



Kaleidoscope

Educator Voices and Perspectives



Transforming Mathematics & Science Education

FALL 2020 / VOLUME 7, ISSUE 1

Prologue

During these unprecedented times, sharing our stories is more important than ever.

When we began collecting articles for the issue you're reading, the very first cases of COVID-19 were being reported in our country. Now, as we publish our latest issue of *Kaleidoscope* and American students go back to school "mask-to-mask," on a hybrid schedule, and/or online only, our nation is powerfully reminded of the crucial and undervalued role that teachers are playing in making things safe for students in so many ways.

We at *Kaleidoscope* are deeply grateful to our community for writing and sharing your stories, as well as for reading and listening to the stories of others. Through our work, we have learned, without question, that stories are how we show up for each other. They're how we celebrate, interrogate and honor the strengths, identities and experiences of our world's beautiful plurality. They're how we hold each other accountable. And they're how we learn, together, to build opportunities that dismantle systems of oppression.

Our nation's systems of schooling have a unique opportunity in this moment to listen to teachers and to value our knowledge. We're thankful to the authors whose stories are featured in this issue and our readers, because we know that telling and hearing stories connects us to each other and allows us to continue—and even to innovate—in the face of enormous challenges.



Becky Van Tassell, a Knowles Senior Fellow, is an editor-in-chief of Kaleidoscope. Reach Becky at rebecca.vantassell@knowlesteachers.org.



Kirstin Milks, a Knowles Senior Fellow, is an editor-in-chief at Kaleidoscope. Reach Kirstin at kirstin.milks@knowlesteachers.org.

KALEIDOSCOPE

EDUCATOR VOICES AND PERSPECTIVES

***Kaleidoscope* Editorial Staff**

RICK BARLOW
Associate Editor

BRITTANY FRANCKOWIAK
Associate Editor

ANGELA LOU
Associate Editor

KIRSTIN MILKS
Editor-in-Chief

BEVERLY STUCKWISCH
Associate Editor

REBECCA VAN TASSELL
Editor-in-Chief

Program Staff Support

LINDA ABRAMS
*Program Officer,
Teacher Development*

Call For Submissions

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

Print and digital subscriptions of *Kaleidoscope* are available at **<https://knowlesteachers.org/subscribe>**; digital subscriptions are complimentary while print subscriptions are available for purchase. If you are a member of the Knowles Teacher Initiative community, please let us know when you contact us, so we can ensure that your subscription is properly processed.

In This Issue

From the Editors' Desk: Remembering Harry Knowles 1

Kaleidoscope Editorial Staff

Call and Response: The Impact of Knowles 3

Now on Teacher Voice: Changing Careers, Part Two 8

Rick Barlow and Kirstin Milks, Producers

Now on Teacher Voice: Affinity Groups 9

Brittany Franckowiak, Producer

Why I Love Story Tables 10

Shira Helft

The Impact of Stealing Conflict 15

Somaly Prak-Martins

Collective Action: A View from the 2019 Chicago Teachers' Union Strike 19

Heidi Park

We've All Got Homework To Do 22

Kit Golan

Transformative Professional Development Through Integrated STEM 25

Percy Canales and Katey Shirey

Teacher's Lounge: So You Think You Can Publish 31

Briana Clarke

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:

Remembering Harry Knowles

The *Kaleidoscope* editors reflect on the impacts of Harry's work with the Knowles Teacher Initiative.

C. Harry Knowles, who passed recently, leaves behind a tremendous legacy: the work of the Knowles Teacher Initiative and hundreds of novice math and science teachers well-equipped and well-supported to teach America's children.

Harry (as we all knew and addressed him) became wildly successful through engineering and invention. The hand-held barcode scanner? That's him. When he turned his mind to philanthropy, Harry recognized that his successes could be attributed to his high school math and science teachers. Until the very end of his life, Harry devoted his energy and considerable resources to facilitating the support and development of early-career teachers and empowering experienced education professionals to build programming and make decisions about the best way to realize his vision.

Harry had a specific vision for improving math and science education, and because he trusted in the professional knowledge of teachers and the Knowles staff, the organization has been able to grow from that original vision into something that exceeded his expectations.

Not all philanthropists are able to operate their foundations that way. And, in education, trusting the capacity and knowledge of trained professionals is exceedingly rare. That stance is surely what has made the Knowles Teacher Initiative so successful in striving towards its mission. Harry was a learner, through and

through, and was thrilled with the work of *Kaleidoscope* as we celebrated and showcased the learning of teachers.

We, in turn, are thrilled to bring the stories in this issue to you. From a math educator in California whose classroom positions students as experts, to a trans teacher in New York who illuminates the parallels between the importance of coming out to his students and his efforts to use anti-racist practices in his classroom, to an educator whose identity as a refugee changes how she sees conflict in schools, we hear stories from unique perspectives that enrich and widen our understanding of schools, students, and the ways that teachers are uniquely positioned to change things for the better.

Kaleidoscope is part of Harry's legacy—our mission to elevate teachers as knowledge generators carries on Harry's vision for positioning teachers as agents of change in education.

Even when we delved into teachers' stories that explored educational issues beyond teaching math

“

Harry recognized the complexity of the teaching profession and noted the 'depth of both thinking and dedication' present in our teachers' stories.”

and science, Harry remained our fervent supporter. He would email us after the release of every issue with his thoughts, encouragement, and excited responses to our work.

Harry recognized the complexity of the teaching profession and noted the “depth of both thinking and dedication” present in our teachers’ stories. And he celebrated with us, as we hope you will, the showcasing of “why we are doing what we are doing...and what Knowles is all about.”

Citation

Kaleidoscope Editorial Staff. (2020). From the editors' desk: Remembering Harry Knowles. *Kaleidoscope: Educator Voices and Perspectives*, 7(1), 1–2.





Call and Response:

The Impact of Knowles

We asked teachers in the Knowles community to reply to this prompt: “C. Harry Knowles, founder of the Knowles Teacher Initiative, passed away recently at 91. How has being a Knowles Fellow impacted your teaching or career?” Here are their responses.

I am incredibly grateful for the support, both professional and personal, that I've received as a Knowles Fellow. The opportunity to receive professional development and fellowship as a new teacher instilled in me a deep sense of hope about the potential impact my practice can have on individual students as well as society as a whole. I credit Knowles immensely for the joy I find in teaching today. Looking back on my first few years, and recognizing how I experienced pivotal moments and overwhelming challenges as a classroom teacher, has me feeling grateful to have been part of the 2014 Cohort of Knowles Teaching Fellows. Teaching is hard, and the Knowles Fellowship gave me the tools to reflect on and take meaningful action in the way I teach students science.

