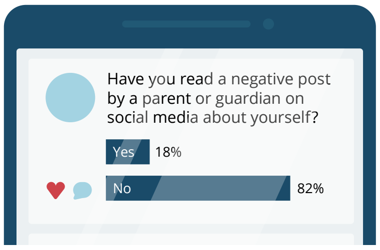
www.nsta.org
May 2019 Vol. 30 No. 9



Social Media's Mixed Impact on Educators 6

NSTA Reports

National Science Teachers Association


ERIK (HASH) HERSMAN FROM ORLANDO

Blick on Flicks: Building With What You Have 14

CONTENTS

Adding Inquiry to 'Cookbook' Labs

"I have converted several standard labs from AP Physics 1 to more engaging inquiry labs using *NGSS* [*Next Generation Science Standards*]. I want my labs to connect to my students' lives, phenomena they see and feel every day," says Jose Rivas, AP Physics 1 and engineering teacher at Lennox Math, Science, and Technology Academy in Lennox, California. "The old way [of teaching labs] was very procedural. Students had to follow steps and get a result, then answer questions at the end. It was very teacher-guided," he says.

Jose Rivas's AP Physics 1 students at Lennox Math, Science, and Technology Academy in Lennox, California, work on a rotational inertia investigation.

One lab Rivas revamped uses an Atwood machine, a physics laboratory device often used to demonstrate basic principles of dynamics and acceleration. The machine typically involves a pulley, a string, and a system of weights. "Students look at how mass affects acceleration when they find the weight of a penny using an Atwood machine…I tell [them], 'You have a penny and equipment [I provide, such as rulers and stopwatches]. You have to figure out how much this penny weighs,'" he explains. He no longer gives students instructions for doing this.

"Students set up their procedure and decide what their claim is and how to support their data. The fun part for them is they develop a setup themselves. They compare their calculations to the penny's actual weight," he relates.

"Some students find out that pennies from different years have different weights. I ask them, 'How does that affect your experimental design?' Then they troubleshoot ways to decrease errors," he reports. "It's important that students get opportunities to fail and re-evaluate their original claim. It's not about [getting] a specific result."

Students can even "use other resources besides the pulley. It gives them an opportunity to be creative. Students control the lab and can explore," Rivas observes. "We miss creativity in science and engineering. Students can still collect data and be creative."

With the *NGSS*, Rivas contends, "students are given ownership of how they approach a phenomenon…[It really works when they can] identify the properties of a phenomenon they witness every day." After identifying students who like baseball, for example, Rivas says he has those students conduct "a baseball bat analysis [in which] students develop their own claim based on what they want to analyze. How can they hit the ball on its 'sweet spot?' How does inertia affect the swing of a bat? Can a bat be made better? They come up with good ideas."

When doing inquiry labs, Rivas stresses to students, "I'm not the repository of all knowledge. We need to look at resources [for finding the answers]…[It's important to] not be afraid to say, 'I don't know.'" He tells new teachers, "You're not going to get this the first time. It's a process."

When revamping labs, Rivas says he uses the *NGSS* Appendices because they "show you what growth should be for science and engineering practices. This helps with vertical alignment." He also uses Page Keeley's Uncovering Student Ideas book series. "They have good open-ended phenomena [and] inspire me to create my own scenarios to develop good investigations for my students."

Transforming "cookie-cutter" labs to inquiry-based labs "takes a lot of time for the teacher, but it's time I want to spend," Rivas concludes.

See Adding Inquiry, pg 4

NSTA Members to Vote on New Name PG 8

COMMENTARY: **Lisa Hinkelman**

How Schools Are Failing Girls…And What We Can Do About It

By Lisa Hinkelman

Lisa Hinkelman

It has long been thought that girls are "good at school." They tend to be more compliant, follow directions, cause fewer disruptions, and earn better grades, and ultimately are often viewed as better students than boys, particularly in K–12 settings. But does this type of performance and compliance translate to postsecondary and career success?

Sometimes.

Educators' persistent mindset that girls are "good at school" has caused them to overlook some of the unique challenges girls face as they progress through school. This can result in success being defined with a narrow lens—one that does not always equate to long-term achievement outside of academics.

We know that girls are graduating from high school—and even college—at the highest rates ever. They have access to courses and careers once considered off-limits for girls; they are making tremendous strides in equal representation in law school, medical school, and many other graduate programs of study.

This doesn't sound like much of a crisis. In fact, it sounds rather promising, right?

We tend to view education as the pipeline to occupational attainment and advancement, which is where this argument fails. When we dissect the national workforce, we find staggering disparities in women's representation in positions with the highest pay, power, and prestige. Case in point, women represent fewer than 5% of Fortune 500 chief executive officers, less than 25% of our country's elected officials, and just 20% of equity partners in U.S. law firms. Even in traditionally female-dominated arenas like education, 77% of K–12 teachers across the country are women, yet represent only 23% of school superintendents.

