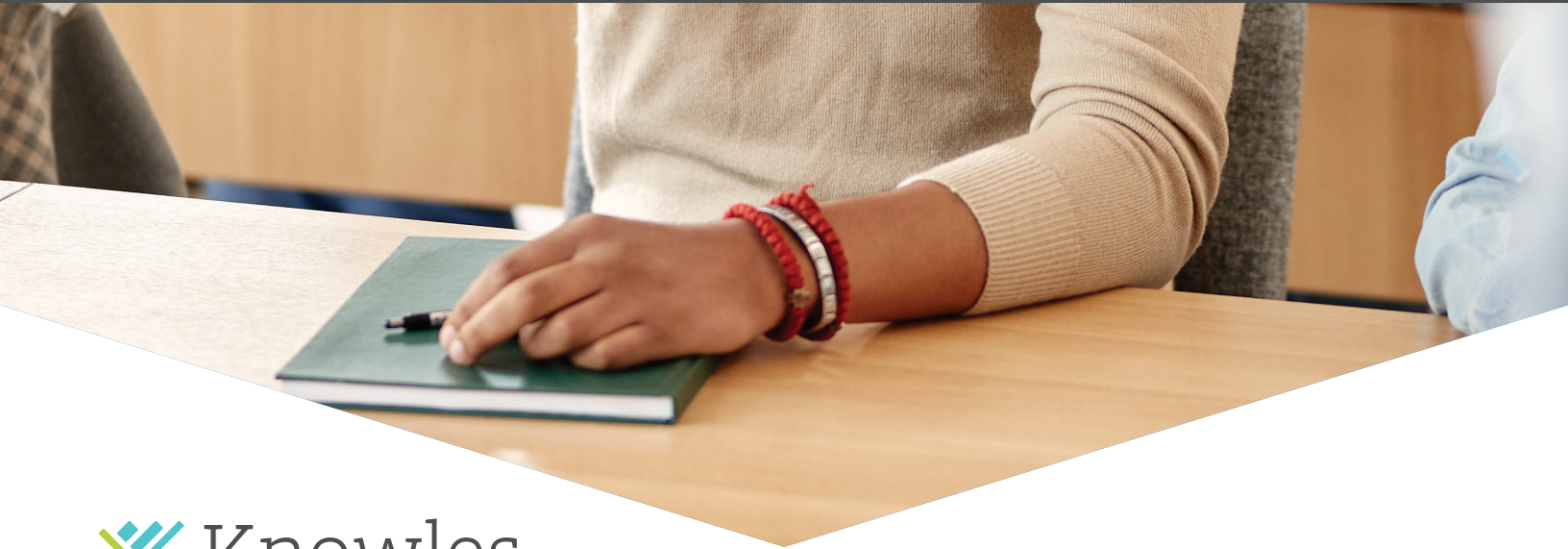




Kaleidoscope

Educator Voices and Perspectives



ABOUT KALEIDOSCOPE: EDUCATOR VOICES AND PERSPECTIVES

In December 2014, the Knowles Teacher Initiative published the inaugural issue of its new journal—*Kaleidoscope: Educator Voices and Perspectives*. Through *Kaleidoscope*, Knowles shares stories from teachers about teaching, leading and learning.

Kaleidoscope strives to provide readers and writers a public space for discourse and dialogue about the knowledge and expertise of teachers and the complexity of our profession. We believe that teachers are well-positioned to improve education in their classrooms and beyond, and we know the power that storytelling and knowledge sharing can hold in the process of transforming educational outcomes for students.

Two issues of *Kaleidoscope: Educator Voices and Perspectives* are published each academic year (Spring and Fall).

ABOUT THE KNOWLES TEACHER INITIATIVE

The Knowles Teacher Initiative is a nonprofit organization that supports a national network of mathematics and science teachers who are collaborative, innovative leaders improving education for all students in the United States. We strive to create an educational system that is led by teachers who are equipped to solve difficult problems and respond to local challenges in order to serve all of our nation's students. For more information, visit www.knowledgeteachers.org.

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KALEIDOSCOPE

EDUCATOR VOICES AND PERSPECTIVES

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The *Kaleidoscope* editorial staff accepts submissions on a rolling basis. We publish in a variety of formats, including print, podcast and video.

If you are interested in writing, or already have a piece in mind, contact **kaleidoscope@knowlesteachers.org** at any time for feedback, information, or guidance. Every submission, from idea to fully-developed piece, is assigned a peer advisor to help develop, build, and edit the piece before submission.

On our webpage, **www.knowlesteachers.org/kaleidoscope**, you can find other resources to help you develop your ideas, including

- a non-exhaustive list of the genres of stories we publish, including examples of pieces from *Kaleidoscope* and elsewhere;
- the rubric used for the final review of submissions; and
- past issues of *Kaleidoscope* to see what others have shared.

We look forward to learning your story!

Subscriptions

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Disclaimer

The opinions and beliefs expressed in the journal reflect authors' perspectives and may not represent those of the *Kaleidoscope* editorial staff or the Knowles Teacher Initiative.



From the Editors' Desk:

Our New Normal

“Back to normal” describes a return to some of our old in-person structures, but doesn’t quite capture the ways we’ve been changed by the experience of the past few years.

“We are so excited to be back to normal on campus this year!” the president cheerfully exclaims during her convocation to the students. While sitting in the back with some other staff members, I thought to myself, “Are we really back to normal?” Some of the lasting changes are obvious: we are all wearing masks in the auditorium, one of the presenters talked about budget cuts and delays in supply chains, and the whole convocation was being live streamed for those who couldn’t attend. Other changes might be more subtle at first: the University has recommitted to social justice and equity issues, there is a campus-wide reading focused on indigenous women, and an initiative to use “Just Data” as a way to change state policies. “Back to normal” describes a return to some of our old in-person structures, but doesn’t quite capture the ways we’ve been changed by the experience of the past few years. Throughout this issue of *Kaleidoscope*, our teacher-authors explore how we move forward from this difficult time. As teachers, we always knew that welcoming our students to our classroom with our curriculum and connection—but also our vulnerability, compassion, and flexibility—was important. The last year has shown us that it is even more important to see our students as whole people.

Teachers everywhere are reckoning with this new reality while also trying to guide their students. Teaching is no longer simply about regurgitating facts from a book, but how we apply the knowledge to current issues. In

“How it Went,” Jason Garver describes his plan for integrating social justice, particularly the experiences of women, people of color, and LGBTQIA scientists into the curriculum. In “Unpacking Human Migration,” David Upegui describes his set of lessons connecting biology to the current state of human migration in the world.

While teaching students, we are also using the hidden curriculum to shape their experience. In Michelle Lo’s piece, she discusses how her first year of teaching in a pandemic disrupted her views on power in the classroom and how she hopes to find a new balance. “Authentically Connecting Students’ Home Lives with the Classroom” shares John Walker’s approach to teaching each student as a whole person, accounting for all the experiences in their lives.

Some of the transition is taking place on a more personal level, as described by Sara Abeita and Jamie Melton in their article, “Vulnerability in Teacher Collaboration and Leadership.”

While we might be excited to see friends and teach in person, the world has fundamentally changed in the last two years and we cannot revert to the way things have been. Explore with the authors of *Kaleidoscope* as we all try to find our new place and our new normal.



Erin Oakley,

a Knowles Senior Fellow, enjoys engaging in mathematical thought with her students. She has had the privilege of being a teacher at a variety of schools and is now a specialist at St. Catherine University.

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Call and Response:

What we've learned
from other teachers

We know the knowledge teachers hold is unique and invaluable, so we asked Fellows and our colleagues: What have you learned from another teacher recently?

I've been drawn to social emotional learning for some time. I was both impressed and intimidated when I saw others run a socio-emotional lesson. How could I possibly do that? Last October, during the height of the pandemic, I read an article from a teacher explaining a daily check-in he does with his students. For some reason, that daily check-in was it. So last year, in Zoom at the beginning of class, I asked students to share a number from 1 (not so good) to 5 (woo hoo) to tell me how they are and include a reason if they wished. Students responded in Zoom chat—some to the whole class and others just to me. This year, since we are one-to-one with laptop/Chromebooks, I've changed the connection to a Google Form. I learn so much about the climate in my classroom from these check-ins! I can nearly instantly know when a student needs extra support and then I provide it. And once I collect the data, I have the students take a moment, with three deep breaths, to become fully present to where they are and to know that it is OK to be there. When surveying my students at the end of last year about their experience, the most frequent comment I received was how much the students liked the daily check-in.

Bob Capriles,
Kaleidoscope Writing Retreat Participant

I learned recently that there are no real answers to teaching problems; when we give a “black and white” solution to a teaching problem because it worked for us does not mean it will work at all for another teacher in a different context. If we really want to give good advice it is useful to say something more like, “Here is what I tried as a solution to my problem and here is some data showing it worked,” rather than saying, “This is the absolute solution to this particular teaching problem and all teachers should do it this way.” Even though I think I knew this somewhat already it was really good to hear another teacher say it out loud and be reminded of it, especially when we take on informal and formal leadership roles in the teaching profession.

Sharon Johnson, Knowles Senior Fellow

Recently, I learned to communicate with colleagues, other teachers, and staff at times that considered more than my own schedule and immediate needs. I accidentally learned this through interaction with different Knowles program officers between years three and five of the Fellowship. One program officer would respond to texts almost as shockingly fast as I do, while another would respond at a later time. This was

an important moment for me. It made me think: "This thought/issue can wait until another time besides 9 p.m. when I had it!" or "Just because I send a message at 6 p.m. does not mean they need to read it/see it/respond to it as fast as I would." This has helped me make notes for myself and led to the realization that my thoughts or requests for help CAN WAIT. And if they can't, I need to text a different person or realize that's my own issue. This idea has trickled on down to how to support colleagues and even how/when I respond to messages/email. I don't NEED to respond to a work text while I am out to dinner. It's OKAY! You're not a horrible person/teacher/colleague because you are busy or taking your own personal time.

Anthony Tedaldi, Knowles Senior Fellow

I always learn from what Fellows share at the Knowles Summer Conference! During Summer Conference in 2021, I learned about trauma-informed strategies for teaching about climate change. It was really interesting to hear from teachers how they are thinking about helping students understand climate science without feeling overwhelmed or hopeless, and helping them identify ways to take local action.

**Roseanne Rostock, Knowles Associate Director,
Teaching Fellows Program**

Citation

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Because it worked for us does not mean it will work at all for another teacher in a different context. If we really want to give good advice it is useful to say something more like, "Here is what I tried as a solution to my problem and here is some data showing it worked," rather than saying, "This is the absolute solution to this particular teaching problem and all teachers should do it this way."