Brenda Minjares, Senior Fellow

Being a Knowles Fellow has impacted my teaching career because it has created a community of driven, passionate, and ambitious science and math teachers from whom I can learn and grow, and also with whom I can share my struggles and successes!

Emily Berman, 2015 Teaching Fellow

Being a Knowles Fellow has significantly impacted my teaching career in more ways than I can count. One of the most pressing is how the Knowles Fellowship, through Harry's and others' generosity, has shown teachers that we are valued as professionals. Too many educational professional development experiences happen at the expense of the teacher, or aren't in a comfortable setting, or aren't really beneficial to a teacher's professional development. As a Knowles Fellow, I've been reminded that teachers are professionals. We are worth the time and money. Through Knowles, I have participated in professional development in comfort (physically and financially), and in turn, I have been pushed to think outside of my comfort zone (educationally). I have learned that teachers can truly thrive together when they are shown that their profession is valued.

Kellie Stilson, 2016 Teaching Fellow

The first few years of teaching can be extremely isolating. In my first job, I was the only person at my school teaching my classes, didn't have a planning partner, and had no set curriculum. That kind of freedom can be nice, but as a new teacher it can also be intensely overwhelming! The Knowles Fellowship gave me a network of teachers that I could not only get ideas from, but with whom I could be vulnerable. The



I have learned that teachers can truly thrive together when they are shown that their profession is valued."

ability to meet and talk with teachers outside of my context was invaluable. The financial support allowed me to do and learn things that would have otherwise not been possible. I am the teacher I am today in a very large part due to this Fellowship.

Beverly Stuckwisch, Senior Fellow

The Knowles Fellowship has been the most impactful experience of my teaching career. From project-based learning to student-centered classroom discussions, the professional development provided by Knowles directly and the outside professional development Knowles funded has allowed me to make major shifts in my pedagogy. The most valuable piece of the Knowles Fellowship has been the community—I know I can always find a critical friend to help me work through an idea or push me further.

Shannon Morey, 2015 Teaching Fellow

It is hard to put into words how much the Knowles Fellowship has affected me. The knowledge I've gained through Knowles meetings has helped me grow more in five years than I could have imagined. As much as I thought it wouldn't be possible my first year, I feel confident in my classroom and as a teacher leader, having an overflowing toolbox filled with opportunities afforded to me through Knowles.

Kylie Bertram, 2015 Teaching Fellow

I can say, hands down, that I would have left education long ago if it weren't for the Knowles Teacher Initiative. The support and opportunities to connect with other educators provide me with the perspective and resources I need to foster the grit required to stay in teaching. Anyone who knows this job well knows it takes more than just commitment. Knowles helps me connect with the "why" I teach, which in turn energizes me to stay in the classroom.

Kelly Melendez Loaiza, Senior Fellow

It was through Knowles that I first started leading workshops and speaking to large groups. Through those experiences, I realized that I have something of value to share with the world. It made me feel like I had something to contribute. It was this disposition that helped lead me to politics, and now I'm the mayor of Montpelier, Vermont, running unopposed for re-election in March 2020. The community I developed through Knowles has been a family and a source of confidence for me that has been important in helping me get to where I am now.

Anne Watson, Senior Fellow

This is just the tip of an iceberg of impact that Knowles has had on my life. Knowles has:

- Taught me the power of collaboration
- Connected me with a community of talented educators
- Given me the financial freedom to choose job opportunities and summer positions that align with my teaching goals and passions
- Taught me what it means to be treated like a professional
- Taught me to be a critical friend and consumer
- Modeled how to not just talk the talk, but walk the walk
- Helped me to understand my privilege and learn how to teach in more equitable ways

Madison Park, Senior Fellow

The professional learning experiences and networks I've been part of as a Knowles Fellow have changed my life in so many ways. I am now an instructional coach, and I credit that to my experiences with high quality professional development as a Knowles Fellow and classroom teacher (including developing the ability to reflect on my instruction and learn and grow through my own classroom inquiry) and my involvement in the



Knowles has and always will reinforce in me the belief that true educational change comes about through supporting and building up our teachers."

Knowles Coaching Network as a Senior Fellow. Knowles provided me with the chance to be a Knowles Academy instructor and push myself to lead professional learning experiences. Knowles helped me develop into a teacher leader and inspired me to also pursue certification in school leadership to make a positive difference in education. Knowles has and always will reinforce in me the belief that true educational change comes about through supporting and building up our teachers.

Kristin Mongelli, Senior Fellow

Being a Knowles Fellow has been one of the most valuable experiences of my teaching career. I was exposed to a variety of teaching techniques, empowered through teacher inquiry, and trained to be a leader in my school and beyond. Above all though, it's the community of teachers, educators, mentors, and friends that has impacted me the most. I'm constantly inspired, humbled, consoled, motivated, and pushed by Knowles Fellows and staff. They've picked me up after a tough day in the classroom, celebrated when I had a breakthrough with a student, and helped me define why I am a teacher. They are the reason I am still in this profession. I am forever grateful to the late Harry Knowles for the opportunity to be a member of such an incredible community of professionals.

Kate Miller, Senior Fellow

One of the biggest fears I've heard and witnessed about the teaching profession is being "alone on teacher island": having to create curricular materials by yourself, fight daily struggles with your own self-doubt, and problem-solve everything on your own. I would not be as excited and confident to battle these everyday issues had I not been a member of the Knowles community. Knowles has been the family I needed during such a crucial time in my teaching career—the beginning! Being a Knowles Fellow provided support that I might not habitually get in my place of teaching and I am so grateful. I would not be the teacher that I am today had it not been for the thoughtful community provided by Knowles.

Anthony Tedaldi, 2016 Teaching Fellow

To say I can't imagine where I'd be in life without the Knowles Fellowship would be an understatement. Through the support of the Knowles community, so carefully crafted by the staff and supported by the generosity of Harry and others, I continue to believe that science and math education are fields worthy of investment. The Knowles Fellowship was, and continues

to be, a constant reminder that educators are valuable and that we must continue to support excellence in teachers and schools. STEM education is a lifelong passion of mine, and the Knowles Fellowship fuels this forever-flame.