What happens during girls' middle school, high school, and postsecondary education and continues into their careers that proliferates this stark inequity? The academic data tells us that it is not a lack of ability, aptitude, or competence holding girls back; other factors need to be examined. We know social, cultural, and historical influences tremendously impact girls' options and opportunities. But is there more to the story?

To develop a deeper understanding of the issues impacting girls' lives, the nonprofit Ruling Our Experiences (ROX) conducted *The Girls' Index* (*http://bit.ly/TheGirlsIndexReport*), one of the country's largest and most unique surveys of girls. We wanted to learn more about the interpersonal, social, and environmental factors that influence girls' behaviors and belief systems. Surveys of nearly 11,000 U.S. girls revealed that their confidence drops precipitously between fifth and ninth grade, and it doesn't return to pre–middle school levels. One in three girls stay away from leadership because they don't want others to think they are bossy, and nearly half say they are afraid to speak their mind or disagree with others because they want to be liked.

We also learned that high achievement does not insulate girls from confidence challenges. More than 30% of girls who earn a 4.0 grade point average or higher report that they do not think they are smart enough for their dream job. In our research specifically focused on girls and science, technology, engineering, and mathematics (STEM) (*http://bit.ly/GirlsAndSTEM*), we found that while girls' interest in STEM careers increased throughout middle and high school, their perception of their abilities in STEM subjects decreased as they got older.

This data shows us that we are dealing with a crisis of confidence.

If we want to create a more equitable world in which girls are well-represented in all sectors and at all levels, schools can no longer afford to focus exclusively on the academic outcomes of their female students at the expense of their social, emotional, and personal needs. Rarely do high-achieving girls receive extra attention, support services, or interpersonal enrichment in schools because we make the false assumption that their grades are the key indication of their potential. Girls need the chance to develop academic competence alongside interpersonal and academic self-efficacy. They need to have the skills, but also have a belief in their abilities so that they can actualize their full potential.

How do we do this?

First, **recognize that confidence does not come from compliments,** it comes from experiences. Girls need a safe environment to take risks, to make mistakes, and to try new things in a space protected from ridicule, embarrassment, and unhealthy competition. We can create classroom environments where exploration, inquisitiveness, and creativity are supported over judgment, perfectionism, and fear of failure. If we don't have a safe environment for new experiences, our capacity to build confidence is compromised.

Second, **implement targeted interventions** focused on building confidence so that girls' confidence in STEM does not negatively impact their interest in STEM. Girls lose confidence in themselves and their abilities in STEM subjects throughout middle school. During these years, the percentage of girls who describe themselves as confident drops 26%, and by ninth grade, 15% fewer girls believe they are good at math and science. Targeted interventions for elementary girls should focus on maintaining their confidence. For middle and high school girls, the focus should be on rebuilding and expanding their personal and academic confidence.

Finally, **recognize that exposure is not enough** to cultivate motivation and persistence. We cannot simply expose girls to STEM activities, coding camps, and robotics clubs and expect them to pursue a STEM career. While we know these activities help create interest, they do not always shift a girl's perception of her abilities in these areas. Ensure that these immersion activities are consistently coupled with the necessary interpersonal awareness activities that girls need to build their self-confidence and self-efficacy. ●

Lisa Hinkelman, Ph.D., is the founder and executive director of ROX, a national nonprofit that delivers evidence-based programming in schools with girls, conducts national research with girls, and educates adults who work with, parent, and mentor girls.

NSTA Reports

National Science Teachers Association
1840 Wilson Boulevard
Arlington, Virginia 22201-3092
703-243-7100
nstareports@nsta.org

Lynn Petrinjak .... *Managing Editor*
Debra Shapiro .... *Associate Editor*
Will Thomas, Jr. .... *Art Director*
Production Staff .... Jack Parker
Catherine Lorrain
Kenneth Roberts .. *Asst. Exec. Dir. for Periodicals*
David L. Evans .... *Executive Director*
Jason Sheldrake .... *Advertising Director*
jsheldrake@nsta.org
703-312-9273

Adding Inquiry, from pg 1

'Don't Reinvent the Wheel'

Vanessa Wentzloff's philosophy about tweaking cookbook labs is expressed in the title of the workshop she hosted at a Michigan Science Teachers Association conference: Don't Reinvent the Wheel: Creating Inquiry Experiences for Students. "Use what you already have," the Avondale High School (Auburn Hills, Michigan) physics teacher urges. "Just modify it…Start with a lab or lesson you're very experienced with, comfortable with, and passionate about."

