teaches AP Statistics, mostly 12th grade.

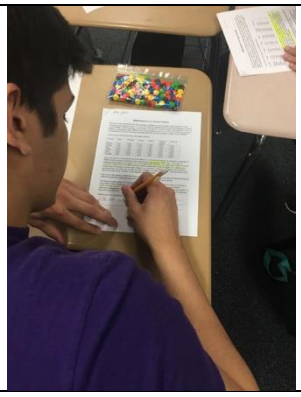
I signed up because I found the announcement interesting - anything to keep girls involved and to see what the options are. So many girls think they can only be a math teacher. There are so many more options, especially with statistics. I originally wanted to work for the CDC in stats. I see the decline in smart girls in math. They don't want to be seen as smart. A few girls get mad when I point out that they are good.

Effect of the PD on educator

I've been working on how to make groups more effective. I walk around and coach them on having everyone participate, asking each other before they ask me, and double-checking each other's work and assumptions. The Chi Square activity was based on group work.







This educator reported gains in SciGirls strategies, particularly in using role models.

Culturally Awareness and Relevant Learning

Biggest Takeaway – Ways to adjust my classroom to make big differences for every learner in there.

Mean for 7 Indicators	Before	After	Gain
Strategies for culturally awareness and relevant learning	5.3	7.4	2.1

Role Models

Biggest Takeaway – I have never done role models so everything was a great takeaway for me.

Mean for 7 Indicators	Before	After	Gain
Role Models	1.0	5.3	4.3

Student-Focused Instruction

Biggest Takeaway – The effect it can have on their learning and ownership of the class.

Mean for 12 Indicators	Before	After	Gain
Student-Focused Instruction	5.1	6.3	1.2

Thoughtful Respectful Communication

Biggest Takeaway – I think the most helpful thing was just taking the time to reflect on respectful communication and growth mindset.

Mean for 11 Indicators	Before	After	Gain
Thoughtful Respectful Communication	7.2	7.6	0.4

Promoting Student Creativity

Biggest Takeaway – Unsure.

Mean for 11 Indicators	Before	After	Gain
Promoting Student Creativity	6.5	7.2	0.7

Critical Thinking

Biggest Takeaway – Ideas on how to make critical thinking an active thing in my classroom and how to be uncomfortable with it.

Mean for 12 Indicators	Before	After	Gain
Critical Thinking	4.7	5.4	0.7

SciGirls Lesson

Here's my mindset for my teaching style with making more of an effort to involve role models, mentors and real-world examples.

- *Begin with a video introduction on a girl in statistics and use a topic from her or the video to further their learning in connection to a topic from the class.*
- *Have them discuss the problem first, together in groups before I gave them any direction.*
- *Give them options of how and what project to choose.*
- *Give them time to get real world data based on their project.*
- *They have freedom to decide on their project and its solution.*
- *Have class discussion and display of data.*
- *Give them issues or topics that are relevant to their life.*
- *Show the video again and discuss*

Effects on Students

- *Some of my girls want to be seen as hard and tough so I don't compliment them in front of other students. They know what I think of their ability so it's become sort of a secret.*
- *With talking more about role models, I see girls being more confident and considering math differently – as more of a possibility for their lives.*

Case Study 24

Setting

The setting is a suburban public school, grades 9-12 with 1,917 students. Most students at this school are performing at or above grade level. Disadvantaged students at this school are not performing as well as other students in the state, though this school may still have achievement gaps. Demographics at this school are: 59% white, 9% Asian, 17% black, 12% Hispanic; 35% are low income. High school science test scores show an achievement gap based on income: the percent proficient in science courses form non-low-income students was 68% and 31% low income. Percent proficient in math were: 59% non-low-income, 21% low income.

Value to the Educator

The class the educator focused on was an entry level CAD design class working on the early components of computer animation for 10th grade students. The focus for the PD was on how to motivate students and help students take ownership of their learning.

- Giving students ownership of their own learning
- Students internal motivation and creative expression
- *Gave students a list of questions to get them researching the topic of Domain Name extensions and asked them to create a presentation to share their findings. They were given the option to work independently or within a group of no more than 4.*

- *Giving students a PSA project whereby they come up with a relevant issue in today's society that needs to be addressed and communicated to the whole. Using any combination of media (Print, Video, Audio, etc.) they will research, develop and create media messages to be distributed.*

Effect of the PD on educator
The course was very supportive of this individual focus. The class was especially helpful for supporting students and being adaptive to meet the students where they were.

- *Each student and or group developed a presentation that they gave to the class to report their findings.*
- *I was unable to move them forward on the PSA's as they needed to learn the tools in more depth than I had anticipated. I changed the lesson to creating/altering an existing movie poster in order that they may be able to learn the tools quicker and not spend time researching on their topic. I have spent most of the time teaching them basic use of tools and computer functions instead of allowing them to have the freedom to create.*

This educator showed gains in use of the SciGirls strategies, especially role models, as shown in the tables below

Culturally awareness and relevant learning
Biggest Takeaway – Knowing that I have intrinsic biases that I need to become fully aware of and be put aside in order to reach ALL students.

Mean for 7 Indicators	Before	After	Gain
Strategies for culturally awareness and relevant learning	7.0	9.1	1.6

Role Models
Biggest Takeaway – As a CTE teacher - having role models was not a new concept. Making them gender specific was. I will make more of an effort to include female role models in my curriculum.