Carlee Madis, Senior Fellow

My career as a teacher would not have survived without the support of Harry Knowles and the Knowles Teacher Initiative! In my second year of teaching, I received a Knowles Fellowship that allowed me to finish my teaching credential and help me to transform from a teacher that just liked his job into one that was passionate about improving my students' lives through learning about physics and engineering. I am currently in my 17th year of teaching and still going strong. Thank you, Harry!

Charley Sabatier, Senior Fellow

While it's hard to predict what would have happened if I hadn't received the Knowles Teaching Fellowship back in 2009, I think it's likely that I might not still be a classroom teacher today. Being a Knowles Fellow has impacted me in many ways that boosted my morale, skills, and motivation—often at just the right moment when I needed support to keep moving forward. In the first few years of the Fellowship, Knowles provided a close knit community of peers and mentors who could empathise with my struggles, and share in the joys of being a new teacher. Together we discovered and swam in the vast sea of questions that we could ask in order to improve our practice. Even at this early stage in our careers, we were treated like professionals with something to contribute to the profession. We had deep discussions about science that, while not



Through the support of the Knowles community, so carefully crafted by the staff and supported by the generosity of Harry and others, I continue to believe that science and math education are fields worthy of investment."

always 100% germane to our teaching, still made us feel connected to and passionate about the subjects we taught. With support and advice from veteran teachers, we collaborated to design lessons based on best practices that also honored creativity and playfulness. (I'm thinking of a particular lesson that involved Brittany Spears and Justin Bieber lost in a cave, trying to figure out how to use some basic circuit elements to light their way out.)

Later in the Knowles Fellowship, I was encouraged to start thinking of myself as a teacher leader in ways that validated my current role in the classroom and pushed me to explore the impact I could have outside the classroom as well. The questions we started to ask ourselves in years four and five centered on how we could connect with other educators in our building, district, or region to improve the experiences and outcomes for all students who walked through our doors. In particular, I remember investigating the support systems for students with special needs at a new school I had just joined. What I found was that there were many colleagues I could collaborate with to help my struggling students, as well as many systemic obstacles that the school still needed to address—and I felt empowered to be a part of that process.

Now, as a Senior Fellow, I am in charge of my own professional development and the degree to which it involves Knowles. I've chosen to continue participating in the Knowles community through my work with the Engineering Leadership Team. As a result, I get to stay connected to an amazing group of peers who continue to sustain me, both personally and professionally. On my own, I never would have considered leading a summer workshop for teachers about engineering design back in 2015, when I was essentially in my sixth year of teaching. However, collaborating with this group of Senior Fellows to create the workshop gave me confidence to try out this new role. We had a collective vision of what good professional development should look like, based on our experiences in the Fellowship. I also had plenty of practice positioning myself as a learner, and seeing that this makes for a more effective facilitator than someone who considers themselves to be an expert. As we've revised and refined our workshop and resources, I've learned a ton about myself as a teacher, and the trajectory I ultimately want my career to take.

I applaud Harry for recognizing that teachers (no matter what their level of experience) can and should be leaders and change-makers in their profession. It's had a profound effect on me, my colleagues, and my students.

Lindsay Wells, Senior Fellow



I applaud Harry for recognizing that teachers (no matter what their level of experience) can and should be leaders and change-makers in their profession."

Being a Knowles Fellow has magnified the impact I can have on my students by growing my teaching practice. Moreover, I feel part of a greater, national movement of teachers committed to both professionalizing and strengthening the STEM teaching profession.

Hai Tran, Senior Fellow

Being a Knowles Fellow has provided me with a steady reminder that teaching is important and my contributions to this work matter. Knowing that a person like Harry Knowles and the outstanding educators and staff of the Knowles community believe in me has given me confidence to take risks and try new things in my classroom. With Knowles I always knew that I could ask questions without judgement, that I could offer ideas without risk of ridicule or just being ignored. Knowles gave me a professional community where I felt valued, seen, and heard. And that has made all the difference in the world.

Christopher Anderson, Senior Fellow

Finding my voice in education and the classroom: this is what the Knowles community has done for me. Teaching these past 16 years, I have found myself redefining what it means to be a teacher of science and more importantly a teacher of high school students. The experiences I have had as a member of the Knowles community have pushed me and helped sustain me as a teacher. It has given me the opportunity to think about teaching in ways that many of my colleagues have not been able to experience, regardless of years of experience. Knowles has empowered me to lead from the classroom and to be a strong voice in bringing educational opportunities to each student that I teach. The experiences and philosophies that I have been fortunate to experience and construct through the Knowles mission have impacted my work and interactions with teachers

and students beyond the Knowles community. The Knowles Teacher Initiative has truly kept me in the classroom and helped me to keep that fire going, which for many teachers without this experience, I have seen extinguished. It has kept my flame burning brightly and will keep it burning for years to come.

Kevin Henson, Senior Fellow

I honestly don't know where I'd be without the Knowles organization and community. I can't even say for certain that I'd have managed to stick it out in the classroom for nine years and counting.

Harry, thank you for everything. For the grants that provided modeling materials, field experiences, National Board Certification, technology and equipment for my classroom, professional development workshops, graduate courses, attendance at professional conferences, summer stipends, and the amazing staff of the Knowles Teacher Initiative.

I, my students, and my school community are indebted to Harry's generosity and vision. May we all strive for such a far-reaching legacy, and may we all be granted such a peaceful end to a long, full life. We will miss you, Harry. Summer Conference will never be the same.

Brittany Franckowiak, Senior Fellow



Knowles gave me a professional community where I felt valued, seen, and heard. And that has made all the difference in the world."

Citation

Minjares, B., Berman, E., Stilson, K., Stuckwisch, B., Morey, S., Bertram, K., Melendez Loaiza, K., Watson, A., Park, M., Mongelli, K., Miller, K., Tedaldi, A., Madis, C., Sabatier, C., Wells, L., Tran, H., Anderson, C., Henson, K., & Franckowiak, B. (2020). Call and response: The impact of Knowles. *Kaleidoscope: Educator Voices and Perspectives*, 7(1), 3–7.

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.



Now on Teacher Voice

Changing Careers, Part Two

In this episode of **Teacher Voice: The Podcast**, we revisit stories from teachers who have come to teaching from another profession. Hear how the experiences they had in their previous professions inform what they prioritize in their teaching today.