An ongoing feature in *Kaleidoscope*, Call and Response features short responses to a writing prompt. Do you have an idea for a storytelling prompt? Contact us at kaleidoscope@knowlesteachers.org.

Vulnerability in Teacher Collaboration and Leadership

Sara Abeita & Jamie Melton



Without understanding our own reactions to feeling vulnerable and being able to stay in a vulnerable space, we cannot successfully navigate personal inquiry or collaboration with other educators.

Part 1: The Idea

As tired, hard-working, and curious teachers participating in a weekend meeting for our Knowles Teaching Fellowship, the two of us sat on the floor of an office/yoga room in New Jersey. Having taught a full week and traveled across the country to meet with our Fellowship cohort to analyze and discuss data from our classrooms, our conversation strayed away from what it was supposed to be about. We think we were supposed to be discussing something about our inquiry data—we had asked a question and collected data to learn more about our classrooms. Instead of discussing our data or using the conversation protocol we were supposed to, we talked about how nerve-wracking it was to look critically at our teaching in this way. To be in a room of other highly accomplished teachers from around the country and share data about how a lesson really flopped or how status and social hierarchies affected our classrooms was scary and vulnerable.

We had been friends since the very beginning of our Fellowship, so three years into the five year program this was by no means our first time working together. Yet we still felt nervous about sharing about our teaching, classrooms, and students. Teaching can feel

like an extension of ourselves, and being critical of our teaching feels like opening the door to being personally judged rather than professionally. Most teachers have likely experienced this: the sting from a lower-than-Exceeds-Expectations ranking on an evaluation or the anxiety you feel when inviting an outsider into your classroom. It seemed to both of us that we'd stumbled upon a pretty major roadblock to meaningfully engaging in inquiry, a foundational piece of the Fellowship. And it was one that no one had really talked about directly.

After finally saying this out loud, we laughed a bit about how both of us thought the other one was the better teacher, and it felt good to realize we weren't alone in feeling nervous about sharing our teaching practice. It was freeing to let go of all the expectations we had for ourselves, and just be real people with each other instead of "perfect teacher" people. In that moment on the yoga room floor, we recognized that being vulnerable was foundational to sharing and learning from stories about our classrooms. Without that vulnerability, we couldn't do the work we wanted to, which was to grow as teachers. We crept out of the yoga room and re-joined the rest of the meeting late with a new outlook and perspective about how to share ourselves and our teaching practice with others.

We have both reflected multiple times on this yoga room epiphany, which laid bits and pieces of the groundwork we'd do together for the rest of our time in the Fellowship. During the annual summer conference for our Fellowship, we both thought we could level-up our vulnerability practice and share our thinking about this with others. After many Zoom meetings, Google Docs, and feedback sessions, that is exactly what we



When we base our self-worth on our students' success, any critical feedback becomes personal and it damages our sense of worthiness."

did. Our presentation had the focus question: "How can understanding vulnerability, self-worth, and identity increase our ability to engage in and lead meaningful inquiry and collaboration?" Without understanding our own reactions to feeling vulnerable and being able to stay in a vulnerable space, we cannot successfully navigate personal inquiry or collaboration with other educators.

Part 2: The Stories

We centered our presentation around the idea of vulnerability, self-worth, and teacher identity in the classroom. We used Brené Brown's work in her book *Daring Greatly* to ground our ideas. In particular, we used her definitions of vulnerability and self-worth and applied those ideas to teaching. She defines vulnerability as experiencing uncertainty, risk, or emotional exposure. When we began our presentation, we asked participants to share their associations with the word "vulnerability" and how they felt when someone provided feedback on their practice. We got

Figure 1

One-Word Participant Associations with the Word Vulnerability



Note: This figure was made with *Poll Everywhere* during our presentation.

responses like: "Defensive! They don't know my class/students/context," "Who are they to judge me?" and "I'm still learning—they haven't seen me at my best" so we knew we weren't alone in our experiences around vulnerability and feedback.

Though our initial conversation about vulnerability had begun in the setting of sharing data from our classrooms, we quickly realized that vulnerability, self-worth, and teacher identity are hugely important aspects of not only being a teacher but also of collaboration and being a teacher-leader. In order to successfully navigate both individual inquiry and reflection or collaboration with other educators, we need to: (a) uncouple our self-worth from our success as teachers, (b) understand our own reactions to feeling vulnerable, and (c) learn to stay in a vulnerable space. For example, take this anecdote from Jamie's first year of teaching:

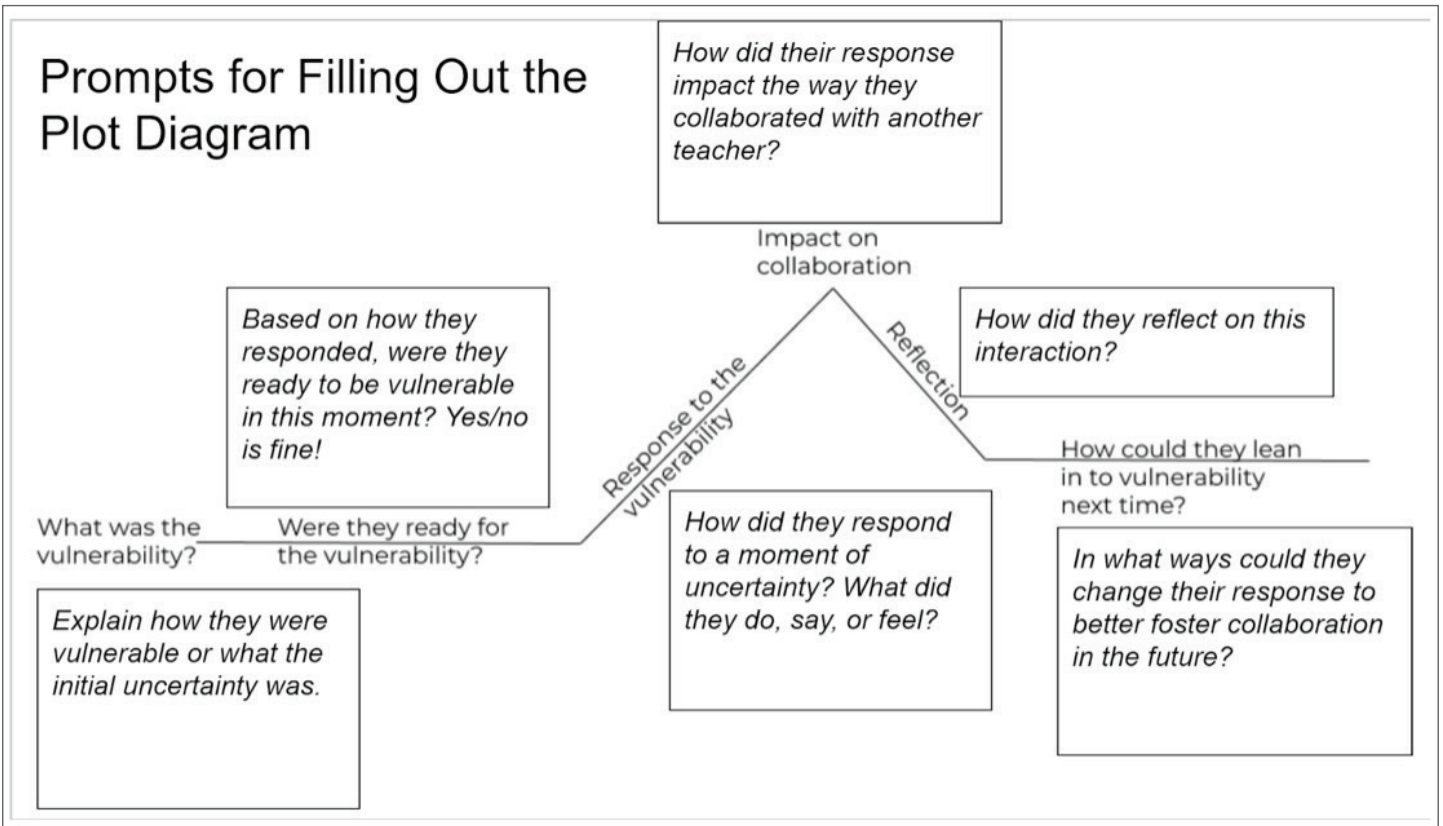
As the other chemistry teacher very kindly shared all of her materials with me, she told me that first-year teachers have a higher failure rate than more experienced teachers. She meant to tell me this as reassurance, but I, of course, responded with a polite smile and the thought, "Challenge accepted." I was petrified by the idea that my deficits as a first-year teacher would negatively impact my students. This fear made it nearly impossible to take feedback without feeling like I was failing. In order to protect myself, I unconsciously made the decision to avoid feedback as much as possible.

During our presentation, we shared this story to help illuminate the relationships between vulnerability, self-worth, and identity. According to Brown, self-worth is defined as our belief that we are all worthy of love and belonging. We feel vulnerable when our self-worth or identity is on display or up for debate. Though it would be far easier to just avoid vulnerability altogether, we cannot teach without infusing our identity into our teaching. The stories we tell, the activities we choose, even the classroom logistics we set up speak to our values as teachers and the meaningful learning experiences we had as students or learned from mentors as early-career teachers. We spend hours of time and buckets of energy trying to be good teachers and often hold ourselves to incredibly high standards.

But there is a difference between feeling vulnerable from being authentic in our classrooms and being vulnerable because our self-worth is on the line. In this particular scenario, Jamie had correlated her self-worth with her students' academic performance, and it limited her ability to reflect and grow as a teacher. When we base our self-worth on our students'

Figure 2

Analysis Template Participants Used During the Presentation



Note: This figure was created by Sara Abeita for the presentation.

success, any critical feedback becomes personal and it damages our sense of worthiness. This is different from engaging in feedback and reflection from a mindset of worthiness and growth. Receiving feedback will always be vulnerable! But by recognizing that our self-worth is not, in fact, based on our success as teachers, we can enter into that vulnerability and engage in the feedback and collaboration more easily.