Mean for 7 Indicators	Before	After	Gain
Role Models	5.1	8.6	3.5

Student-Focused Instruction
Biggest Takeaway – Being in a new environment, I am seeing that I need to allow for more of these types of discussions across the classroom. It happens one on one with me and individual students, but I am not fostering enough of it among them peer to peer.

Mean for 12 Indicators	Before	After	Gain
Student-Focused Instruction	7.5	9.1	1.6

Thoughtful Respectful Communication
Biggest Takeaway – My classes are naturally designed for creativity. Motivation is more of the issue as opposed to promoting creativity.

Mean for 11 Indicators	Before	After	Gain
Thoughtful Respectful Communication	7.7	9.9	2.2

Promoting Student Creativity

Biggest Takeaway – While I am good at permitting failure and helping students learn, I need to be more intentional with encouragement in general.

Mean for 11 Indicators	Before	After	Gain
Promoting Student Creativity	7.2	9.2	2.0

Critical Thinking

Biggest Takeaway – With our information overload in society - I see this as the biggest challenge. Motivating the students to take ownership of their own perspective and the importance of sharing it.

Mean for 12 Indicators	Before	After	Gain
Critical Thinking	4.5	8.3	3.8

SciGirls Lesson Described and Observed

While the project is conducted alone, the students were are encouraged to work together to solve problems and share solutions. The students continued to working to develop skills so that they can complete the final project which will be of their choosing and shared with the class. The current investigation is all hands-on as they are doing and learning the programming necessary to design in CAD and render images for production. All learning types are able to learn as they wish and work at their own pace to achieve a complete understanding. The programming is challenging for some students and they are helped by those that have a better understanding.

Effects on Students

"Took a tour of TPT studios. One was part of a group that went to US Bank stadium and filming a HS football game. The other two students are animators and illustrators. Going to the studios gave them the perspective that there is something real about what they are doing. Three female students expressed their interest and excitement with the experience. They became more engaged with the teacher and one started a film club as a result. Third student continues to take additional media courses."

- *While the activity was successful in engaging the students, I rushed the implementation and did not have a spectrum of objectives for the groups to all choose to report on so every presentation ended up being the same and repetitive in the end. This may have attributed to the fact that many students chose to play internet games instead of do the task.*
- *I have movie posters not PSA's yet. My idea was not feasible due to students lack of knowledge with media production options.*

Case Study 25

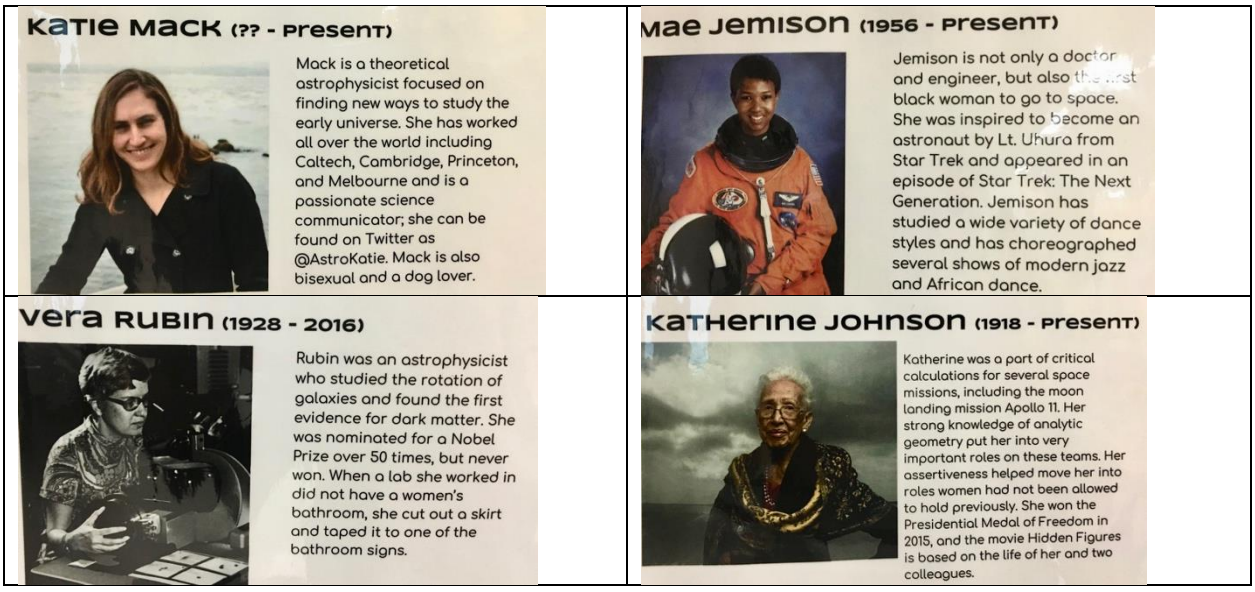
Setting

The setting is a 9-12 high school in a suburban area with 1700 students. About half of the students are white (58%), 15% black, 13% Asian, and 9% Hispanic. In science, 75% of white students are proficient, 60% Asian, 35% of Hispanics, and 39% Black. In science, 48% of low income students are proficient compared with 73% non-low-income. In math, 73% of white students are proficient, 52% Asian, 25% of Hispanics, and 30% Black. In math, 36% of low income students are proficient compared with 74% non-low-income.