*"I had two options: go traditional, or go with what I think would be helpful for my students."
- Valentina Bumbu*

In this episode of *Teacher Voice*, hosts Kirstin Milks and Rick Barlow, both career changers, revisit their conversations with other teachers who have also joined the teaching profession after another career.

What emerges in these conversations is how these teachers emphasize professional skills, like taking initiative to ask for resources that you need or valuing failure as part of the learning process, because those are the very things that were either missing in their professional worlds or skills they wished they had developed earlier in life. Listen in to hear how these teachers are really grappling with what is best and most important for students to take with them from their classrooms.

*"I think a lot of things that happened could have been avoided in terms of the perks that I've experienced or the pain, if I had failed earlier, but I went to school with a teacher that just told me I was amazing all the time."
- Diarra Gueye*

To hear more about these teachers' journeys to the classroom, listen to the podcast on our website.

Digital Media Citation

Milks, K., & Barlow, R. (Producers). (2020, February). *Teacher voice: Changing careers, Part two* [Audio podcast]. Retrieved from www.knowledgeteachers.org/kaleidoscope.

Music Attribution

"Curious" by Jean Luc Hefferman is licensed under **CC-BY-NC 4.0**

Listen to *Teacher Voice: The Podcast* at knowledgeteachers.org/kaleidoscope.



Now on Teacher Voice

Affinity Groups

In this episode of **Teacher Voice: The Podcast**, we learn about affinity groups from educators in the Knowles community and how their participation has impacted them.

"I think it's [acknowledging] that there are varying points of view, varying identities, varying experiences within [an] organization—and then an opportunity to value what comes out of each of those groups in a way that's not under the layer of the power dynamics of larger organizational conversation."

- Swetha Narasimhan

Members of the Knowles professional community have been engaged in various affinity groups as a tool to address inequality and problems of representation and access within our own community. In this episode, we talk with many members of the Knowles community about the benefits of affinity groups for creating opportunities for conversation about how our identities impact our work together.

We also hear about some of the challenges of affinity groups, like how we translate our learning from our affinity group experiences into meaningful changes to the structures and practices of our community.

Just having affinity groups won't solve problems of racism and marginalization in organizations. But we learn that these groups can help members see these issues as a system. We hear about the power of a space with shared understanding around our identity and how that empowers and validates individuals in their experiences.

To hear more about the Knowles community's experiences with affinity groups, listen to the podcast on our website.

Digital Media Citation

Franckowiak, B. (Producer). (2020, February). *Teacher voice: Affinity groups* [Audio podcast]. Retrieved from www.knowledgeteachers.org/kaleidoscope.

Music Attribution

"Curious" by Jean Luc Hefferman is licensed under **CC-BY-NC 4.0**

Listen to *Teacher Voice: The Podcast* at knowledgeteachers.org/kaleidoscope.

Why I Love Story Tables

Shira Helft

"I'm good at math. You can ask Ms. Helft."

If you've met me at a conference, or on the Internet, or maybe even in passing on the street, I have probably talked your ear off about story tables. Why do I love story tables so much?

One part has to do with learning the language of algebra. I believe that fluency with algebraic symbols is one key to the "math clubhouse;" it separates those people who perceive they "can do math" from those who

believe they "can't." Activist Bob Moses of the Algebra Project takes it a step further calling fluency in algebra "the gatekeeper for citizenship" (Moses and Cobb, 2001, p. 14).

Six years ago, my colleague and I were brainstorming a way to support students to develop this kind of fluency. We had the idea to stretch out the traditional x-y table so there was one column for each step between x and y. These would eventually be called *story tables* because they helped students see the story of numbers as they transform from inputs to outputs.

Three years later, this same idea would cause me to stain the back of a student's pre-calculus honors placement test with tears of joy.

"I'm good at math," he wrote.

Here is one example of a story table next to a more traditional X-Y table. If you'd like, take a minute to see what you notice and wonder about the story table.

X-Y Table	
x	$-5(x+3)^2+20$
-5	0
-4	15
-3	20
-2	15
-1	0

Story Table				
x	x+3	$(x+3)^2$	$-5(x+3)^2$	$-5(x+3)^2+20$
-5	-2	4	-20	0
-4	-1	1	-5	15
-3	0	0	0	20
-2	1	1	-5	15
-1	2	4	-20	0

Ariel¹, a student in my Algebra 1 class last year, noticed that the headings of the tables are helpful to understand the meaning of each symbol. For example, the -5 in $-5(x+3)^2+20$, which sometimes looks like multiplication and sometimes looks like subtraction, represents multiplying all of the values by -5.

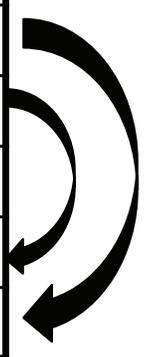
	$+3$ 	$()^2$ 	$\cdot -5$ 	$+20$
x	x+3	$(x+3)^2$	$-5(x+3)^2$	$-5(x+3)^2+20$
-5	-2	4	-20	0
-4	-1	1	-5	15
-3	0	0	0	20
-2	1	1	-5	15
-1	2	4	-20	0

At the beginning of Algebra 1, Ariel had told me that math felt like an “alien language.” By the end of the year, her questions like “Does the dash in $y=6-(x+3)^2$ mean a multiplying by -1?” pushed the entire class to deeper understanding.

“I’m good at math,” he wrote.

Andre noticed that there is a whole lot of symmetry in the story table of a parabola like this one.

x	x+3	$(x+3)^2$	$-5(x+3)^2$	$-5(x+3)^2+20$
-5	-2	4	-20	0
-4	-1	1	-5	15
-3	0	0	0	20
-2	1	1	-5	15
-1	2	4	-20	0



¹All student names are pseudonyms.

Andre was a student who always wanted to share his ideas, but whose ideas weren't always respected by the rest of the class. One day, he pointed out that the symmetry starts in the third column: " $(-2)^2 = 4$ and $2^2 = 4$, so all the numbers after are the same."

Our class called Andre's realization the "Dre-ainbow." We used the Dre-ainbow to make sure we were using the best inputs for our tables of parabolas and to help find key features, like the vertex and x-intercepts.

"I'm good at math," he wrote.

Daniela noticed that the middle row of some story tables have a whole string of 0s in the center. She connected this row with the highest point, or vertex, of a parabola.

x	x+3	(x+3)²	-5(x+3)²	-5(x+3)²+20
-5	-2	4	-20	0
-4	-1	1	-5	15
-3	0	0	0	20
-2	1	1	-5	15
-1	2	4	-20	0

We called this "Daniela's Rule" and used it to help us identify the vertex directly from an equation. Before this, Daniela had convinced herself that she could never do math because learning differences made keeping many different steps in her head a challenge. After this, she was more willing to share her ideas with her partners and the class.

