Girls in STEM
Using images to improve female students’ interest and motivation in science, technology, engineering, and mathematics
By Melanie Kinskey

In the last 10 years, science classrooms in the United States have transformed into interdisciplinary vessels including technology, engineering, and mathematics. While educational reforms continue to expand the horizons of our classrooms, one historical trend has remained constant: Young girls are continuing to demonstrate a lack of interest and success in Science, Technology, Engineering, and Mathematics (STEM) disciplines. The 2015 NAEP science scores, for example, reveal higher average scores for males than females in both grades 8 and 12 (NCES 2015), while the 2018 Programme for International Student Assessment (PISA) revealed an average of 1% of 15-year-old girls from OECD (Organisation for Economic Cooperation and Development) countries expressing interest in a STEM-related career, compared to an average of 8% of boys (Schleicher 2019). As girls enter middle school, their interest in science begins to decline. While female STEM leaders are not unheard of, women continue to be underrepresented in the science and engineering workforce as well as on science and engineering faculties of college and university campuses (NGSS Lead States 2013, p. 281).

For these reasons, the Framework of the Next Generation Science Standards (NGSS) is rooted in guiding principles of equity, stressing that opportunities for in-depth teaching and experiences with science and engineering practices should be equitable and made available to all students (NGSS Lead States 2013). Additionally, the Framework states “an effort should be made to include significant contributions of women and people from diverse cultures and ethnicities” (NGSS Lead States 2013, p. 288).

In this article, I share a strategy I used in my former fifth-grade classroom and now share with the preservice teachers I teach: incorporating images of female scientists in the classroom to improve the connections female students make with the field of STEM (Figure 1). The purpose of these connections is to improve female interest in STEM and to show our female students that if they want, they can be a woman in a STEM field. When students have a personal connection to what they are learning, their interest and motivation may increase. This article allows me to share a method that promotes the equitable environment the NGSS aim to establish.

DISPEL THE STEREOTYPES
To prepare our classrooms to be equitable and meet the needs of the NGSS, we must rid our students of the idea that STEM careers are more suitable for males than females. When most children are asked to draw a picture of a scientist, many will draw what is considered the stereotypical image: a white male with crazy hair wearing a white lab coat (Bodzin and Gehringer 2001). In a similar study where students were asked to draw a mathematician, the same was true: a male dressed in nice clothes wearing glasses was most often the perceived image (Aguilar et al. 2016). Finally, Fralick, Kearns, Thompson, and Lyons (2009) found that when students were asked to draw an image of an engineer, 50% of those images were male while only 13% were female. These results em-
Other students is appropriate. The images change throughout the year to reflect both student interests and current science topics. I usually posted about five images at one time. The second component of this strategy is intentional planning. I planned to highlight a scientist during my regular lessons. If the scientist were one of the scientists on a poster, I always made sure to draw attention to that image. For example, if I were teaching about space, I might show a quick video clip about one of our astronaut scientists, perhaps Mae Jemison, to connect the topic to a career. I would then state, “One of our feature scientists for the next few weeks is Mae Jemison. When you have time, be sure to visit her poster and learn about her experiences as an astronaut!” As students finished their work, during center rotations or silent reading time, they were able to visit one of the posters and learn about that scientist.

When choosing the scientist or engineer, being culturally aware is important to ensure equity is achieved. Choosing modern women in STEM is helpful for students to see women who are STEM leaders in today’s society. I have found the female STEM leaders in Table 1 to be of current particular interest and relevance to the various cultures in my former fifth-grade classroom and those of the classes where my preservice teachers work. Along with each image, I include a short biography and QR code, which links to the websites shared in the table. Students can read the short biography about each female STEM leader and then use an iPad or computer to access the website for further exploring. With the NGSS emphasizing the need to connect science to student interests and experiences, I also included a brief explanation about which students might connect to each scientist—for example, their country of origin or what topic they study.

Using images to communicate with students about opportunities available for different ethnicities and genders not only influences the perceptions females have but also the perceptions that male students have of females in STEM industries. While the girls may change their mindset from “I can never be a scientist” to “I can be a scientist,” boys might change their mindset from “girls can’t do that” to “girls can be scientists, too!” This shift in thinking is extremely impactful for creating a classroom environment of equity and fairness.

**DECIDING WHICH SCIENTISTS TO INCLUDE**

I have found the best way to find out what my students enjoy learning about in science is to have them complete an interest survey at the beginning of the school year (Figure 1). When instruction is linked to students’ individual interests, the likelihood that they will be motivated to continue learning about the topic is increased (Palmer, Dixon, and Archer 2016). Knowing my students’ interests helps me incorporate scientists who work in those fields. I also ask students about their future goals. I want to know if they see science in their future in any way. If so, I want to encourage their interests by choosing scientists who may act as role models for their future choices. If they do not have future goals in science, I ask the question about how they feel about science to determine if it is a lack of confidence that I may be able to improve throughout the school year.