Value to the Educator
This 12th grade physics teacher focused on collaborative work, critical thinking, and role models.

Effect of the PD on educator
In the past, I have hesitated to utilize role models in my classroom out of fear that it could become tokenism. As a woman in physics, I was frequently encouraged to follow in the footsteps of Marie Curie, which created the impression that there is only one way to be a woman in science. SciGirls has given me a better understanding of the best practices around using role models in my classroom and I have begun using role models to give my students opportunities to see scientists they can relate to. One of the best practices identified in the SciGirls materials is that, when discussing role models, it is important to frame them as whole people, not just as scientists. In addition, it is critical to address the challenges individuals faced as a result of their identities. For example, the stories I heard about Marie Curie while I was a student consistently framed her as only a brilliant scientist, making her an unattainable ideal. Emphasizing her other roles, such as mother and Red Cross volunteer, and acknowledging the obstacles she faced as a result of her gender help to make Curie a full person.

As part of my attention on role models, I have been putting up new visuals in my classroom to emphasize diverse contributors to science. I notice my students, regardless of race or gender, taking time to look at new posters and read the short biographies posted in my classroom.



The other major theme that has come out of my work during SciGirls is providing more effective scaffolding for my students in collaboration and creative thinking. This year, I have been struggling to get my physics students to engage effectively in the course. I use an approach that requires significant collaboration, critical thinking, and scientific reasoning and, in the past, have been able to get students to make the leap with limited instruction specifically on those skills. The discussions during the SciGirls class and the reading and reflecting I have been doing in between sessions have helped me to realize my students this year have fewer of these skills, which means I need to include more instruction on these skills. As a result of my work in

SciGirls, I had my students participate in an activity from Lotan and Cohen's Designing Groupwork designed to teach them to work more effectively in their groups. I have also implemented strategies such as group roles and explicit instruction over critical thinking strategies.

This educator reported small gains in SciGirls strategies as shown in the tables below.

Culturally Awareness and Relevant Learning
Biggest takeaway - Need to teach students how to listen to each other's ideas, not just expect them to be able to do it.

Mean for 7 Indicators	Before	After	Gain
Strategies for culturally awareness and relevant learning	7.4	8.4	1.0

Role Models
Biggest Takeaway – Role models need to be used in a way that emphasizes their humanity and their struggles.

Mean for 7 Indicators	Before	After	Gain
Role Models	2.7	3.1	0.4

Student-Focused Instruction
Biggest Takeaway – I need to work on teaching effective collaboration skills.

Mean for 12 Indicators	Before	After	Gain
Student-Focused Instruction	6.3	6.8	0.5

Thoughtful Respectful Communication
Biggest Takeaway – This need to be explicitly taught; students often do not realize the ways their communication may be disrespectful to a peer.

Mean for 11 Indicators	Before	After	Gain
Thoughtful Respectful Communication	7.8	8.4	0.6

Promoting Student Creativity
Biggest Takeaway – The creative aspects of science are rarely visible to students.

Mean for 11 Indicators	Before	After	Gain
Promoting Student Creativity	8.4	8.5	0.1

Critical Thinking
Biggest Takeaway – Groups can be structured to support critical thinking.

Mean for 12 Indicators	Before	After	Gain
Critical Thinking	8.1	8.5	0.4

SciGirls Lesson
I showed students a 'mystery box--a small project box with three visible light bulbs. Students began by sketching possible circuit diagrams for the light bulbs on a whiteboard. Students then had time to work with the mystery boxes to determine the correct circuit diagram for each of several boxes. Students worked in groups of 3-4 for the task. I gave explicit instruction over how

to work effectively and respectfully in a group. Whiteboards provided a common workspace for students to reference throughout the task. Most groups had multiple markers, allowing multiple students to write on the whiteboard at any given time. Many of my students are motivated by puzzles, so the mystery box was an intrinsically motivating framing of the task.
Students had to manipulate the bulbs in the boxes, but there were not specific steps to follow. Students had to determine from their diagrams what they should try and what kinds of observations would be useful. I intentionally did not have a key available, so students could only determine if they were correct by explaining their thinking. All of my feedback was therefore restricted to the quality of students' arguments in favor of a particular circuit diagram. Students had to connect multiple representations of a circuit to their observations to solve each mystery box.

Effects on Students

- *Having the "Scientists Can Be…" board has been interesting to students. I hear students having conversations with each other about what they see in the room. This seems to be contributing to the increased confidence I am seeing from the white women and people of color in my classroom, as they see the physics classroom as somewhere people like them have a place.*
- *I have seen my students working more collaboratively as I have put my learning into practice and continue to improve as they continue to practice these skills explicitly. Moving forward, I want to bring this collaborative culture to whole class activities. It is frequently clear many students are not getting the concepts or information I intend from those discussions. I need to work on how to scaffold students in bringing the same skills they are developing in their lab groups to the context of the whole class.*
- *My current students have already been benefiting from my work with SciGirls. A wider variety of students now see the physics classroom as a space where they are represented thanks to my new use of role models and students are becoming more skilled at working collaboratively and thinking critically thanks to strategies I am using to scaffold students in those areas. I expect the benefits of these shifts in my instruction to increase as the year goes on.*

Case Study 26
Setting
The setting is a suburban public school, grades 9-12 with 1,756 students. Most students at this school are performing at or above grade level. Disadvantaged students at this school are performing better than other students in the state, though this school may still have achievement gaps. Demographics at this school are: 91% white, 3% Hispanic; 2% Asian, 1% Black and 12% are low income. High school science test scores show an achievement gap based on income; the percent proficient in science courses form non-low-income students was 71% and 45% low income.