"I'm good at math," he wrote.

Hector realized that you could extend Daniela's strategy to model equations of parabolas if you know the vertex and another point.

x	x+3	(x+3)²	??(x+3)²	??(x+3)²+20
-3	0	0	0	20
-1	2	4	-20	0

Diagram illustrating the construction of the table above. Arrows show the operations: $+3$ from x to $x+3$, $()^2$ from $x+3$ to $(x+3)^2$, $??$ from $(x+3)^2$ to $??(x+3)^2$, and $+20$ from $??(x+3)^2$ to $??(x+3)^2+20$. A box highlights the row for $x = -1$.

Hector started by putting the vertex into the first and last column of the table with zeros in the middle: "If you know those, then you can figure out the addition or subtraction parts of the equation. In order to figure out the 'multiply number' you need one more point." In this case, If you use $(-1,0)$ as a second point, the only way to get from 4 to -20 by multiplying is to use the number -5 .

I gasped out loud when I realized that you could extend Hector's strategy to find the equation of a line through two points using a story table.

"I'm good at math," he wrote.

Kaya saw that sometimes the x-intercepts appeared in the table and sometimes they did not. However, you could always find the x-intercepts by putting zero at the end and working backwards to find the input.

x	x+3	(x+3)²	-5(x+3)²	-5(x+3)²+20
-5	-2	4	-20	0
-4	-1	1	-5	15
-3	0	0	0	20
-2	1	1	-5	15
-1	2	4	-20	0

Mei used Kaya's strategy to teach half our class how to solve the most complex equations on a challenging quiz.

"I'm good at math," he wrote.

I taught Matthew both Geometry and Algebra 2. If I had a dime for every time he said that math wasn't for him, I'd—well, you know the end of that quote. He ended up earning a D in Geometry and needed to repeat the class.

Some time in mid-November of Algebra 2, things changed. We were studying transformations of functions using story tables. I asked Matthew to write his idea on the board.

x	x+3	(x+3)²	-5(x+3)²	-5(x+3)²+20
-3	0	0	0	20



Story tables have opened doors to switch the narrative about who is capable of deep and useful knowledge in math and have helped to unlock the deep mathematical creativity my students have always been capable of using."

Matthew didn't need to draw the whole story table at all. He realized that you could learn a lot about a story table just by looking at the headings and the critical point. This strategy was useful because it meant that we could focus on the most important point of the graph, making it easier to quickly understand how a function behaves. It was more than that, though. Matthew took a tool we had always used a certain way (by choosing the best five inputs) and questioned the assumptions of how it could or should be used.

We called the one-row method "Matthew's Rule," which proved to be exceptionally handy as we sketched and discussed key features of functions like cubics, square roots and cube roots.

Five months later, I blubbered onto the back of his pre-calculus honors placement exam.

"I'm good at math," Matthew had written.

So why do I love story tables?

Story tables have opened doors to switch the narrative about who is capable of deep and useful knowledge in math and have helped to unlock the deep mathematical creativity my students have always been capable of using.

On her first day of school, Mei told me that learning math in another country made it really hard for her to understand math taught here; she said she always mixed up the symbols. With story tables, she ended up positioned in our class as an expert on solving equations. Ariel, Andre, Daniela, Hector, Kaya, Mei, Matthew and

others used story tables to create brilliant strategies for procedures I otherwise would have presented to students. As students authored the rules, we credited them and used their ideas to push our own understanding. These students (and their ideas) were elevated in a way that society does not typically elevate people of particular races, genders, classes, and neurotypes. Some of them even rewrote their own stories about who they are as mathematicians and as learners.

I can't tell you that story tables fix it all. Teaching is far too complex and rich for one tool to help every student understand every concept deeply and flexibly. There are situations for which story tables are cumbersome; for example, equations with more than one instance of x , like $3(x+5)(x-7)$, can be difficult to parse. In the wrong context, story tables can become just another procedure. Furthermore, story tables don't directly counter any of the parts of society that can make learning in schools an unsafe place.

What I can say is that story tables are one tool my students and I use to honor and appreciate the beauty and brilliance of mathematics and the beauty and brilliance of each other.

"I'm good at math," he wrote.

My students always had been.

Reference

Moses, R. P., & Cobb, C. E. (2001). *Radical equations: Math literacy and civil rights*. Boston: Beacon Press.

Citation

Helft, S. (2020). Why I love story tables. *Kaleidoscope: Educator Voices and Perspectives*, 7(1), 10–14.



Shira Helft,

a Knowles Senior Fellow, loves puzzles of all kinds. This led to her infatuation with math and math learning; she is fascinated by the ways people think through ideas and how this affects their identity and

power in society. Shira has been fortunate enough to learn as a teacher, coach, curriculum lead, and professional development coordinator at schools in the Bay Area. She now is a lesson developer at Desmos, whose mission is for all students to love math and love learning math. In her spare time, Shira grows her brain with cryptic crosswords, puzzle hunts, and chasing the best dumplings in the Bay Area. Reach Shira on Twitter @MsHelft or by email at shira.helft@knowlesteachers.org.

The Impact of Stealing Conflict

Somaly Prak-Martins



What is the impact of a system that constantly steals conflict? And why should systems of accountability reconsider this approach?

As a person who has been in multiple roles in education (i.e., learner¹, parent, teacher, administrator, district administrator, and now school designer), I have experienced, observed, and felt frustrated with the negative impact of the traditional, punitive accountability system.

When I was in kindergarten, I asked my teacher if I could use the restroom. I wasn't fluent in English, because it was my second language. I don't remember how assertive I was, but I remember the teacher telling me "No, you have to wait." Well, if I was anything like my own five-year-old, I probably didn't ask until I had to go. Maybe I even waited to the point of dancing around. I waited in my seat

¹In the current education system, "student" is used to describe the person who should be learning and "teacher" is used to describe the person with all of the information. It insinuates a one-way flow of information, as well as a hierarchy in terms of knowledge and status. This is against my philosophy because everyone, including adults, should enter all interactions with a learner's stance. Therefore, I deliberately use the term "learner" in this piece because learning should be a reciprocal process amongst all who are involved. We need to change the narrative around who the "learner" should be, particularly in situations involving stolen conflict.

but could not hold the urine. I vividly remember sitting there as it dripped from the seat onto the floor. I was sitting in a pool of urine as the other learners around me laughed. My teacher, upset, began to ask, "Why did you do that?" Learners were now staring at me. The laughter grew louder and fingers began to point. The teacher told me to go to the nurse. As I left the room dripping in urine, I was ashamed. When I walked by her on the way out, my teacher handed me a sheet (written in English) and told me to give it to the nurse.