**CONCLUSION**

The strategy in this article is designed to help elementary school teachers begin to improve female students’ interests in STEM fields. While a lifelong passion for science, technology, engineering, or math does not happen overnight, exposure to the possibilities of STEM experiences is a great
### TABLE 1

**Female STEM leaders.**

<table>
<thead>
<tr>
<th>CULTURAL BACKGROUND</th>
<th>FEMALE STEM LEADER</th>
<th>SHORT BIOGRAPHY</th>
<th>NGSS CONNECTIONS TO STUDENTS – WHO WILL THIS SCIENTIST CONNECT WITH?</th>
</tr>
</thead>
</table>
| South America / Bolivia | Kathrin Barboza | • Born in Bolivia, South America  
• She is a biologist  
• She is considered an expert in bat research!  
• Students from South America  
• Students who want to learn more about bats |
| African American | Mae Jemison | • The first African American woman in space!  
• Her father was a roofer and a carpenter and her mother was a teacher  
• Not only is she an astronaut, she’s also a medical doctor!  
• See a video and learn more about Mae Jemison here: [www.biography.com/people/mae-c-jemison-9542378](http://www.biography.com/people/mae-c-jemison-9542378) | • Female Students  
• African American Students  
• Students who want to be a doctor  
• Students who love space |
| American/ Caucasian | Maria Fadiman | • Raised in California  
• She studies plants and loves the rainforest!  
• Learn more about Maria here: [www.nationalgeographic.com/explorers-/bios/maria-fadiman/](http://www.nationalgeographic.com/explorers-/bios/maria-fadiman/) | • Female Students  
• Students who enjoy plants  
• Students interested in the rainforest |
| Taiwan | Chung-Pei Ma | • Born in Taiwan  
• She is an astrophysicist (a scientist who uses math, physics, and chemistry to understand space)  
• She plays the violin  
• She and her team discovered some of the largest known black holes!  
• Students from Asia  
• Students who play an instrument  
• Students who have interest in space, physics, or chemistry  
• Students interested in black holes |
| European/ English | Jane Goodall | • Jane Goodall studies animals, specifically chimpanzees  
• Born in London, England  
• She is known for her amazing observations of chimpanzees  
• Learn more about her work here: [www.janegoodall.org/](http://www.janegoodall.org/) | • Female Students  
• Students who love animals  
• An interest in working in the wild  
• Students who love the outdoors |
way to begin planting seeds of interest in an area some students never considered for themselves. Driven by the emphasis on equity in the classroom, using images of female scientists can provide role models students can connect to. This aligns with the NGSS principles of connecting science to student interests and experiences.

Of course, this strategy is not to discourage our male students from pursuing science, but to help all of our students see science opportunities as inclusive. For every image of a female scientist, it would be beneficial to include an image of a male scientist of the same cultural background. When highlighting scientists during my lessons, I always included a variety of male and female scientists, though I did not have a poster for every scientist. Being intentional about including both male and female scientists supports the NGSS: “Attention to factors that may motivate or fail to motivate students from particular demographic groups is important to keep in mind when designing instruction” (NGSS Lead States 2013, p. 279).

REFERENCES

**FIGURE 2**

**Science interest survey.**

<table>
<thead>
<tr>
<th>Name: ____________________________</th>
<th>Date: ________________</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rank each item below 1 – 14, with 1 being your favorite topic and 14 being your least favorite.</td>
<td></td>
</tr>
<tr>
<td>__ weather</td>
<td>__ water cycle</td>
</tr>
<tr>
<td>__ plants</td>
<td>__ human body</td>
</tr>
<tr>
<td>__ animals</td>
<td>__ life cycles</td>
</tr>
<tr>
<td>__ space</td>
<td>__ the earth (erosion/weathering)</td>
</tr>
<tr>
<td>__ rocks</td>
<td>__ ecosystems (rainforest, desert, arctic tundra)</td>
</tr>
<tr>
<td>__ states of matter</td>
<td>__ energy</td>
</tr>
<tr>
<td>__ chemistry</td>
<td>__ pollution</td>
</tr>
<tr>
<td>What do you want to be when you grow up? Why? ____________________________</td>
<td></td>
</tr>
<tr>
<td>______________________________________________________________________</td>
<td></td>
</tr>
<tr>
<td>Do you like science? Why or why not? ____________________________</td>
<td></td>
</tr>
<tr>
<td>______________________________________________________________________</td>
<td></td>
</tr>
<tr>
<td>Do you think you can be a scientist? ____________________________</td>
<td></td>
</tr>
<tr>
<td>______________________________________________________________________</td>
<td></td>
</tr>
<tr>
<td>Is there anything else you would like to share with me? ____________________</td>
<td></td>
</tr>
<tr>
<td>______________________________________________________________________</td>
<td></td>
</tr>
</tbody>
</table>

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