Value to the Counselor
This educator is a career counselor working with CTE classes in three schools.

- *I am connecting with students in grades 9-12. I was working toward goals with role models and creating a deeper connection for our students.*

- We are just reviewing issues with equity in our District. Our Advisory Council is a strong support network as we establish goals that meld well with the Sci Girls 7. I appreciate the format of the course and enjoyed the face to face. I would like to see how this expands as the material, lessons, strategies apply across many more disciplines in our district.

Effect of the PD on Counselor

- *I appreciate the format of the course and enjoyed the face to face. I would like to see how this can be expanded since the material, lessons, strategies apply across many more disciplines in our district.*
- *I have a deeper understanding of and awareness of what I do and say that can be changed to support recruitment and retainment of female students in these areas.*
- *I am excited about the progress we made and am looking forward to continuing to implement more strategies as I can. I know that I am more cognizant of the way I speak and listen. I look more at my actions and the actions of others. This is powerful work on insight and reflection on what we say and do that can have an impact on others. I feel as though I learned more than I felt I would and look forward to the possibility of expanding this to reach more of our staff.*
- *This counselor reported gains in all SciGirls strategies and big takeaways. See the tables below.*

This counselor reported gains in all the SciGirls strategies as shown in the tables below.

Culturally awareness and relevant learning

Biggest takeaway - Be cognizant of actions and words as bias is easily created.

	Before	After	Gain
Strategies for culturally awareness	7	9	2
Relevant learning experiences	6	9	3

Role Models

Biggest Takeaway –Provide an arc for presentations to guide their involvement; the structure will provide the opportunity to gain what is needed in a common format.

Mean for 7 Indicators	Before	After	Gain
Role Models	8	10	2

Student-Focused Instruction

Biggest Takeaway – Group girls with girls!

Mean for 12 Indicators	Before	After	Gain
Student-Focused Instruction	6	9	3

Thoughtful Respectful Communication

Biggest Takeaway – Listen intently and be open to ideas.

Mean for 11 Indicators	Before	After	Gain
Thoughtful Respectful Communication	6	9	3

Promoting Student Creativity

Biggest Takeaway – Give alternative options that students may create their own.

Mean for 11 Indicators	Before	After	Gain
Promoting Student Creativity	5	9	4

Critical Thinking

Biggest Takeaway – Ask questions from a higher depth of knowledge.

Mean for 12 Indicators	Before	After	Gain
Critical Thinking	6	9	3

SciGirls Activities

- *I don't have students directly involved in a class, so implementation is challenging. I will speak to the Women in STEM event as it is one that provides an opportunity to involve females in the planning and execution of the event. This is new and by creating a student group to assist, we are likely to garner further insight to and support for the event. Nearly all the strategies can be utilized in some capacity.*
- *We utilized student voices to create a video to support the Women in STEM event. In addition, we are having for students to present projects or activities at the event.*
- *We have and will continue to meet with students in small groups to provide support for them. I am also reaching out to the Society of Women Engineers to see what we can do to bridge middle and high school female involvement in STEM coursework. The event itself offers a variety of opportunity for students to showcase their work, passions, and interests.*

Effects on Students

- *We have been having helpful conversations in the CTE group about how to recruit and retain more girls in these classes. When I talked with the girls in the classes, they like them. They don't like the behavior of some of the boys who have special needs and how discipline issues are handled in the class. They would like more relevant projects and to work together with other girls.*
- *Through Sci Girls, I co-created a support network for young girls in the STEM fields. These young girls said that the Women in STEM event was by far the one event that made them feel supported with their choice to pursue this pathway.*

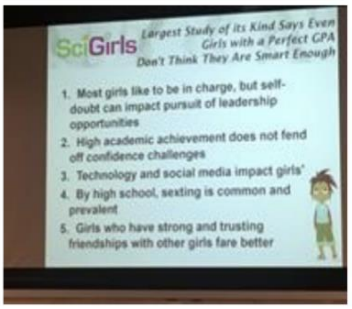
CTE NOVEMBER, 2017

FFA IN THE NEWS!

Hudson FFA in the Country Today!

Congrats Cindy and students

SCI GIRLS RESOURCES and WOMEN IN STEM



- Jess and I are working on a video with current students to highlight their interests in STEM in hopes to generate further interest in taking courses in this area. Once completed, we will share it out with you!
- Women in STEM is another targeted goal and TPT/Sci Girls is partnering with us to make this event another outstanding one for our students. As Jess and I have spent time interviewing current girls interested in STEM related fields, they have noted that this event is, by far, one that stands out as one that helped inspire and nurture their passion for STEM careers. We are forming a team of students to work on marketing internally and with planning this year's event!
    - **Follow us on Facebook: Hudson Women in STEM**

Case Study 27

Setting

The setting is a public high school, grades 9-12 with 1200 students. Test scores at this school fall below the state average. This suggests that most students at this school may not be performing at grade level. In science 65% of white students are proficient in science and 43% proficient in math. The graduation rate is 93%. 21% of Hispanic students, and 15% of black students. Almost half (45%) of students are low-income. In science, 21% of low income students are proficient, compared with 59% of non-low-income students. In math, 27% of students are proficient, compared with 57% of non-low-income students.