I arrived at the nurse crying and wet. She told me to wait in the corner on a chair. My mom arrived, walked towards me and grabbed my hands and said in Khmer, "I don't have time for this. Mommy has to work and you don't want me to get fired, do you?" As we were walking out, the nurse handed her the note from my teacher. Neither my mom nor I could read it.

We were a Cambodian family who recently fled our country because of genocide. After relocating to three states in three years, we finally settled in Providence. This was during the industrial boom. My mother got a job making \$3 an hour and was proud of it. Both my parents worked and refused to go on welfare. They were determined to take this second chance and not waste the opportunity to earn a living. They were thankful to the "Americans" because we were safe and did not worry about landmines, grenades, and being executed at any moment. As a child, I was to be thankful and always do what my teacher told me to do.

Adult-ism is a cultural anchor for Cambodians. In a Khmer household, there is no talking back to an adult, especially ones with authority, and the teacher had both

factors playing in her favor. My parents never spoke about or questioned the teacher, the system, and/or the policies that forced a five-year-old to urinate on herself.

Over three decades later, this traumatic experience still haunts me. I felt guilty and ashamed about what I did. I caused an inconvenience for my mother and my teacher. My peers shamed me and I was also shamed by the teacher and again by my mother. I was dismissed and silenced. This conflict impacted me negatively and deeply. For years, I would have anxiety attacks when meeting with supervisors or people I deemed “authority” figures. I never questioned authority because I felt unworthy and insignificant.

Looking at my experience from my current vantage point as a parent, administrator, and school designer, I recognize that the people who were impacted the most were robbed of learning opportunities. In schools where traditional systems of accountability are enforced, discipline codes are designed to meet the needs of the dominant school culture efficiently. Those in power are encouraged and empowered to “steal conflict” from those directly involved. When conflicts are stolen, the act of seeking “justice” is passive, oppressive, and creates a false sense of accountability rather than repairing harm and healing relationships.

When the conflict was stolen, I was robbed of an opportunity to develop and practice agency; hold someone accountable; and develop solutions that work for me, the classroom and the collective community. My mother was robbed of the opportunity to express how this incident could have a financial impact on our family and also to hear how her words negatively impacted me. The teacher was robbed of the opportunity to develop and practice active listening skills, culturally responsive teaching, empathy, ownership and solutions that were respectful of the biological and cultural needs of her learners. My peers never heard how their behavior impacted another learner in their community.

Another impact of the traditional “discipline” system is that learners develop feelings of being unworthy. As an administrator, I would get calls from teachers to remove learners from their classrooms. Some calls were about extreme behaviors, while others were about behaviors that could have been redirected at the classroom level. Many educators had trouble productively de-escalating conflicts and used the disciplinary structures in place to end these conflicts, reinforcing the power of the dominant culture, and removing agency from learners involved in the conflict.

One particular story comes to mind. It was 20 minutes into the period right after lunch. A teacher called me for support about a behavioral concern involving vulgar



When the conflict was stolen, I was robbed of an opportunity to develop and practice agency, hold someone accountable, and develop solutions that work for me, the classroom and the collective community."

language and “insubordination.” When I entered the classroom, the teacher was standing in front of a desk, loudly saying to a learner, “You just came from lunch. You cannot eat in this class. If you were that hungry, you would have eaten earlier in the lunchroom.” The learner continued to eat her food but said nothing to the teacher.

I asked the teacher to step out of the classroom and with the door still open and me standing with a view of the entire class, I asked him to recount the incident. The teacher, agitated, raised his voice as he was telling the story. “She always does this! She never listens! She is so disrespectful! I refuse to teach if she stays in this room! I don’t care where she goes, but she needs to leave!” I realized the teacher needed time to de-escalate himself. I walked over to the young lady and quietly asked her to leave with me. She asked “Why?” and said, “I need to stay! I did nothing wrong!” I replied, “I would love to hear your perspective on this incident, but I don’t think it would be helpful to have this discussion in front of all your peers. Mr. X seems upset; it may be best to give him time and space to reset himself and use this time for you and me to talk about what happened.” The learner responded “Okay,” picked up her bags from the floor, and walked out of the class.

As we walked to the office, she said, “It doesn’t matter, they don’t listen to us! They just yell and then call you to take us away and then act like nothing happened the next day. So, what is the point?” When we got back to my office, the learner and I processed the incident and agreed that she had to go back to the classroom and not eat in the room or demonstrate a behavior against the school norms. I also circled back to the teacher



I was a new administrator, but soon realized I was perpetuating the behavior that I—a minority genocide survivor—set out to fight against."

and spoke to him about the outcome of the situation. However, I never took the time to address his behavior or allow the learner to communicate her perspective on the incident. The protocols for addressing teachers with these types of concerns required the Human Resource Department's approval and a lot of documentation and time. I felt I barely had time to deal with learner discipline referrals, never mind redirecting adult behavior.

After a few months as an administrator, I reflected and gained insight from processing my own behaviors as a person with authority. I realized that a learner's self-perception of their own worth in the eyes of our school's teachers, the administration, and the discipline system was mostly negative. I was a new administrator, but soon realized I was perpetuating the behavior that I—a minority genocide survivor—set out to fight against. This discipline system I was charged to deliver oppressed the student eating in class and many other learners. The protocols, established by the dominant culture, did not allow her (and many other learners) a voice and/or agency to change the behaviors of those who negatively impacted her. I began to wonder: what is the impact on learners when feeling unworthy becomes the norm?

When conflict occurs in a traditional work or school setting, the authority figure typically interjects by dominating the conversation and determining what the "consequences" should be and how the punitive decisions are carried out. In most cases, the protocols and consequences have already been established (by the dominant culture) and written in a school or company conduct code. These systems favor those in power and oppress those who are deemed "subordinates." Most often, the offenders and victims are not included in creating a solution, inadvertently becoming passively engaged. The opportunity to learn how to navigate conflict by seeking

understanding and changing unproductive behaviors is stolen by those in power. Feelings of disrespect and shame remain unaddressed. The perpetrators of the behaviors that negatively impact the community are not held accountable by those directly impacted, therefore creating a false sense of accountability.