After looking generally at the ideas of and relationships between vulnerability, self-worth, and identity, we then shared three stories of vulnerability with our participants and asked them to analyze the stories in a jigsaw style in breakout rooms. In the first round of the jigsaw, participants read the stories and were asked to consider how the teacher in each story reacted to feeling vulnerable in a collaborative setting. Participants then rotated into groups in which each participant had analyzed a different story. Jamie shared one of the stories, included below, for participants to analyze:

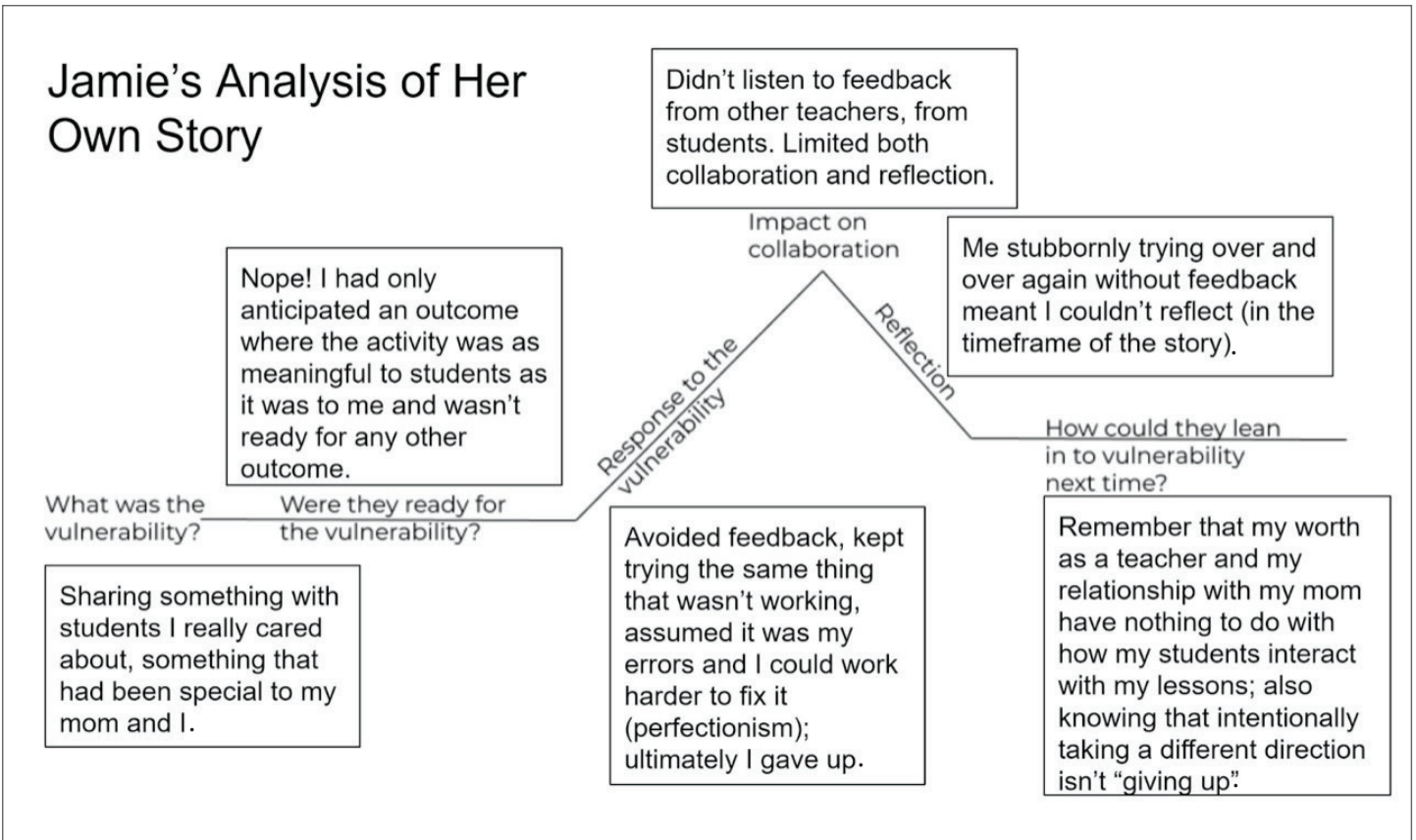
I grew up in a pretty small town with only one high school; this meant I had my mom for biology and for AP Biology! I loved this, and when I became a biology teacher I wanted to

integrate as many meaningful experiences from her classroom as I could. I started with a Socratic seminar based on Aldo Leopold's essay, "Thinking Like A Mountain." My teaching team wanted to modify it to match the Socratic seminars the English department did and to spend less time on some of the supports Mom had used. I agreed to their modifications without a lot of push-back because I felt like they had more experience than I did. The lesson went OK with my honors students but didn't seem particularly impactful, while my general students (who typically had lower reading levels) struggled. My colleagues weren't surprised and stopped using it, but I was determined to make it work. I tried it for another year, with similar results. When I moved to Utah, I tried it one more time, thinking that my student population's familiarity with hunting would help them connect to the story. Instead, students openly mocked the reading during the seminar. I was crushed by the negative responses and stopped using the essay in my classroom all together.

Our analysis tool was a plot diagram, likely familiar from your seventh-grade English class.

Figure 3

Jamie's Filled Out Version of the Analysis Template



Jamie filled out the plot diagram for her own story, which you can see in Figure 3.

Because each participant had read a different story, they could look for patterns across the stories. As we listened in on their conversations, one main pattern emerged: when confronted with a vulnerable situation, the teachers in all three stories disengaged in some way. We stepped back and allowed the opportunity for more collaboration and/or leadership slip away.

Part 3: The Defense Mechanisms and Reflection Strategies

When we came back together as a whole group, we entered into a discussion about defense mechanisms that typically show up in response to vulnerability. Often we don't realize we're using defense mechanisms in the moment—we certainly didn't while we were in the middle of living our stories! But until we can notice and become aware of our defense mechanisms, we remain locked out of the vulnerable moments that are necessary for reflection, collaboration, and leadership.

Brown lists many defense mechanisms throughout her book *Daring Greatly*, but we focused on the ones that showed up for us in our stories.

In Jamie's filled-out plot diagram, she mentioned "perfectionism" as one of her responses to struggling with her lesson. Perfectionism is the belief that we can avoid vulnerability if we just work hard enough and do everything perfectly. This defense mechanism also showed up in the other two stories, along with serpentine (the belief that we can avoid vulnerability if we are totally prepared before we begin something) and intellectualizing (avoiding vulnerability by generalizing and/or theorizing to move away from the emotions of the situation).

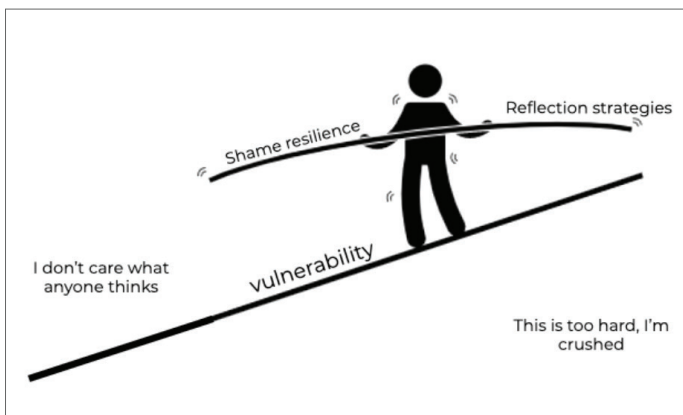
Everyone has some kind of defense mechanism, or more likely a cocktail of them, to help protect us from vulnerability. Though we mentioned three, there are lots more to explore. We know we identify with different defense mechanisms in different situations, and the more we've reflected on our own defense mechanisms the more we are able to notice and check them in order to stay in vulnerable situations, even though it's

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If we are going to walk this tightrope of vulnerability, we must toe the line between caring too much and caring too little about feedback we receive.”

Figure 4

Graphical Representation of the Tightrope Analogy



Note: This image was created by Sara Abeita for the presentation.

really hard! Brown uses a tightrope as an analogy to help explain exactly what's at stake in vulnerable situations:

The idea behind this tightrope analogy is that in order to stay engaged with vulnerable moments (walk the tightrope), we must build up our shame resilience and practice reflection strategies (balance bar). Being vulnerable with other people can be scary, and it is easy to fall off on either side of the tightrope. On one side we fall into our fear of being judged, and are consumed by the moment, taking everything personally. Taking in feedback about ourselves is uncomfortable, and it can give way to endless thoughts of self-doubt and obsession. On the other side of the tightrope is the complete opposite—building a wall around ourselves and telling the story that we don't care what others think. If you build the persona of not caring what others think, then you protect yourself from any kind of critique or possible shame. If we are going to walk this tightrope of vulnerability, we must toe the line between caring too much and caring too little about feedback we receive.

Because of both the difficulty and the importance of being able to stay “on the tightrope” (stay engaged in a vulnerable moment), we focused the rest of our presentation on the reflection strategies that act like a balance bar to help us be resilient in those vulnerable moments. This starts with becoming aware of our defense strategies and when we're using them—often they're so ingrained we don't even notice. Sometimes noticing we're using a defense strategy is the first moment we realize we've been in a vulnerable spot at all. Once we have this realization, we can respond more openly and thoughtfully.

For both of us, identifying our most common defense mechanisms allows us to take a deep breath, step back from the situation for a moment, and employ some reflection strategies that allow us to more clearly assess the vulnerable situation and make better choices about how we want to react.

To present other reflection strategies, we both shared an “update” to our story. Jamie's update explained how she utilized a community of supportive peers, including Sara, to help her notice her defense mechanisms and realize when she is in a vulnerable situation. Jamie also identified the story she was telling herself about this particular lesson, which was about how failing at this lesson was somehow failing her mom. When she could discard that story, it became much easier for her to take feedback on the lesson and realize that the decision to change it out for something else that worked better for her students, in her context, was actually a good teaching move, not a failure.

We also included several other reflection strategies in our presentation to give our participants more opportunities to find something that resonated with them. The first was checking our assumptions about other people involved in the situation. For example, it's easy to assume that a colleague doesn't want to help students succeed because they demonstrate a deficit mindset, but it's possible they just don't have any practice using an assets-based or growth mindset.

“

Embracing that you can't be perfect at anything, including vulnerability, is a big part of being a leader.”



I do not control the big systems, but I am in control of how I interact with students, and that's where I can make the most impact."

Another reflection strategy we talked about was seeking first to understand. By coming to a situation with an inquiry mindset or from a place of curiosity, we can take a step back from our own opinions and beliefs and defuse a lot of our own defensiveness. The last reflection strategy we shared was setting and communicating clear boundaries and expectations. These boundaries don't remove vulnerability, but they do create safety that allows everyone to stay in a vulnerable space more easily.

By being aware of our defense mechanisms and using reflection strategies before, during, and after vulnerable moments, we can grow our ability to stay in vulnerable spaces. This allows us to be more authentic in our own classroom, and to collaborate and lead more effectively. But like all skills, this one can be complicated and takes a lot of practice!