Value to the Educator

Initially, this 11-12 physics educator chose growth mindset to focus on.

- *I have always been intentional on trying to get students to the next step of their work, but the language surrounding growth/fixed mindset has helped me become clearer and give better feedback to students, in a way that promotes a growth mindset.*
- *I've been wanting to give students an opportunity to approach a problem from a different direction (video explanation) and apply it to a situation that is familiar to them. Using accountable talk strategies to help students navigate group work.*
- *To focus on the growth mindset in students. When students are struggling with physics concepts, there is a tendency to say "I don't understand it, I'll never understand it, I'm not going to try." The goal is for students to push through things they may not know and build their brains.*
- *To continue my work on using Growth Mindset statements with students, and to continue to push students to think critically.*
- *We are working on building a Women in STEM event, where students have the opportunity to meet and interact with female Role Models.*

Effect of the PD on educator

This educator worked on multiple approaches.

- *Students created a video of a situation where +/- is required to solve the problem mathematically.*
- *A video in class focusing on the growth mindset. (https://www.youtube.com/watch?v=ElVUqv0v1EE&feature=youtu.be) This video was shown to students after they received a test back. Once we went through the test, I showed the video and had students self-reflect on their own mindset (I did not collect any reflections or have them share out). I also talked about how some of the systems we have in place are aimed at helping students move out of a place of being stuck.*
- *When working on practice problems or lab work, a large portion of my time is spent moving from student to student, trouble-shooting their work. My focus here is to identify how my time is spent (gender and race) and to determine if the tone was one of a growth mindset, encouraging students to think critically.*
- *I am working with Angie Corbett, Alison Noah, and Hannah Wedger to create an event (January 10) for our students to interact with STEM role models.*

This educator reported gains in all the SciGirls areas as shown in the tables below.

Culturally Awareness and Relevant Learning

Biggest takeaway - Creating ways for students to make work meaningful to them. I still struggle with multiple, useful examples, but I have become intentional on seeking out places in conversation that I can help students recognize ways a topic is culturally relevant.

Mean for 7 Indicators	Before	After	Gain
Strategies for culturally awareness and relevant learning	3.6	8.0	4.4

Role Models

Biggest Takeaway – I had never worked with role models in my class. By taking this class, I was required to take a leap and introduce role models. I worked with some of my colleagues, who

were also in the SciGirls class, to put on a panel discussion. The outcome was amazing - we are planning to do it each year. I also used videos in my class - I loved hearing students react to the work these women were doing. I feel it opened up doors for them to consider various career choices.

Mean for 7 Indicators	Before	After	Gain
Role Models	1.0	8.0	7.0

Student-Focused Instruction

Biggest Takeaway – I was challenged to be intentional in my grouping strategies. When I tried different grouping strategies, I was encouraged seeing the impact the grouping strategies had on the students.

Mean for 12 Indicators	Before	After	Gain
Student-Focused Instruction	2.6	5.9	3.3

Thoughtful Respectful Communication

Biggest Takeaway – I learned ways to use language that led toward growth mindset, over a fixed mindset. By trying out various strategies, I have become much more intentional in the way I address students when they are working through a difficult task.

Mean for 11 Indicators	Before	After	Gain
Thoughtful Respectful Communication	5.3	7.3	2.0

Promoting Student Creativity

Biggest Takeaway – One of my cycles focused on creative work. It stretched my comforts, but I found that students benefited from the experience. As a result, I am more comfortable using creative strategies.

Mean for 11 Indicators	Before	After	Gain
Promoting Student Creativity	3.9	6.5	2.6

Critical Thinking

Biggest Takeaway - I was able to tie critical thinking to growth mindset to help students push to the next level.

Mean for 12 Indicators	Before	After	Gain
Critical Thinking	3.3	7.0	3.7

SciGirls Lessons

Students are building their own musical instruments. The lesson stretched over 5 class periods. Day 1 - When I introduced the requirements of the project, I had the students discuss options in their table groups. Students will be encouraged to choose an instrument or song that they like. If a student plays a specific instrument, I encourage them to build something similar. Song choices are open ended - if a kid is motivated to learn a song they like, they will stretch to produce good work. The outcome of this project is fairly broad - they need to create an instrument to produce a song. I show some projects from past years, many that don't go along traditional lines. With that, I also encourage students in individual conversations, to approach the work in the way they think will work best. This is where growth mindset language becomes important in directing students, particularly when they might be stuck. Students are applying the knowledge they have recently learned to the project. In doing that, most get stuck somewhere between the math and the

building so critical thinking skills help them work to the next step. Upon wrapping up, I will show a video of a role model building instruments. I have been more intentional on incorporating group discussion and work, have been able to incorporate role models, and have become mindful of using Growth Mindset statements with students.