Wentzloff offers these steps for transforming cookbook labs:

- Identify the Disciplinary Core Idea (content) and Science and Engineering Practice (skill) you wish to teach.
- Find a lab, demonstration, or activity you already use to cover this content.
- Explore how you can adjust this lab to meet your skill.
- Decide when you're going to do the inquiry experience and determine what purpose it serves.
- Adjust the purpose and guiding question based on inquiry.
- Keeping your skill in mind, determine what you want to keep from the original lab.
- Create your inquiry lab, making it as student-driven as possible.

She acknowledges that when revamping labs, "you're dealing with a mindset shift in the science department" because both new and experienced teachers can "have a learning gap, [and say,] 'We weren't taught to teach like this.'" Teachers can focus on students' interests when choosing phenomena. "The phenomenon is my favorite part of the unit because I can see what students are curious about…[You can] go off script based on students' interests or what they're curious about."

In true inquiry, Wentzloff maintains, "students have lots of questions that can be connected to other things." For her energy and momentum unit, for example, her students came up with this driving question: Is hockey more dangerous than football? "We looked at collisions in football: Why are they dangerous? [Because of] the energy or momentum transfer," she notes.

"We've been so rigid with curriculum, and now we have a chance to make it student-driven instead of teacher-driven," she says. "Look at the content piece; don't [lead] students in a certain direction…[Think] of the process instead of the right or wrong answer."

During inquiry-based experiences, "the students will figure it all out and make most of the conclusions you're about to say out loud," Wentzloff quips.

For example, she changed her circuits lab by asking students to build circuits, then make conclusions. "I didn't give them any vocabulary; they had to make inferences" and describe what they saw, she explains. "This was very challenging for students… Sometimes students won't get it right away or will see different things than what you expect. But the phenomenon should lead to questions [on the teacher's part]. 'What do I need to know to teach it?'"

If teachers think they'll have to buy a lot of new equipment and supplies to do inquiry, "that's a misconception," Wentzloff points out. "If you're already doing these things in your classroom, then just modify what you're doing and use what you have at your disposal."

Preparing for Inquiry

While modifying labs and lessons to make them more inquiry-based as a sixth-grade teacher at Woodrow Wilson Middle School in Council Bluffs, Iowa, Jessica Rosenberg—now a K–12 science curriculum specialist for the Council Bluffs Community School District—says she discovered she "had to work up to that inquiry piece" instead of immediately doing guided and open inquiry with her students. During her first year of teaching, she says she "followed the stages of inquiry in order, but this didn't work. I had to teach based on what students needed…I had to help students lead themselves a bit better, gradually prepare them to do that."

First "I would teach lab safety skills and do the lab as is," without any inquiry, she recalls. "The next time [I taught a lab], it was still more teacher-led, but somewhat student-led [so I could] push their thinking a little further. It helped them gain more confidence."

Eventually her students became ready for guided inquiry. "I gave them a scenario and a suggested list of materials or let them create a poster," Rosenberg explains.

Finally, they were able to do a lab or lesson with full inquiry because "they were more confident and willing to try different things," she reports. "I asked students to solve a problem or make something better." For example, when teaching about potential and kinetic energy, she asked students to create a bobsled track to keep athletes safe during the 2014 Winter Olympics in Sochi, Russia.

"One big misconception is that every lesson can be inquiry-based," Rosenberg points out. "If the students don't have the skills for it, you have to meet them where they're at. Do scripted labs at first, then work up to student-led labs."

Building students' levels of confidence "is so hard because this generation feels like their every move is being looked at under the microscope" due to social media, she admits. "We need to teach them a level of acceptance of failure, that they won't be outcasts [if they fail]. We need to build relationships with students and help them feel safe."

Rosenberg says she has found "it helps to have a prepared list of probing questions to ask students, to prompt them, but not give away too much of the solution, guiding them when necessary." In addition, teachers should "be flexible because students' investigations may take a different turn. Maybe a student makes a connection that you didn't anticipate. This makes the project even better," she contends.

In a unit, "not every lab has to be inquiry-based," Rosenberg maintains. She found what worked with her sixth graders was to have a driving question board featuring a topic or a debatable question. "Students posed questions on the board, and that helped keep them interested in the unit and allowed them to share ideas," she recalls. "It helped me guide the conversation and hit the standards, tie in what students wanted to know based on the standards. Full inquiry came into play a lot more at the end of the unit," although "not all students made it to full inquiry" because as sixth graders, they needed more time to develop the necessary skills, she relates.

Rosenberg determined whether students were doing full inquiry based on informal observations of "the percentage of how much I was doing versus the percentage students were doing. If students were [doing a high percentage], it was true inquiry," she concludes. ●