Part 4: Reflections and Disclaimers

All of this work comes from the goal of trying to stay in vulnerable spaces longer and more productively to enable collaboration and leadership. However, this all comes with some major caveats. Being vulnerable is uncomfortable and we need to push ourselves to stay in vulnerable moments, but there are also times where situations move from being vulnerable to being unsafe. Being observed, receiving feedback on a lesson plan or pedagogy strategy, and sharing our teaching values are all potentially powerful moments, but those moments can also become unsafe, and it's really important to recognize the difference. When critique shifts from our work to our identity or worth, when our experiences and knowledge are disregarded, or when people cross boundaries or break norms, these are unsafe situations. It is especially important to consider situations in which we or our colleagues are in unbalanced positions of power or privilege, because it becomes even easier

for vulnerable situations to become unsafe. When faced with them, we do not need to continue pressing ourselves forward in the name of vulnerability; in fact, this is why boundaries are such an important part of being able to be vulnerable in the first place.

Despite the potential pitfalls of navigating vulnerable moments, we know (and our participants agreed) that we can't expect to grow as teachers or teacher leaders without figuring out how to enter these spaces. Being vulnerable helps to build trust within our communities, which can be a powerful agent for much needed changes in our educational settings. Through building trusting and strong relationships, we open ourselves up to being more than just one person but a community of people working, growing, and enjoying our profession. It is scary to open up or invite vulnerability into our practice, but we have both found that in most cases, the reward outweighs the risk.

At the end of all of this, as we reflected together on vulnerability, we wanted to acknowledge that it is still hard. After our presentation in the summer of 2020, we didn't even look back at the feedback we asked participants to give us on our presentation for several months. After all the hard work, Google Docs, and hours on Zoom, it felt scary to see what people thought about our presentation, which was about embracing vulnerability and feedback—ironic, right? Vulnerability, trust, and growth are difficult. Even in established relationships like ours, it can be easier to avoid the vulnerability than to open ourselves up to it. But without the vulnerability that came from looking at our feedback, we couldn't grow from the experience of giving our presentation. Embracing that you can't be perfect at anything, including vulnerability, is a big part of being a leader. After finally looking at our feedback, we noticed that our participants were overwhelmingly thankful for the vulnerability that we modeled, and were excited to build their balance bars of shame resilience by identifying defense mechanisms and practicing reflection strategies.

In many cases, being vulnerable means that you have to give up some control, that sometimes as teachers we are used to having. It requires more listening than speaking, which can be difficult, especially when your own work is being critiqued. That being said, vulnerability is empowering. We are still constantly revising our own understanding of vulnerability and how it fits into our practice, but it is clear to us that growth occurs when we engage in vulnerability rather than run away from it. That growth helps us identify our own strengths and weaknesses, all while building community and trust with those around us.

From our summer presentation, we realized that our

participants wanted to continue the conversation we began, and turn the focus on themselves. We provided our own stories to lower the risk for our participation, but after modeling that, they still wanted more. They wanted to enter that space with us, which really illustrated the power of vulnerable collaboration and leadership. We are hopeful that after reading this, you too will feel

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Jamie Melton,

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BioInteractive ambassador and loves presenting to share resources with other teachers. Currently, Jamie lives in Ogden, Utah and is taking a year off to stay home with her first child. Reach Jamie via email at jamie.melton@knowlesteachers.org.

CTRL+Z: Undoing and Rethinking Power and Student Voice in the Classroom

Michelle Lo

How virtual teaching led to centering student voice and choice by sharing power.

During a precalculus class on Zoom, a student wrote to me privately in the chat, “Ms. Lo, can I have more time on the test? I can’t finish my test right now because I have to take care of my little sister. I have work later so I won’t be able to work on it until 7:00 p.m.” My stomach twisted. The first math test of the year was due 10 minutes after class. A slew of questions tumbled through my head. Could I give extensions? Would it be fair to the other students? I had been conducting classes on Zoom due to the COVID-19 school closures in California, where I teach high school mathematics. Up until this point, I had made the unintentional choice of setting deadlines for assessments and assignments. After all, this was the norm based on my own experience as a student and in other classes at my school. I had never thought deeply about the reasons why deadlines existed, much less the impact on students and their needs under different conditions and especially during an uncertain time. This was only one instance where an unintentional choice impacted my students’ experience in my class. I negotiated a deadline with the student and we came to an agreement to turn in the test by 9:00 p.m. that day.

Several days before the test, another student asked me a question I never considered before as a teacher: “Can we use notes on this test?” Realizing that the norm of “no notes” was again a choice I had made without much thought, I paused. “Yes, you can use any notes you

have.” So, open-note summative assessments became the norm across my classes. My other alternative was to resort to the honor system or continue surveillance on students—both options involved using control to take away the learning that students want to voice on assessments. Stress levels were high, and I believed allowing notes provided some relief for students juggling multiple responsibilities at home. Allowing students to use notes supported them in building upon their authentic voice when applying concepts on assessments.

Given the typical norms around taking tests, what prompted these students to ask for a time extension or to use notes on the assessment? Not only did these students initiate change surrounding test-taking norms, but they also pushed the boundaries of choices I had made unintentionally and intentionally. These two experiences led me to reflect about the choices I have as a teacher. I learned how the decisions I make as a teacher affect students’ voices and power in the classroom and came to see two different “types” of control that were available to me: one that reduces students to rule followers and one that establishes an environment where students share voice and power.

Who decides?

When I first started student-teaching, I made millions of conscious and unconscious decisions each day in the classroom. Some decisions were related to academic material, and some were related to facilitating student participation and engagement, which included how, when, why, and who participated. In the classroom, I made decisions about who to call on to answer

a question. I also decided on the types of student discourse allowed (e.g., turn-and-talks with a partner, presenting to a class, etc.) during different activities. I even decided when students were silent: during an assessment, a presentation, or silent work time. When the pandemic was underway and I started my first year of teaching, the virtual Zoom format also yielded several privileges for me and very little for the students. For example, I decided who entered my Zoom room. I decided whether students spoke by unmuting their microphones, whether students could communicate with each other privately in the chat, and whether students could share their screens or annotate the screen during a call. Although some of these were default settings, I made intentional decisions about student voice similarly as I did in the classroom. I also had the option to move a student into a waiting room with the click of a button if a student was “misbehaving.” As a second-year teacher still figuring out what exactly classroom management means, I wonder: can I re-imagine what, exactly, I am managing? Can I strive to share power and center student voice through intentional decision-making?

One way I learned to center student voice and power during my first year of teaching was in the co-creation of how to be in the classroom. Instead of providing the norms to students this past year, I co-created norms with them, which I called “Class Commitments.” This list included commitments that students agreed to commit to as well as commitments I made to them. After I shared my initial requests of commitments from students, they worked in groups to discuss the commitments they wanted from me this year, and then we shared as a whole class to collect everyone’s ideas. The day after, I organized common themes from students’ requests for commitments and created a final version to share and make “official” for students. Some examples included, “Try your best by completing all work and engaging in class as much as you can (e.g., completing Desmos, entering in the chat, unmuting to speak, etc.),” and “Honor others’ thinking by respecting each others’ questions, contributions, voice, and ideas (‘I agree/disagree because . . . ’ instead of ‘That was dumb. She already said that!’).” This shift from providing norms to co-creating norms with students was in itself a way to deepen the trust between students and myself.

By letting go and sharing some of the power in deciding how to exist and be in the classroom, I trusted my students to be themselves in a way that is also safe for others. I believe my students developed further trust in me when I relinquished some power in the classroom. However, I still retained control by compiling the final version of the list of commitments. In the future, I can further share power and voice with students by letting them finalize their compiled list of commitments. I

also hope to revisit these commitments frequently throughout the year for revision and reminders for students. Although there is room for improvement, I believe this foundation of commitments allowed students to use their voice and power in the classroom to challenge the choices made in this class, such as asking for more time on assessments or permission to use notes to improve their learning experience in my class.

While my students used their voice and power to challenge the choices I made in my class, most students likely do not even realize that they deserve to have voice and power at school, given that adult permission is required for almost everything: to speak, to use the restroom, and the list goes on. Though I didn’t realize at the time, I also experienced control as a student in the public school system. I was an obedient student, which is perhaps why I did not realize I was subjugated to methods of control: following strict school dress codes, standing neatly in line for recess, and being silent to follow a teacher’s cue, among many others. I simply believed these rules existed to maintain order among students to prepare us for the “real world.” In addition to my obliviousness towards the systems of control as a student in school, I did not realize something perhaps more crucial to my own growth as an individual: the amount of power and agency I had to challenge the spoken and unspoken rules, critique why different rules existed, and consider how these rules could be more fair. Now, as a teacher, I wonder if my students are aware of their own agency and how I can



As a second-year teacher still figuring out what exactly classroom management means, I wonder: can I reimagine what, exactly, I am managing? Can I strive to share power and center student voice through intentional decision-making?"

shed light on the possibilities. I wonder if my intentional and unintentional teaching decisions replicate these methods of control in my own classroom, taking away student power and voice.

Reflecting on the impact of my classroom decisions on student voice and power, I see two forms of control: one that constrains students and another that encourages their agency. The first type of control seeks to reduce students to rule followers, obeying the written and unwritten rules of being a student. The second type of control seeks to maintain safety and some level of direction while still making room for student freedom and voice.

Changing What I Control

As a new teacher, I felt the need to make up for my novice status by asserting my authority over my students. Earlier in the school year, I primarily lectured about the mathematical content on my shared screen, which centered and highlighted my view of the curricular content, such as going over problems using one strategy, deciding who gets to present, and deciding what parts of a strategy receive airtime. Students who followed these rules were “successful” in my eyes, thus reinforcing the first type of control.

Then I started to ask—what does it mean to shift into the second type of control and let students lead the conversations in the classroom? This might mean that norms are co-created, like previously described, such that students can advocate for a strategy to a problem that they want to discuss more, encourage others to present their thinking to the class, and share multiple approaches to a problem. I started to allow students to share their screen and even to annotate on each others’ screens. As a way of creating more classroom discourse beyond the chat and unmuting, I wanted students to get a chance to share their thinking and work with the class by means of deciding what to share. Additional students leapt at the opportunity to explain their thinking while others simultaneously annotated for their sharing partner. By allowing students to share their screen, which is a mode of expression during virtual teaching, I made space for students to share their voice.

Learning to let go and share power with students, especially when teachers are typically seen as authority figures in the classroom, is not easy for me. However, my developing beliefs as a teacher in letting go and sharing power with students have been shaped through maintaining a view of students through their assets instead of their deficits. When I view students in terms of their strengths and capabilities instead of things they lack, I feel less need to “fix” students through means of control. I cannot work towards achieving equity if I

am constantly in control over students’ voices, actions, and even ideas. Having complete control as the teacher strips students’ agency and power away from them. Early on, I used to teach with the goal of empowering students. However, this assumes that students are inherently powerless, and that teachers (with power) need to teach students how to have power. I believe that students inherently have power as human beings. Yet schooling, with its rules and structures, takes that away from students by means of the first type of control and reduces them down to rule followers. I wish to continue working towards the second type of control, where there is direction in the classroom but also room for freedom and agency for students to bring forth their own power.