Effects on Students

- *Students enjoyed the video project, collaborated well, and were creative.*
- *Students know they will get support if they sign up for my physics class.*
- *The counselors know that they can recommend girls for my physics class because I believe everyone can be successful in physics.*
- *Three of my students were telling me about how they were helping a friend from another school on skype with her physics homework and she didn't understand the basic ideas, so they explained things to her. They said, "We don't think they are teaching physics very well over there!" Their explanations were what they had learned in my class, but more importantly, they owned them because they develop them. They weren't just parroting things I had said, but helping the girl develop an understanding. That was just wonderful for me to hear.*

Case Study 28

Setting

The setting is a suburban public school, grades 6-12 with 2077 students. Most students at this school are performing at or below grade level. Disadvantaged students at this school are not performing better than other students in the state. Demographics at this school are: 5% white, 59% Asian, 22% black, 12% Hispanic; 91% are low income. High school science test scores show an achievement gap based on income: the percent proficient in science courses form non-low-income students was 26% and 14% low income. Percent proficient in math were: 58% non-low-income, 32% low income.

Value to the Educator

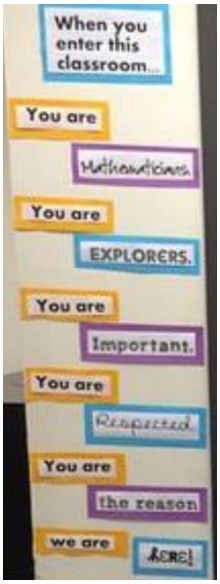
Last year during a staff meeting, the coding club did a presentation and it was all boys. This didn't set well with me. Then someone sent me the flyer for SciGirls. It sounded like something I hadn't gotten PD on before and that I think is important. Even though I'm a woman in math teaching, maybe I would have gone into coding if I had seen something like code.org.

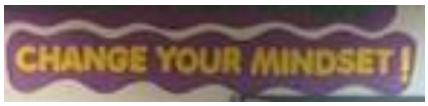
I read the book Mathematical Mindsets this past summer and was inspired by Jo Boalers' ideas of bringing the creativity of math into the classroom. I really struggle with the traditional style of teaching of lecture, drill and kill, depositing information into the kids brains that is so easy to fall back on. This doesn't foster a joy of learning and doesn't lead to deep, conceptual knowledge. I'm hoping to spend more time this year finding tasks and projects that allow students to be creative, do meaningful math, have fun, and enjoy the math.

Effect of the PD on educator

- *SciGirls was really good for helping with doing the new Algebra. We have a geometry cohort in the district to talk about the sequence, use Schoology, and make lessons conceptual. I got a lot of ideas from SciGirls for that project.*

- *I tried to use SciGirls strategies with something I was already doing. I like the hybrid class. I really enjoyed going because it was so beneficial to chat with other teachers. I liked doing the activities that put me in the position of the learner. It helped clarify goals for the classroom and motivated me to hear what other people are doing. I would think, "Ok they are trying it, I should too."*
- *I showed some FabFems videos, then I got one role model in. I want to have more, it's just a lot of effort.*





I have been very explicit in my language, trying to promote growth mindset thinking and highlighting students that are practicing a growth mindset. I referred to my classroom growth mindset posters to encourage student growth mindset language. I gave students rewards after they impressively persevered through challenges.

This educator reported gains in SciGirls strategies as shown in the tables below.

Culturally Awareness and Relevant Learning

Biggest Takeaway – From this course and another PD I am currently in, I really want to focus on providing and creating an atmosphere where students value each other's perspectives. I think I have allowed students' perceived status to get in the way of good collaboration and culture in the room. It's clear who the students' think are the smart ones and not smart ones, and this hinders students from being vulnerable and open to each other in class. I did to find ways to value and praise more types of smartness in class.

Mean for 7 Indicators	Before	After	Gain
Strategies for culturally awareness and relevant learning	5.0	8.0	3.0

Role Models

Biggest Takeaway – In my four years of teaching I have never brought a role model or guest speaker into my classroom except for my mom teaching an origami lesson for fun one time. I enjoyed having the role model in person and want to find my fluid ways to incorporate them. I think the videos were great for students to explore different ideas and see role models. I need to keep exploring these strategies.

Mean for 7 Indicators	Before	After	Gain
Role Models	1.4	6.4	5.0

Student-Focused Instruction

Biggest Takeaway – I really want to work on teamwork tactics to emphasize accountability.

Mean for 12 Indicators	Before	After	Gain
Student-Focused Instruction	4.7	7.0	2.3

Thoughtful Respectful Communication/Growth Mindset

Biggest Takeaway – This has been an area of strength and focus for me in my teaching that I want to continue to grow in. My takeaway was strategies for inclusive language and environment. How am I providing opportunities for students to feel included in the class?

Mean for 11 Indicators	Before	After	Gain
Thoughtful Respectful Communication	6.8	8.7	1.9

Promoting Student Creativity

Biggest Takeaway – The idea that I can TEACH creativity was huge for me. I limit myself in thinking that I am not very creative, so I need to have a growth mindset about that in myself so that I can support students in their own creativity.

Mean for 11 Indicators	Before	After	Gain
Promoting Student Creativity	3.7	7.6	3.9

Critical Thinking

Biggest Takeaway – I used to do a lot more problem-solving activities, but I don't do them often enough anymore. I need to teach and allow students to practice more critical thinking.