As a learner, teacher, manager, administrator, parent, and district leader, I have been a victim, complicit ally, co-conspirator, and perpetrator of these systems. Unfortunately, the learning that needs to occur most has been stolen from and by me when productively navigating conflict failed to happen. So I encourage leaders, educators, parents, family members, and learners from all walks of life who are trying to cultivate an inclusive and collaborative environment to reflect on your system and behaviors.

SOME QUESTIONS TO CONSIDER WHEN REFLECTING:

- *Identify a conflict that has been stolen from you.*
 - ▶ *What happened?*
 - ▶ *Who stole the conflict?*
 - ▶ *Who else was involved?*
 - ▶ *If given the opportunity, what would you have done differently?*
- *What is your ideology when it comes to conflict?*
- *Does your accountability system (e.g., home, school, classroom, etc.) steal conflict?*
- *Is your accountability system impacting your learners the way you intended it to?*
- *Does your system align with your mission or the mission of your organization?*

Citation

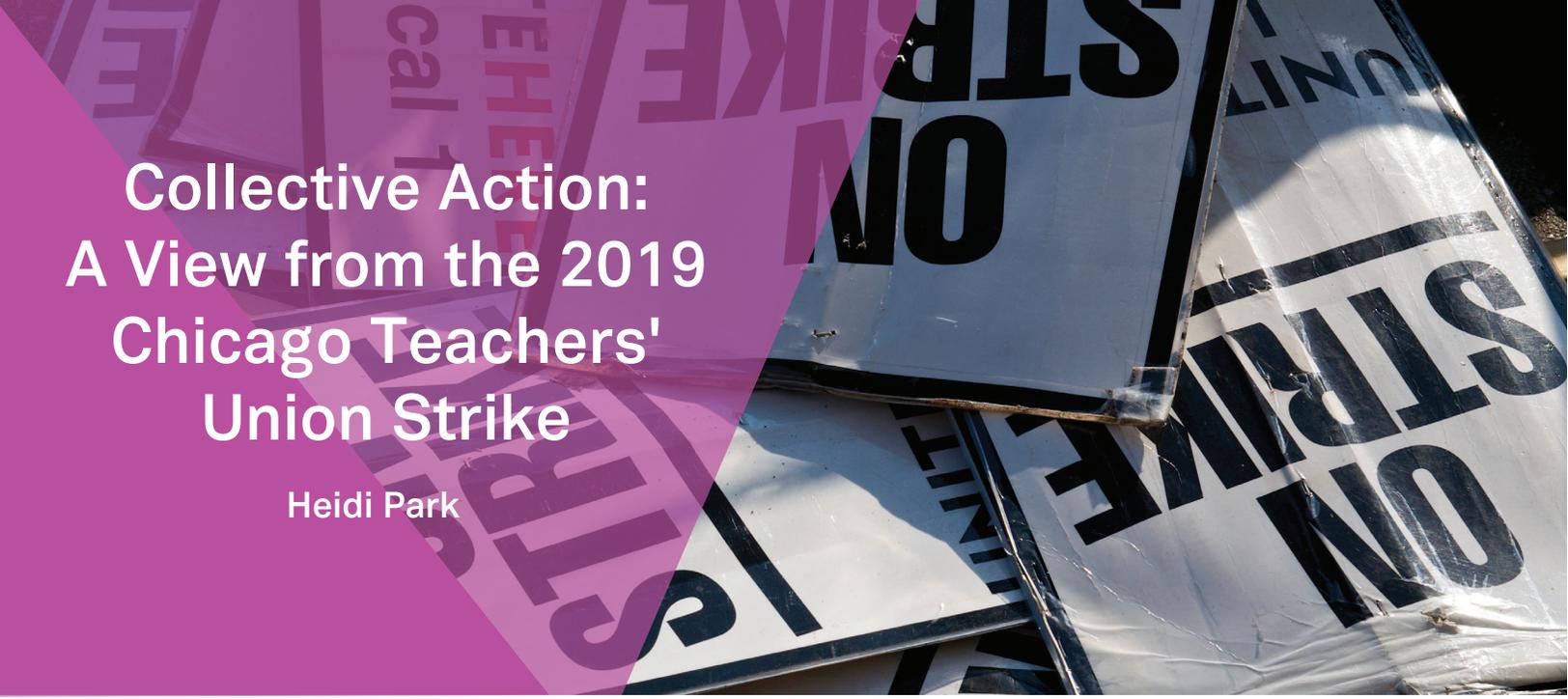
Prak-Martins, S. (2020). The impact of stealing conflict. *Kaleidoscope: Educator Voices and Perspectives*, 7(1), 15–18.



Somaly Prak-Martins

is a refugee and survivor of the Khmer Rouge Genocides. Having lost everything, obtaining an education was a non-negotiable in her household. Because Somaly believes TRUE freedom can only be

obtained through freeing the mind, she is relentless with helping all learners UNLEASH their full potential through education. Somaly is unapologetic about supporting learners in building capacity to develop the audacity to forge productive change. Reach Somaly on Twitter @2Thrive1 or at somaly@2thrive.org.



Collective Action: A View from the 2019 Chicago Teachers' Union Strike

Heidi Park

Going on strike as a Chicago teacher.

I appreciated Matthew Sakow's (2019) candid reflections on his attitude towards strikes and unions in his piece "From 'Strikes to 'Collective Action': Reflections on a Changing Mindset." I didn't start out as anti-union, but for most of my life I've felt ambivalent towards unions in general. Although I was student teaching during the 2012 Chicago Teachers' Strike (the first one since 1987), I have to confess I didn't pay that much attention to it. Some of that was from a self-preservation standpoint: a lot of vitriol gets thrown out during a strike, and I didn't want to process how some of the public viewed teachers just before I jumped into a new profession. I recognize that privilege of being able to step back from the issues.

Although we came close to a strike in 2016, a midnight agreement prevented it, and we all breathed a sigh of relief. Even though workers' strikes are at their highest since the mid-1980s, I think it's hard to see the value in a union and collective action until you actually need it. And this fall, I found myself right in the thick of things.