Despite the hardships, this past pandemic school year was not entirely a waste—going back to “normal” is no longer an option. What can I re-imagine for the future? What aspects of my teaching are habitual and “the way things have always been” such that I am unaware of the inequities resulting from these controlling practices? I strongly believe that new strategies, actions, and practices are better supported when I can re-imagine for the future. Namely, can I re-imagine what it means for teachers to let go of aspects of control as a means of sharing control with students in their classroom? How might I continue to center student voice and agency? As evident through the examples I shared, my current classroom is not my ideal classroom yet. I am still working on ways to let go of control in order to eventually share control and power with students. In an ideal classroom, I would share power with students by implementing the second type of control mentioned earlier: control that seeks to maintain a level of safety and direction while making room for student freedom, flexibility, and voice.

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How It Went: Tackling Gender Bias and Barriers in STEM with Students

Jason Garver

Experiences integrating topics around gender bias and barriers women face in STEM into physics curriculum during the 2020–2021 school year.

What To Do During Distance Learning

Thirty-five minutes, twice a week via Google Meets that students were not strictly required to attend. That was all. Like many districts, mine had to scramble in the fall of 2020 to reinvent school and that was “class” for my students most of the 2020–2021 school year. In my context, which is a large, diverse urban school, we quickly learned that online learning presented many barriers for students as far as attending and engaging in short synchronous class sessions. Since fewer than half my students attended, I could not provide equitable access to physics content during those classes. Because of this, I shifted all instruction to asynchronous materials like readings and videos, which left all of our synchronous class time open for discussions. This left me without much to do during class, but also created a space where I would have the freedom to explore something I knew was important to both myself and students: issues related to social justice. I made the decision early on not only to provide the same 10 or so students who came to class with the chance to explore social justice topics, but all students. Many of our synchronous activities were done in a way that students could participate after the fact using different

digital tools. Students were able to share ideas in discussion posts, Flipgrid videos, and Padlet posts centered around the same materials, regardless of their attendance in synchronous sessions.

I eventually came to focus on barriers women face in STEM because I recognized that those barriers were present for my students and would be exacerbated in this online learning environment. I also knew that while many of my students faced barriers in science, that few teachers explicitly discussed the problem or solutions. Our short synchronous classes needed to feel meaningful and interesting, but I did not want to punish students who could not attend so none of these activities were attached to the students' grades. What started as a three-lesson segment turned into a half-year discussion about gender representation in science, including discussions of barriers and solutions.

Data As Motivation

It is well known that, historically, women are vastly underrepresented in STEM. According to the National Science Foundation's Science And Engineering Indicators from 2018, at best, women make up only 30% of the science and engineering workforce. Additionally, in college, women can be half as likely to complete STEM degrees as compared to men (Weeden et al., 2020). Many STEM educators, especially teachers who have been trained in the last 10 years, know that there is a point during middle school where achievement in science for U.S. girls and boys begins to diverge (Rittmayer, 2008). Girls begin taking fewer STEM classes than boys and believe they are worse

at science and math; as a result, the achievement gap in these fields starts to grow. Additionally, research has shown that girls' interest in STEM throughout high school generally declines whereas the same is not true for boys (Sadler et al., 2012).

As a newer teacher, my preparation program was still fresh in my mind. Due to the knowledge and passion of one of my professors, equity, especially around race and gender, was a large and impactful part of my training. I started my career with a sense of urgency and a commitment to tackle these issues. I did things like watching my students carefully to ensure girls were able to handle lab equipment and gave students roles and procedures to ensure equity of voice and participation in group work. I tried to structure my classes to promote equity, while including examples of successful and interesting role models in addition to our science content. Yet I never felt that these efforts were connected or robust enough to combat the systemic problem in STEM.

It is easy to look at nationwide data and say "not my school," which is a trap I fell into as I started my teaching career. My students come from many linguistic, cultural, and racial backgrounds, which in many ways helps to foster a natural community of equity within the school. I believed then, as I do now, that my students are inherently good, so I thought gender disparities in science would be less pronounced.

The claim that my students have an inherently more equitable experience in science than average because they have a strong community is a large one. Like any good scientist, I captured and analyzed my own data to compare with what I knew from research. In my first year of teaching, I analyzed average grades and pass/fail rates of my students by gender and saw in my classes the same results national research publications have

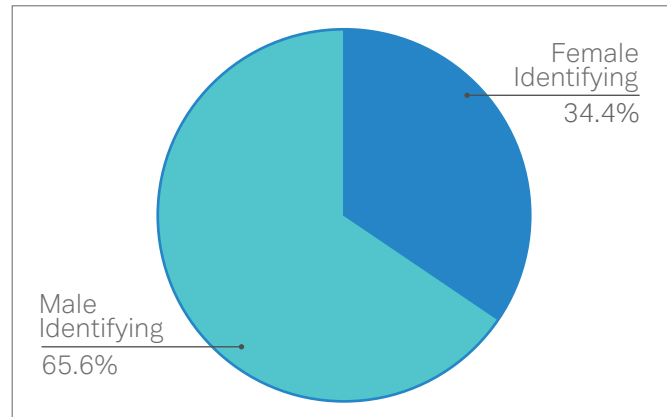


If I wanted to tackle something like gender inequity, it needed to be integrated into, not in addition to, the science content of the class."

claimed for years. Girls passed at a lower rate than boys, despite completing the same amount of work. In my second year of teaching (during the COVID-19 pandemic), I tallied the number of times students communicated during synchronous Google Meet class (speaking or typing) by their self-reported gender. Girls engaged less overall, were the first to respond to a question a smaller portion of the time, and were interrupted at a higher rate than boys (see Figure 1). Just like what we see in nationwide data, there was a gender gap in achievement for my students. My belief that my students were somehow exempt from gender barriers in STEM was frankly wrong, and that did not sit right with me. I was aware of the problem of sexism in science from a historical lens, but after seeing my own female-identifying students struggling, I decided that this was something that deserved time in my class.

Figure 1

Discussion Engagement Over 20 Class Sessions



Note: This figure displays data taken during the author's synchronous Google Meet classes in the 2020–2021 distance learning school year.

The Beginning Of My Journey

At the start of my second year of teaching, I asked my students what they cared about. They overwhelmingly responded with ideas about social justice, equity, and liberation from racism. Even as a new teacher, I was no stranger to integrating social justice into physics education. In my first year of teaching, my students explored the number of citations given for running red lights from automatic traffic cameras, which disproportionately affects inner-city, low-income communities. Using their knowledge of motion, they not only predicted more appropriate yellow light durations, but also discussed what effect this could have on communities. Through this successful series of lessons, I developed the belief that if I wanted to tackle something like gender inequity, it needed to be

integrated into, not in addition to, the science content of the class.

As I transitioned to teaching several synchronous online classes at the beginning of my second year of teaching during the COVID-19 pandemic, it occurred to me that I was not satisfied with the steps toward greater equity that I attempted previously. As a classroom community, we were not addressing equity issues outright and I was throwing in mostly unrelated “token scientists” in an attempt to show girls they are represented. Equity in STEM education is serious business, but I knew I wasn’t taking it seriously unless it was integrated into my practice.

I knew I just needed to jump in; instead of adding some discussion about women in STEM to my physics lessons, I needed to center the lessons around these equity issues. I was not quite prepared for the effect it would have on myself and my teaching practice, or how impactful it would be for students.

The Fundamental Difficulties

I want to preface my experience in integrating equity issues into the curriculum with the fact that I did not know what I was doing, though I did have some key background knowledge. I knew that girls face barriers like stereotype threat, which can have solutions, and that girls, LGBTQIA students, and students of color have more success when they see themselves represented in science. I knew that not all students believe they can do science, and that a history of oppression and systems that support oppression were the cause. I also knew that as science educators, it is ultimately up to us to change those systems and feelings about who can do science.

I started in a relatively simple way: we would learn about forces in the context of rocket science while taking a historical look at the progression of women in the National Aeronautics and Space Administration’s (NASA) astronaut program. There was just one problem, none of my teacher preparation training, or my masters of education work, truly gave me the pedagogical skills I needed. In other words I lacked the practical “how.” So I again turned to the data.

In particular, I wanted students to analyze how the number of female astronauts selected for each class in the history of NASA’s astronaut program changed over time as a way to tease out their ideas about gender inequity. The trouble was, after half an hour of searching, I could not find the numbers—at least not in a usable or easily accessible form. I spent another half an hour clicking through the NASA astronaut classes starting with Mercury 7 in 1959, all the way to today,

to tabulate the gender of the astronauts. Then the data needed to be graphed in an appropriate way for students, before I could even start any lesson planning. This process, making only the first lesson of a three-week series, took me around two hours to complete. At many points during this planning, I wondered if it was worth all the extra time and effort for something used in a single class period.

Therein lies the difficulty: integrating social justice into science curriculum takes time that teachers don’t have. It wasn’t just the first dataset: later when I looked for good videos of Sally Ride and Mae Jemison, two of the most famous female astronauts, I was at a loss. Many videos were low quality or did not include subtitles, or were otherwise structured in ways that would not be accessible to my students. Not only was it difficult to find materials, but I also found it difficult to figure out how to present material and guide student discussions in an authentic way. Quite frankly the whole process was laborious and frustrating, and took more time than any of my content planning ever has.

My Anger

There was a particular breakthrough moment for me that shifted my perspective and caused me to feel angry in a way that provided newfound purpose and energy. In addition to having students analyze data and discuss possible reasons for the shortcomings of society, I highlighted women in the history of NASA who made amazing contributions. After the frustration of developing materials subsided I felt pretty good about the direction we were heading, until I put together a lesson about Margaret Hamilton. Margaret was the director of the Software Engineering division at the Massachusetts Institute of Technology (MIT) Instrumentation Laboratory, recipient of the Presidential Medal of Freedom in 2016, and among other things is often credited with coining the term “software engineering.” As impressive as this sounds, if you search for “famous software engineer,” on Google, Margaret Hamilton is listed below many men I have never heard of.

Margaret also developed the onboard flight software for Apollo-era NASA missions. A working mother in the 1960s, she often brought her young daughter to MIT on the weekends and on one such occasion, her daughter crashed a simulator by pushing a button. Margaret wondered how the onboard computers could handle errors created by, for instance, an astronaut inadvertently bumping a switch. It was not long after NASA told her that “astronauts are trained never to make a mistake” that on the Apollo 8 mission an astronaut made the same error Margaret’s daughter had. Because of Margaret’s foresight, the error was

quickly handled and the mission continued. A change in my thinking started to occur; I stopped thinking about her as a successful female scientist and instead as the software engineer who had extraordinary foresight that allowed humans to walk on the moon in 1969, making her one of the most impressive scientists I can think of.