Mean for 12 Indicators	Before	After	Gain
Critical Thinking	4.3	7.4	3.1

SciGirls Lesson

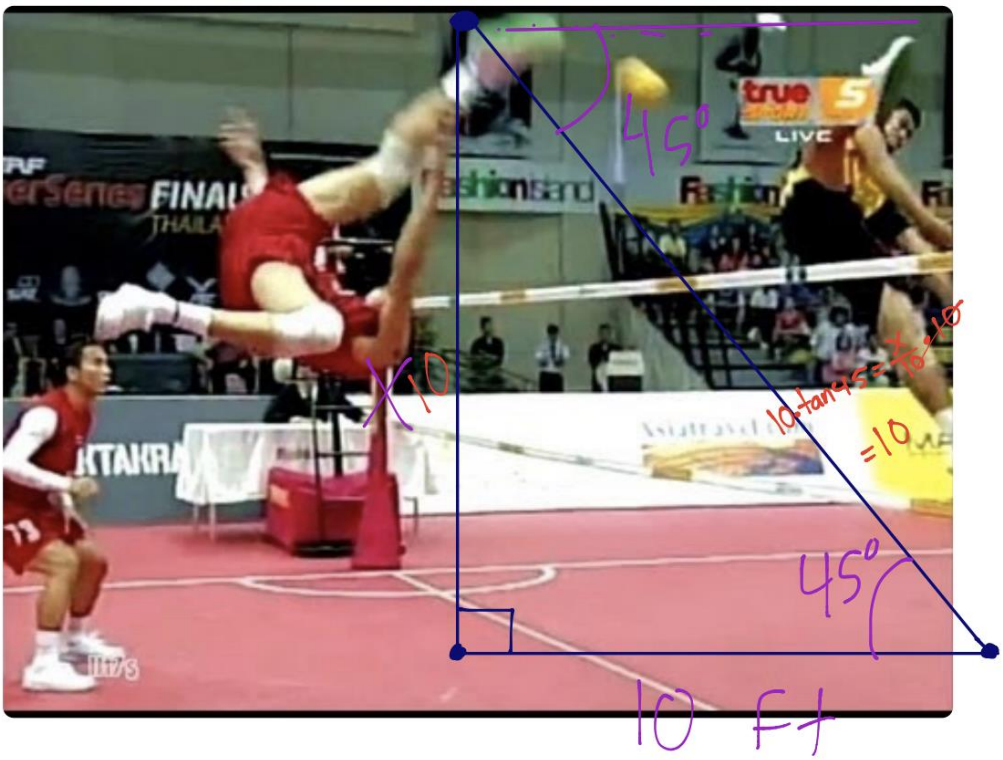
Our first geometry unit is the foundations of geometry, which means we go over a lot of the vocabulary and notation that the students will need to know for the year. I decided to end the unit with a creative Vocabulary project where students are tasked to find their geometry vocab words in the world around them, take pictures, annotate the pictures and define them. Students made a slide presentation to share the findings with the class.

- *I showed some of the role model videos and allowed students to explore careers freely during advisory. I talked specifically with girls that volunteered to take our surveys about women in STEM and showed them the SHE++ documentary with all the data. This opened up a very interesting discussion afterwards.*

Effects on Students

Trigonometry word problems developed by students.

Cane ball from Thailand i like it because back flip and it fun. One time i kick the ball over the net with the back flip and the ball hit the ground is 10 feet away from me . The Angle of depression of the ball is 45° from my foot. How high my foot on the ground.



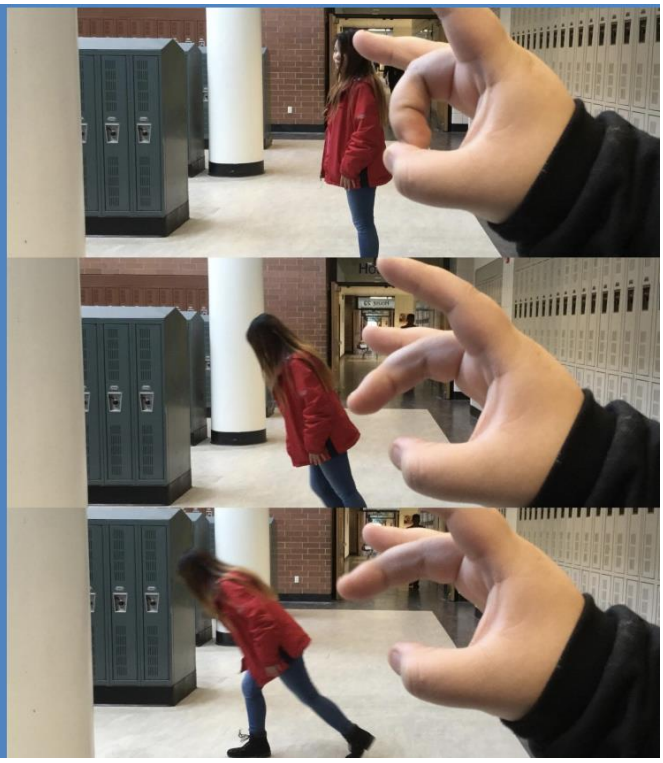
Example of student outcome for force perspective.

In the picture, Hannah's hand is 3cm from top to bottom. In real life her hand is 15cm. So the ratio is 3:15.