The fact is, Margaret Hamilton pioneered the field of software engineering and played a major role in getting humans to the moon, despite barriers she faced from society and her colleagues in male-dominated engineering. Yet unlike the other heroes of the Apollo era, Margaret is not a household name. In 1969 during the first moon landing, the craft containing Neil Armstrong and Buzz Aldrin had only 30 seconds of fuel left when the onboard computer became overloaded by errors. Their savior was a program made by Margaret that would allow the computer to relay important information to the astronauts so they could successfully land on the moon. Stories like this are all too common, where there are extraordinary people left out of the history of science. I felt angry that interviews with the first American woman in space, Sally Ride, focused on her gender and not her achievements as an astronaut and physicist. I felt angry because my students are still facing the same barriers that Sally Ride and Margaret Hamilton did and that countless other women in STEM have faced. This is the anger that motivated me to turn my “three-week segment” about gender in STEM into a focus for the rest of the school year and to continue this work even after distance learning was over.

Impostor Syndrome

Drawing on my anger and newfound motivation, I quickly shifted gears from a brief historical perspective on women in NASA, into a full focus on barriers that people face in STEM based on their gender, race, or sexuality. Instead of presenting Sally Ride or Margaret Hamilton as role models, we used their stories to identify attitudes and barriers women face in STEM. However, I wanted to connect these large scale trends to the very real barriers my students face every day. There was just one problem: me. As a cis, white, straight, English speaking male, I am not representative of my students. We know from research that when students have teachers who reflect their identity, they have better outcomes than those who don't. Therefore, I did not feel like I was the right person to do this work. I did not have specific training or lived experience with this kind of oppression and, in fact, I benefit from the systems that create the oppression in the first place.

It wasn't until I made a lesson where students would identify times they felt impostor syndrome that I realized that I felt like an impostor. I was uncomfortable making every lesson concerning gender in STEM and worried

that I would use the wrong terms or that my data or anecdotes were not exactly correct. When I wanted to have students discuss a video that talked about NASA's famous confusion with the number of tampons Sally Ride needed for a few days in space, I felt the need to ask a female coworker if it was appropriate for 11th and 12th graders. I didn't feel qualified to talk to my students about barriers women, people of color and members of the LGBTQIA community face in STEM. A mentor of mine said, “If you don't do it, how will they learn?” which is especially impactful considering I am the last science teacher many of my students will ever have. I had to do exactly what I was teaching my students to do; identify that I was feeling impostor syndrome, and use strategies to separate my feelings of inadequacy from the reality that what I was doing was better than nothing.

Bringing In The Cavalry

Something that always bothered me about providing students with representations of women in STEM was that it felt disconnected from real life and inauthentic. Sally Ride is not a figure my students grew up with, and she does not represent their local and immediate culture. Although I felt like an impostor, I knew people much more qualified than myself who could help. I asked a group of colleagues that I met during my teacher preparation program if they would be willing to share their experiences as women in STEM with my students. I didn't provide any guidelines and the resulting stories my colleagues told in their short 10-minute videos were unparalleled to anything I had used previously.

One of my colleagues told the story of how she overcame feelings that she was an impostor by leaning on her support system, after a professor in college couldn't believe that she met the requirements to be in a selective advanced biology course. Another spoke about struggling as a physics undergraduate, where she gave my students a key piece of advice: just because you struggle or fail, that does not mean you can't do science. The next was a colleague who explained how she was passionate about marine life. Her college advisor condescendingly told her she would never become a marine biologist since her grades weren't perfect and instead she should go into the more suitable field of nursing. That colleague ended up traveling around the world doing research for the National Oceanic and Atmospheric Administration and other marine biology groups, despite her advisor's words. Yet another colleague outlined the painful harassment women can face in male dominated fields like veterinary medicine, and how even a good support system might not be enough.

I was appalled at what these women, my friends, went



We learned a lot through our difficult discussions, but there was something I didn't have to teach my students: the openness to having these conversations and motivation to instigate change in themselves, the school, and the world."

through. Just like before, I was angry about these experiences that would have never happened to me but certainly could happen to my students. I also felt a strong sense of pride to know these women; not only did they do really cool science and have become exceptional secondary science teachers, but that they did so given so many challenges. This was one of the first times that I felt hope that things could change, but not without a lot of work.

Student Reactions

At this point the reader may be wondering, what did the students think about all of this, how did they engage, and how did their views change? When I initially told a few colleagues and mentors that I was planning to facilitate these discussions with students I got warnings that students might not act appropriately. After all this is not something they have a lot of experience discussing, and there was the very real possibility that students might make inappropriate comments or otherwise handle themselves in ways that could become more harmful than helpful.

When we learned about NASA's lack of spacesuits that properly fit women, many of my students were flabbergasted. They made short reaction videos on Flipgrid, where an anger similar to mine came out complete with some not totally school appropriate "expressive language." It was incomprehensible to my students that an agency like NASA postponed the first all-female spacewalk because it "didn't have enough spacesuits" when it had the resources to literally travel

all around the solar system. When we discussed the differences in questions asked during TV interviews with female scientists versus male scientists, students' jaws dropped, signified by the "astonished face" emoji that filled the chat. Students expressed on anonymous Jamboards how idiotic this discrimination is and how it's based in bias and outdated thinking.

As the initial confusion and shock faded, students' weekly written reflections illuminated much more personal feelings. Students wrote that they felt the same feelings of impostor syndrome and stereotype threat as my colleagues in the videos they watched. After discussing the inequitable use of materials in science classes, some students, who identified as male, realized they had participated in that behavior and wondered how to apologize, sort of lost in a hazy guilt. In group discussions, students started to leave space for their classmates and on more than one occasion, explicitly monitored who already spoke and who had not without my guidance. We learned a lot through our difficult discussions, but there was something I didn't have to teach my students: the openness to having these conversations and motivation to instigate change in themselves, the school, and the world.

At the end of the year, one that was marked by a terrible pandemic and the killing of George Floyd that sparked protests against racism quite literally in their backyards, my students reflected on what was most important to them. It was not my clever use of online games in teaching about electric charge and it was not my flexibility in due dates that stuck with kids. The most common answer across the board was the heartfelt appreciation for bringing issues about gender, race, and sexuality into the spotlight as we learned science. Not as an extra topic, but as part of the class.

Just The Beginning

I am not an expert in teaching social justice, or issues relating to gender in STEM. Teaching students about the barriers people face in STEM was not easy, and I was not the best person for the job. I frustratingly clicked through Wikipedia pages to tally the gender of astronauts, I made presentations about stereotype threat that I was unsure about, and I awkwardly facilitated discussions about how NASA struggled to figure out how many tampons a woman needed for a week's journey into space. I spent more time planning these lessons than the actual science content, but seeing emails from students after graduation thanking me for including this work makes it all worth it.

If all of that wasn't enough motivation to keep this going, the last day of school this past spring was. It was the beginning of June on the last class of the day

where I presented a slide I made at the last minute to introduce a few LGBTQIA scientists for the start of Pride month. A ninth-grade student stayed after class to thank me for representing what she called “her community,” because none of her other teachers had done so. That is all the motivation I need as an educator to continue to learn and bring issues around gender, race, and sexuality into my curriculum. My mentors were right that if I don’t do this, who will?

Although this all started because of the space distance learning provided, if anything I am more excited to continue this work when we’re all back fully in-person. The barriers women face are just one narrow, incomplete slice of the discrimination people face in STEM that leaves out people of color and members of the LGBTQIA community. I have plans to extend this work to include race, non-binary gender, and sexuality, and the barriers those groups face in STEM moving forward. If I learned anything teaching through the 2020–2021 year, it’s that there are many social justice issues which are important to students, and watching them struggle and talk through barriers women face in STEM has only shown me that they can tackle those issues. This coming year, we will explore climate justice and solutions, systemic racism and classism, and pandemic misinformation using physics as our vehicle. Not as additional topics, but again as important issues integrated into the science curriculum.

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Unpacking Human Migration

David Upegui

A lesson on human migration provides a way to explore how the tools of science can be used to empower students to explore social injustices.

On the morning of November 9, 2016, I found one of my students crying in the hallway. Thinking that the reason for her tears might be the election results, I asked her if Trump's victory upset her. She answered by telling me that while she was getting her morning coffee at Dunkin' Donuts, an older woman behind her grew impatient after my student made a change to her order. The older woman proceeded to shout at the student, "I'm so glad that he won! I can't wait for all you motherf**ers to get deported." At that point, my student just simply canceled her order, walked out and walked into school; she did not ask for a refund or eat breakfast that morning.

When my student arrived at school, it really hit her! She, an American-born citizen, was being told that she does not belong in our country because of her heritage. At that moment, all I could do is to comfort her, remind her that she does belong, and that society is waiting for her to develop her skills so she can take her rightful place in our world. Like this student, I felt pained and hurt—I knew I had to do more.

As science educators, it is part of our jobs to contextualize science for our students and help them develop the skills they need to improve our world. In

other words, our students need to appreciate that science is a tool of empowerment and the knowledge they gain in our classrooms is transportable into other arenas in their lives. In this way, the tools and practices of science—asking questions, analyzing and interpreting data, engaging in argument from evidence, etc., as listed in the Next Generation Science Standards (2013)—are also the tools needed to explore and change our world by addressing unjust social constructs. In particular, incidents involving hate speech and hate crimes have risen over the last few years, and I think it's important that students understand that they can use science to explore the topics underlying hate-filled actions.

After some time thinking about what had happened to the student that morning, this situation gave me an idea about a set of lessons on human migration. I wanted to utilize the tools of science to look at the current political rhetoric on human migration and its biological validity.

I began with two main driving questions: (a) why do humans migrate? and (b) what are the effects of migration? Activities would entail a student-led exploration of migration, and the resulting assessments would include a group presentation and a 500-word (or fewer) essay. I kept the essay short, similar to lab reports (really, lab abstracts) because students need to be aware that writing concisely and precisely is a powerful scientific practice. I envisioned the essay as an individual assessment and the group presentation as a collaborative grade.

The set of activities looked at the then current political climate in the U.S. and questioned if the rhetoric that had been utilized was, in fact, warranted and backed by science. Table 1 lists the sequence for each of the components of this lesson. At the end of the unit, students presented their collective group findings to the rest of the class and submitted their essays for feedback and grading.

Table 1

Components of the Lesson Series

Sequence of events:	Notes
<ul style="list-style-type: none"> Literature Review 	Topics: A. Animal Migration B. Early human migratory patterns C. Human migration into the USA D. Current political rhetoric about immigration
<ul style="list-style-type: none"> Student Discussion 	Completed in small groups of four students, each student as an expert on one of the topics.
<ul style="list-style-type: none"> Weighing the evidence and reaching individual conclusions 	Students solidified their thoughts after completing a t-chart based on the discussion.
<ul style="list-style-type: none"> Essays and presentations 	Both individual and collective grades were assigned, followed by a self-reflection grade.

All students began the assignment by priming their thinking by watching a short video like "We Are Wanderers - Carl Sagan | A Profound Speech" (RedFrost Motivation, 2017), in which Sagan reads part of his 1997 book, *The Pale Blue Dot*, "We were wanderers from the beginning . . . When the drought was prolonged, or when an unsettling chill lingered in the summer air, our group moved on—sometimes to unknown lands . . . We could always begin again" (p. 5).

There were four major topics to the literature review. The four students in the group divided the topics, each becoming an expert in their area:

- animal migration: nonhuman animal migration including migratory patterns of whales and monarch butterflies in North America, as well as wildebeests in Africa
- early human migratory patterns, namely the patterns of humans out of Africa around 65,000 years ago
- human (historical) migratory patterns into the



The tools and practices of science—asking questions, analyzing and interpreting data, engaging in argument from evidence, etc., as listed in the Next Generation Science Standards (2013)—are also the tools needed to explore and change our world by addressing unjust social constructs."

territory now comprising the United States, from those early migratory patterns of people that crossed around 20,000 years ago into what has happened over the last 500 years due to mass European migration and the enslavement of Africans, and

- recent political rhetoric about immigration made by political figures.

Resources were provided for each of the topic areas, but students were free to find additional information and use their critical thinking skills to evaluate the validity of the sources of information. Some potential sources of information are included at the end of the article in Table 2. After each expert had conducted their basic research, students met in uniform groups (e.g., all experts on animal migration) to ensure the students were able to exchange information and share their experiences before going back to meet with their mixed-topic working group.

At the beginning of the activities, some students were vocal about their uncertainty with why we were looking into political rhetoric in an AP Biology class. After some discussion, collectively we came up with the benefits of utilizing the tools and methodologies of science to explore these concepts. These benefits included the utilization of science as an exploratory and democratic endeavor, where "who said it, how loudly they said it,

and how often they repeated it” are irrelevant and all voices matter. The true currency for science is empirical evidence.

This certainly was a charged set of activities and one in which I had to carefully nurture the students in order to have productive engagement without emotional harm. Nurturing these young minds entailed conveying to the students that they were genuinely cared for individually and en masse, as their culture, emotions, and intellects were and are valued. I took students’ questions seriously through showing focus and used a tone of voice that demonstrated I valued their ideas as I addressed each group’s questions specifically. I also wrote down student questions or comments and tried to reference a student’s name when I talked about an idea that they first brought up. From the very beginning of the assignment, I set high expectations for student performance, and tried to help students feel that the knowledge gained and skills practiced would help them to have conversations about this topic with a greater sense of understanding.

During the third part of this lesson, students compared the reasons for, advantages and disadvantages, problems and solutions, and facts and opinions by using a t-chart graphic to organize their insights and record new information in a purposeful way. Once students determined the type of information that was to be recorded in each column, they added details based on prior knowledge, background information, their additional research, and student comments during class discussion.

The focus questions I planned for the group discussion included:

- “What does science actually have to say about migratory patterns of animals?”
- “What about human migratory patterns?”
- “What does history say about migration into the United States?”

This activity sequence resulted in high engagement, as evidenced by an immensely productive classroom discussion. Student contributions to the conversation addressed issues by utilizing the lenses of science with only minimal prompting from me. My students were eager to contribute and used other students’ names when they were building off a previous point. There were lots of personal stories shared about immigration, allowing students to explore their own and each other’s backgrounds. I was happy to see and hear students asking questions, analyzing and interpreting data, engaging in argument from evidence, and working with information as specified in the Next Generation Science Standards (NGSS). Even more importantly, I was glad

that students’ comments and questions, both in the class discussion and with thinking partners as they shared their notes-in-progress, showed they were considering how the skills and practices of science can play a vital role in exploring the natural and socially-constructed world in which we live.

Students’ final essays for this lesson series were full of high-quality critical analysis that blended biology knowledge with analysis of modern rhetoric (see quotes in Figure 1). The first quote is from a Black student who did not consider himself an immigrant, but whose ideas matured as he explored the topics. The second quote is from a Latina student who is the daughter of immigrants. These quotes demonstrate the type of critical analysis that was utilized by the students.

Figure 1

Samples of Student Work from Final Migration Study Essays

“Humans have always migrated, that’s how we’ve developed as the species we are today. To say that immigration is bad, is to say that our nature as a species is bad. Even so, there is still a huge debate that continues to accelerate, and probably will continue to do so as long as we have people from different backgrounds in our country. But that in itself is what makes America great and the human species great. The fact is that we need to have discussions about topics such as immigration so that the world can be a better place.”

“Since the beginning of human time, there has always been migration. Organisms move from place to place in order to better their living conditions. Humans have migrated all over the world. We first started in Africa and we began leaving Africa about 60,000–70,000 years ago (Science Insider, 2015). When migrants move, they bring a range of skills and perspectives, which nurture innovation and stimulate economic growth. For example, when humans migrated from Africa to colder climates, they figured out how to deal with their new environments. They created sophisticated weapons, which allowed them to hunt efficiently.”

Our students bring a variety of backgrounds to our classes, but the one thing that they have in common is they are all growing up in an era with potential for tremendous personal growth and power. After the activities, the students demonstrated greater

understanding of biological concepts. Namely, they were better able to describe the unity and diversity of biological life. Additionally, students had a greater sense of the reasons for migration, the migratory pattern of early humans, the homogeneity of human groups, and how environmental pressures can lead to phenotypic changes in populations over time—evolution. These themes showed up in student essays, as well as their presentations. Anecdotally, several students described how they felt more prepared to deal with people who made erroneous or incomplete claims about human migration. Lessons that cover biological patterns and then socio-political phenomena and are relevant to the students' lives, enable and encourage rich discussion as demonstrated by the many intricacies of the immigration debate.

It is important to highlight that I did not voice my opinion about political sides. I did not say that one side of the argument is right (or wrong). The data speak for themselves. In my role as a biology teacher, I try to help students understand that science is, in fact, the pursuit of knowledge; because knowledge is power, those who understand and do science have power. I planned this activity centered on argument based on evidence so that students could feel part of the larger scientific community (see NGSS science practices, 2013). We were learning applicable and meaningful science—an endeavor in which all can participate.

Lessons that address social justice are just one of the ways in which a liberating culture can be fostered in our classrooms. The kind of classroom where I want to teach is one where all members are valued and empowered. In science classrooms, the what (the content) matters as much as the how (the pedagogical practices). In front of us each day are the future problem-solvers of the world and it is up to us to enable them to recognize their great potential. We have more power than we recognize, and we are either part of the problem or the solution.

The injustices in our society did not begin with the rhetoric of a single person and these problems will certainly not go away with a different federal administration. It is important for us to recognize the insidious ways in which the terminology, tools, and symbols of patriotism were weaponized, and no longer represent the intellectual, if not the actual, history of our country. Last year, our school's girls volleyball team traveled to a suburban high school where the student body is predominantly white. As my students (many of whom had darker skin pigmentation than the all-white home team) entered the gymnasium, a group of rowdy boys started chanting the lyrics of a song which they had altered to be, "It's getting DARK in here." As the game progressed, the rowdy group of boys shouted

from the stands that my students should "go home, where you belong." The conclusion of the night was that, as the young ladies from my school boarded the bus to come home, the boys proceeded to get in their trucks. With some of them standing on the bed of the trucks waving American flags, the boys began circling the bus. The trucks made several passes before our school's bus was able to drive out of the parking lot. In arguably the most advanced country in the world, a country founded in the principles and empiricism of the Enlightenment, the young ladies from my school's team were reduced to their phenotypic characteristics and treated as unwanted human beings. The event highlights the need for discussing social justice in ways that benefit students from both schools.

As a society we MUST do, and be, better than this. We can begin by utilizing the science classroom, where evidence is valued, as a place where the tools enable us to look deeply into the natural world, as well as the socially constructed world. Darwin wrote, "If the misery of the poor be caused not by the laws of nature, but by our institutions, great is our sin" (p. 456). Let's use our classrooms as places where we can explore Darwin's question and find solutions!

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Table 2

Potential Data Sources for the Literature Review Portion of the Migration Lesson

<p>Animal migration:</p> <p>NGSS: HS-LS4-2, HS-LS4-5, HS-LS2-8.</p> <p>AP (EUs): EVO-1, SYI-3, IST-1.</p> <p>Nebel, S. (2010). Animal migration. <i>Nature Education Knowledge</i>, 3(10),77.</p> <p>Parry, W. (2010, November 4). Why do animals migrate? <i>Live Science</i>. Retrieved November 30, 2020, from https://www.livescience.com/10235-animals-migrate.html</p> <p>BBC Earth Unplugged. (2017, October 9). Epic animal migrations [Video]. YouTube. https://youtu.be/EMshFxmNQhs</p>	<p>Early human migratory patterns:</p> <p>NGSS: HS-LS4-6, HS-ESS3-1.</p> <p>AP (EUs): EVO-1, SYI-3, IST-1.</p> <p>Love, C. (2019, January 18). In their footsteps: Human migration out of Africa. <i>National Geographic</i>. Retrieved November 30, 2020, from https://www.nationalgeographic.org/article/their-footsteps-human-migration-out-africa/12th-grade/</p> <p>Gugliotta, G. (2008, July). The great human migration. <i>Smithsonian Magazine</i>. Retrieved November 30, 2020, from https://www.smithsonianmag.com/history/the-great-human-migration-13561/</p> <p>Science Insider. (2015, June 3). Map shows how humans migrated across the globe [Video]. YouTube. https://youtu.be/CJdT6QcSbQ0</p>
<p>Migration into the USA:</p> <p>Roberts, S. (2009, April 13). Who's coming to America. <i>New York Times</i>. https://archive.nytimes.com/www.nytimes.com/learning/teachers/featured_articles/20090413monday.html</p> <p>Teaching Tolerance (2011). Ten myths about immigration. <i>Learning for Justice</i>. https://www.tolerance.org/magazine/spring-2011/ten-myths-about-immigration</p> <p>Business Insider. (2016, October 19). Animated map shows history of immigration to the US [Video]. YouTube. https://www.youtube.com/watch?v=-Fe79i1mu-mc&ab_channel=BusinessInsider</p>	<p>Trump administration's immigration rhetoric:</p> <p>Arce, J. (2019, August 6). Trump's anti-immigrant rhetoric was never about legality—It was about our brown skin. <i>Time</i>. Retrieved November 30, 2020, from https://time.com/5645501/trump-anti-immigration-rhetoric-racism/</p> <p>Fritze, J. (2019, August 21). Trump used words like 'invasion' and 'killer' to discuss immigrants at rallies 500 times: USA TODAY analysis. <i>USA Today</i>. Retrieved November 30, 2020, from https://www.usatoday.com/story/news/politics/elections/2019/08/08/trump-immigrants-rhetoric-criticized-el-paso-dayton-shootings/1936742001/</p> <p>Urrea, L. (2020, November). American caudillo. <i>The Atlantic</i>. https://www.theatlantic.com/magazine/archive/2020/11/trump-american-caudillo/616467/</p>

Next Generation Science Standards Evidence Statements for Referenced Standards

HS-LS4-2. Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.