In the picture Beh is 2.7 cm so we can set up the following proportion.

$$\frac{3}{15}=\frac{2.7}{X}$$

When you solve for X you get 13,5 cm so Beh would be 13,5 cm in real life but, we know that she's actually 148.86 cm So it's force perspective.



Case Study 30

Setting

The setting is a suburban public school, grades 9-12 with 1,756 students. Most students at this school are performing at or above grade level. Disadvantaged students at this school are performing better than other students in the state, though this school may still have achievement gaps. Demographics at this school are: 91% white, 3% Hispanic; 2% Asian, 1% Black and 12% are low income. High school science test scores show an achievement gap based on income: the percent proficient in science courses form non-low-income students was 71% and 45% low income.

Value to the Educator

The class the educator focused on was welding. While there has been some effort to recruit more girls, there is a stigma associated with e melding and shop classes that even keep parents from encouraging their daughters to participate.

- *It makes you think about how to incorporate collaboration into*
- *For the students it is about projects. They get more and more choices*
- *Fixing broken machines and equipment from the school district.*
- *I go overt the specific welds with the students and I ask them to fill out an evaluation sheet.*
- *Big changes now but it is always good to sit back and reflect.*
- *In our welding class we read welding articles and then write about what they read.*
- *Difficult to find woman and minorities who are in the industry especially in this area of the country.*
- *Hansen is excellent. Jody Ray as well. They started a Girls in STEM night. The first year was a little limited but this year there 150 vendors (tech colleges, universities, businesses, fire departments, police) and mostly students talking to them.*

Effect of the PD on educator

This educator reported increases in use of all the SciGirls strategies (see tables below). The course was very supportive of this individual focus. The class was especially helpful for developing ways to talk with the students, encouraging them, and finding ways for them to work at their own pace and interest.

- *Don't feel that I have not changed too much but it has really gotten me to do more reflection.*

This educator showed gains in use of the SciGirls strategies, especially role models, as shown in the tables below.

Culturally awareness and relevant learning

Biggest Takeaway – My School is not very diverse so it's hard to associate with that.

Mean for 7 Indicators	Before	After	Gain
Strategies for culturally awareness and relevant learning	5.4	6.6	1.2

Role Models
Biggest Takeaway – Providing role models for my classes male or female is very important to students.

Mean for 7 Indicators	Before	After	Gain
Role Models	2.7	4.9	2.2

Student-Focused Instruction
Biggest Takeaway – Some students have great ideas, but sometimes it doesn't pertain to the curriculum.

Mean for 12 Indicators	Before	After	Gain
Student-Focused Instruction	5.0	7.3	2.3

Thoughtful Respectful Communication
Biggest Takeaway – I am a go go go type person I have learned that sometimes it is a good idea just to sit and reflect.

Mean for 11 Indicators	Before	After	Gain
Thoughtful Respectful Communication	6.5	7.7	1.2

Promoting Student Creativity
Biggest Takeaway – In some of my classes students can be very creative and in other it is very technical and it has to be a certain way, finding a balance of both is hard to do some times.

Mean for 11 Indicators	Before	After	Gain
Promoting Student Creativity	5.5	7.2	1.7

Critical Thinking
Biggest Takeaway – It is hard and it always will be hard to make students think really deep about a subject especially if they are not interested in the subject.

Mean for 12 Indicators	Before	After	Gain
Critical Thinking	5.9	6.9	1.0

SciGirls Lesson Described and Observed
While there was no specific lesson developed based on the SciGirls strategies for observation, the students were busy working on learning the welding skills required for completion of the class. There were a number of different levels of skill in the class and those students who needed more help were often instructed by students with more skills.

- *Students were working together to accomplish welds and cuts with the torch. Learning skills were relevant to the students when they started to think about how they might use what they learned to further develop an individual project.*
- *Very hands-on activities. Most activities and investigations were prescribed for the "one hour" students while the "two hour" students were more likely to be working on areas of interest after gaining the basic skills.*
- *Giving the students the opportunity to work until they felt their work was the best representation of their skills. Feedback was specific to the student's skill level and related to their interests.*

- *Different students had an opportunity to work on areas that were interesting to them.*
- *Giving tasks and the basic knowledge while challenged to think critically about they were doing and seeing.*
- *Teacher as role model was the most common theme for the class. Older and more skills students were acting as role models for the younger students. Students help each other and that is an important part of the process. Trying to help them see how things work in industry as well. Having some industry people coming in to talk to the kids about what it is like in the industry. Sharing the experiences and working on "soft skills" as an important aspect of working.*

Effects on Students

"The environment does not attract very many girls. I was hoping that from the program I would get more information about how to attract girls. For girls, it is loud, it stinks, and this is not something that typically attracts girls. Opening the room up with the renovations and window to the hall that will hopefully get us more exposure to the school."

- *One student scored a perfect score on his ACT. He would come down for study hall and weld and learn the other skills but could not take the class because he would not get the same credits as the other students taking AP classes. He talked about it and was valedictorian and could not lose that.*
- *Students critiquing each other's work as part of the project. Will lay their welds on the table and talk about what they see and arrange them by what they think are the better welds and then sort them. Grades are based on this plus what the teacher sees.*
- *In the advisory group we talk about changes in courses that they are taking. We had some good conversations with the 5 girls in our advisory. They were afraid of things. Some of the girls cut out flower petals with the plasma cutter and got some experience. It was scary at first but they became more comfortable.*