HS-LS4-5. Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

HS-LS2-8. Evaluate evidence for the role of group behavior on individual and species' chances to survive and reproduce.

HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

AP Bio Enduring Understandings:

EVO-1: Evolution is characterized by a change in the genetic makeup of a population over time and is supported by multiple lines of evidence.

SYI-3: Naturally occurring diversity among and between components within biological systems affects interactions with the environment.

IST-1: Heritable information provides for continuity of life.

Citation

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Authentically Connecting Students' Home Lives with the Classroom

John Walker



By incorporating a strategy of authentically engaging students, we can achieve a goal of creating opportunities for them to show up as their authentic selves.

When you leave work and go home, are there challenges that you are dealing with in your life? Are there aspects of your life that are less than the mythological “perfect?” Of course. Maybe your child is struggling with school, you got in a fight with your partner, or a loved one is experiencing major health challenges. Do you think about those things when you show up to work the next day? Of course. This is certainly true in my role as an educator. While it may not be at the forefront of my mind as I begin the performance of shaping young minds, it is certainly present and impacts my mood, my concentration, how I respond to students, how I engage with colleagues, and how I grade. While all of these scenarios could be their own story, it is important to note that they are all connected. Educators would be naive to think that their students do not enter our classroom with some form of challenge impacting how they show up for us. These challenges could be relationship troubles, worrying about the next meal, or dealing with parental separation, to name a few among an endless list of life's scenarios. The challenges vary in number, severity and complexity, not to mention that they can fluctuate from day to day. Regardless, they are most certainly there.

Let's examine the life of a student, as told by him years after these experiences. He moved to a new state after his parents lost the first home they ever purchased only two years into the mortgage. Financial hardship is a common cause for divorce, as was the case here, with his parents separating a few months after losing the home. While he tried to find stability in this new land, the student moved from house to house, never staying more than a year. Not only did he come from a "broken home," but also so did everyone in his extended family. That's all he knew. But they were family—so he hung out with older relatives who distracted him from the woes of his life with drugs. At that time, he was only 10. It started off light, but then quickly grew into much stronger substance abuse.

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Educators would be naive to think that their students do not enter our classroom with some form of challenge impacting how they show up for us.”

How does a fifth grader doing cocaine outside of school show up in the classroom? The student performs above average by all academic measures. But when returning to school from weekends or holiday breaks, he doesn't have anything to write about for "What traditions does your family have over the holidays?" or "What did you do over the weekend/break?" An upper elementary student doesn't just write "I took bong hits of weed laced with cocaine" in his school's writing journal or bring it up in the small group or whole class discussion. So what does he do?—Lie. He tells a story that has elements of truth: "I hung out with my cousins and friends and cracked jokes about each other." Technically, that was true—just incomplete. Should anyone have asked to know more, the story would have certainly turned to fiction.

That was fifth grade. In the years to come, he continued on this path that seemed to almost be a dichotomous relationship—doing drugs, selling drugs, and engaging in various criminal acts outside of school, all while performing at the top of his class every year. Then the anger and resentment would build up, leading to hostility inside of school. The student got in multiple fights, was suspended several times, and was denied entry to the National Honor Society because he "had an attitude problem and rejected authority" as the club advisor put it.

What this story illuminates is the varying worlds that can coexist within our students—one at school and one at home. These worlds are not completely separate, as what happens at their homes affects how they show up in the classroom. In this student's case, how could he show up to school as his full authentic self? It was not possible. The lifestyle outside of school caused challenges inside of school. How could he be open and trusting when doing so could separate him from his family and put both him and his loved ones in jail? How could he build relationships with other students or even staff members? Because he was a top academic performer, he was often tracked into classes in which the classmates were not people he associated with outside of school. How does he show up authentically in that space? In short, he doesn't.

By authentically engaging students, we help them to tackle this endeavor of showing up as their authentic selves, rather than navigating that dilemma on their own. I know that would have helped me, as the student story outlined above is my story. Had I had this particular support, maybe I could have had something to write about in my fifth-grade writing journal that wasn't incomplete. But having lived through it and since becoming an educator, this part of my identity allows me to interrogate my own practice through a different lens.

The school system isn't designed to support a dynamic such as the one I lived through. I'm not advocating that we should condone 11 year olds abusing hard drugs, but I am saying that educators can examine our own beliefs and practices around how we invite students to authentically show up in the classroom. This is important because life is very much a collection of relational experiences. These experiences do not reside in a vacuum. We can, and must, interrogate our own beliefs about why a student might present themselves a certain way inside the school building.

While every child will show up differently based on what they are experiencing at home, it is illogical to ask secondary teachers, who often have large student loads, to navigate this for every single student each day they show up to class, in addition to the already over-demanding role we play. While most teachers I know would love to be able to help all their students through such a complex task, we could not possibly do so and live healthy lives ourselves. However, we can reflect on how we invite students to show up as their authentic selves and create space to navigate those various identities that they may hold, and at times, hold in conflict.

The notion of "authentically engaging students" (a strategy) to show up as their authentic selves (the goal for students) seems vague. And it is. But that may be because there is not a one size fits all solution. Students, and people in general, are unique. So when I think about this dilemma, I think about student choice and voice—not just "What problem do you want to do first?" but "What problem matters to you? What is it you are looking to change?" and "What do you enjoy and how does that relate to the work we are doing?"

For instance, I teach multiple sections of a ninth-grade engineering class in a public community school in a large school district in California. I ask my ninth-grade engineering students, "What is a problem in your life, family, or community that you would like to see fixed?" Before students begin to design a solution, they individually brainstorm answers to this question. This is followed by sharing their ideas in their teams so they can collectively determine what is the problem they want to address. Some individuals and teams struggle to generate a list, but others have extensive lists that include everything from people barging in their room while they are trying to work or not wanting to clean their room, to forest fires or trash on their block, and even national and global issues, such as racism, poverty, unemployment, and COVID-19.

At this point, I ask a series of questions for students to reflect upon both individually and collectively. They

include “Why did your team select this challenge as the one for which you want to design a solution?” and “Is your team choosing a challenge that you think would be easy to address, or one that is important to you?” I join each group and ask them to share out some of their responses. Depending on their answers, I may push them to think more critically, think about what they would say if I wasn’t here, or simply dig deeper in their reflection. This takes many different forms. One example involved students creating a mask sanitizing station for stores. I asked them why that was important and the initial response was that they wanted to make sure their mask was sanitized and safe. I challenged them by saying it is a great idea, but is it necessary if they could just put on a fresh mask. Members of the group shared that buying additional masks can really add up when you have several people in a household and the pandemic is already impacting families financially, particularly in their neighborhood. I shared that they need to use this justification when presenting their design brief. The students’ first response was surface level, but after further questioning, they shared one that hit closer to home.

In considering my approach to challenging students’ surface-level responses, it is important to recognize how well I have developed relationships with the students at this point. If they are still not sure if they can be authentic, I might invite them to dig deeper, but then leave the group to allow them to answer those questions without me around and then I can return later. If I have a good relationship, I can press a little harder in the moment to tease out more of the reasoning behind the project choice. This little step is crucial to helping breakdown the barrier between the students’ world outside the classroom and how they show up in the classroom.

As the project progressed, students created multiple design sketches, decision matrices, 3D models and technical drawings, which finally culminated in a final presentation in which they not only shared their design solution, but also their entire learning journey both individually and collectively. The built-in reflection outlined above is implemented after each step throughout the entire project.

Students have always impressed me, but this particular project exceeded my expectations. While project implementation was far from perfect, the students still created designs that I would not have expected in a first-year engineering course. The mask sanitizing station mentioned earlier was carefully thought out with respect to how the individual pieces fit together and how the sanitizer can be refilled. A forest fire early detection sensor was beautifully designed using design techniques that we did not even cover in class, but

students chose to look up because they were invested in the project.

Students told their other teachers about the project and those teachers wanted to see their work. This led to a showcase that was shared with all staff. Most importantly, students told me how proud they were of what they accomplished. They stayed after class (on Zoom) to talk to me about their projects, and the process. They told me that they felt the work was important and it didn’t always seem like “work.” I told them that while the designs were important and I cared about the content, I was more interested in them reflecting on their journey with respect to what they took away from the project and how it was important in their lives outside of the classroom. Several students stated that is what they liked most—that I cared about what it meant beyond the academic space.

While this scenario is specific to my Intro to Engineering Design class, the approach is universal. Reflection, and more specifically, reflection that connects to students’ lives outside of the classroom, is just one strategy that creates the opportunity for students to sincerely engage with the content. However, for reflection to be an effective tool for genuine engagement, students must be shown that they can be themselves. This can be done a few ways; teachers can share examples from their own lives or even share examples from current or previous classes (excluding student names). The more “real” educators get with the students, the more “real” students will show up in the class. When this happens, students will engage with the teacher and the class, even if they don’t like the content. I have had multiple students who say “I hate engineering, but I love your class.” While I can’t say for certain, I believe it is the opportunity to be authentic that they enjoy. How they move through the world outside of our classroom becomes the same as how they show up inside our classroom.

Creating opportunities for students to explore the complex identities that they hold and the things that matter to them most is a starting point. This helps invite authenticity into the academic aspect of the classroom, but it also comes down to not policing behavior. If we want them to truly engage we can’t get upset, reprimand, etc. when they actually do. So while I may not be able to offer a catch-all solution, I hope that this allows us to question what we do in hopes that we do find a solution that fits our context. We, as educators, must ask ourselves, “What is it that we ‘deem acceptable’? Do we actually allow students to show up authentically or do we punish them for doing so? Do we, ourselves, show up authentically, or do we put on a front of professionalism?” Let’s choose authenticity.

Citation

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