I'm in my seventh year of teaching, and as I write this, Chicago just went through its second teachers' strike since 2012. This time, we were out for a total of 11 school days, and being on strike at the end of October was certainly no picnic. I empathize with Matt's experience when a barista told him how nice it would be to have a long weekend, when he knew the opposite was certainly

true. Some of my friends and family asked how my "vacation" was going, and it was all I could do to not roll my eyes.

As I anticipated, the strike was not a vacation; it was exhausting. The experience of striking was physically draining, as the union asked us to be on the picket lines in front of our schools from 6:30–10:30 a.m. most days, and also often organized rallies and marches in the afternoon. In a union with nearly 30,000 members, I could have slipped under the radar and skipped out, but a sense of solidarity and a belief in what we were fighting for brought me out to the picket line every day and to as many other events as I could physically handle. The big bargaining team was at the table reviewing all of the proposals and counter-proposals; it was our job as the rank-and-file members of the union to provide a visual to the rest of the city about the cause for which we were fighting.

The strike was also emotionally and mentally draining, as we heard (sometimes directly, sometimes through social media) all of the negative views that the general public has of teachers. Some of our union members had fliers dropped on them at a downtown march that said things like "We want teachers, not SJW [social justice warriors]!" and "Work 12 months!"; others were spit upon from the office buildings we were marching around, and everyone heard people saying things like "Go back to work!" and "Stop being so lazy." Putting aside these misrepresentations of teaching as a profession, it was infuriating that we had to walk off the job and march in the streets to convince the powers that be in the city that our students deserve basic support services.

Our strike focused on increasing support staffing in our schools (e.g., nurses, social workers, and librarians) and making class sizes manageable, not increasing teacher salaries. The city highlighted major salary increases in their initial proposal, but a lot of misconceptions were circulated—the media continuously reported that with this new contract, the average teacher would be making \$100,000 in five years, but that figure ignores the reality of teacher turnover. We were painted as being greedy for demanding increased support for our schools and communities in addition to fair compensation, and a common sentiment I saw on social media was along the lines of, “If it’s for the kids, then give up your raise!” But as a union, we felt like it shouldn’t be an “either/or” in terms of salary versus student support.

This strike made it apparent to me how little the general public knows about what goes on in schools, particularly in schools that are different from the ones that they attended. The general public, who had a lot of opinions about us and whether we should accept the district’s initial proposal, didn’t know that many of the approximately 500 schools in Chicago currently don’t have a nurse every day, nor a full-time social worker or a librarian (or in many cases, even a library). Those without school-age children are unaware that some of our kindergarten classes have nearly 40 students. The constant budget cuts and lack of enforceable protections mean that our students have borne the brunt of the city’s economic hardships.

The school where I work manages to weather the chaos that happens in Chicago. We are a selective enrollment school, where the majority of our students test in, and our students come from all over the city. In the 2015–2016 budget crisis, our “Friends of”



This strike made it apparent to me how little the general public knows about what goes on in schools, particularly in schools that are different from the ones that they attended."

parent group was able to raise over \$250,000 in the matter of a few weeks to cover our budget shortfall. And yet, as a special education parent posted on Twitter, “Many at schools on the northside don’t fully understand how under resourced schools on the south and west sides are. Just because your ‘Friends of’ can fund-raise to meet budget gaps doesn’t mean this strike isn’t important for your kiddos too. We need equity in CPS schools now” (Chicago SpedPac, 2019). Many of my colleagues shared that understanding: we weren’t on strike for our students and our school per se, but for all of the students in the city of Chicago and for our future students as they come up to high school.

As we moved closer towards a tentative agreement, the general feeling from teachers on social media was that our wins were not enough. We did convince the district to commit funds to hire more social workers, nurses, and other support staff for English language learners and students in temporary living situations, among others. However, the class size caps are still large; for example, more than 28 students for kindergarten is considered “overcrowded,” but an automatic appeal doesn’t trigger until the roster is above 32. Librarians had been left out of the previous contract, and while we pushed to include librarian staffing levels in this new contract, they were again left by the wayside. From 2012–2019, we went from 454 district librarians to 108 because there hasn’t been any contract language guaranteeing schools librarians. What will happen to these numbers by 2023? The district also absolutely refused to budge on prep time for elementary school teachers, who only get 60 minutes a day with several “principal directed” preps every week, which means they may not have time to actually prepare their classes on some days.

As we wrapped up Day 10 of this strike, there was a sense of weariness. My school colleagues acknowledged that many of the outstanding issues (e.g., the still-large class size caps and the lack of prep time for elementary school teachers) affected elementary school teachers more than us, so we were willing to continue the strike if that’s what our elementary school colleagues wanted. But there wasn’t a clear way forward, and we had to acknowledge that these outstanding issues would be extremely expensive to address. So, at the end of October, the House of Delegates, which is made up of each school’s union delegates, moved to suspend the strike, and the Tentative Agreement was then ratified by our overall membership and approved by the city’s Board of Education in November.

Both the union and the city have claimed this new

contract as a win. And overall, it is a win for our students. By 2023, there should be a social worker and nurse staffed in every school. There are increased supports for English language learners, students in temporary living situations, special education, and sports. But there's still a lot to fix. And I can't deny that the strike cost teachers, staff, and students. We missed 11 school days, and the mayor agreed to only five make-up days, meaning teachers and staff are going without six days worth of pay this school year. Additionally, because the make-up days couldn't be scheduled immediately, we lost 11 days of pay in the short term. The Service Employees International Union (SEIU) Local 73, which represents many of our aides, security guards, and other service staff, walked out with us, and I know they had more to lose financially. Some of our students missed out on key sporting events, and some of our fall sports teams were out of the state tournament because of the timing of the strike. Our juniors missed the PSAT, and our seniors stressed about early college applications since we came back to school on November 1. All of this sacrifice was so we could start on a path toward equity in education in Chicago.

I don't regret going on strike because I saw that collective action works. As Matt says, "acting collectively, not as one voice but as a multitude in harmony, can inspire immense change" (Sakow, 2019). The city didn't start bargaining in earnest with the teacher's union until 94% of our membership voted yes to authorize a strike, and some things that the city had refused to negotiate on at all are now in an enforceable, legally binding contract. But it still makes me angry that we had to go on strike at all. Everyone involved in education says, "it's for the students." What would it look like if, instead of forcing teachers, staff, and students into drastic actions, those in positions of power were willing to truly listen to and partner with those of us who are on the ground in improving schools?

We still have a long way to go, but I am hopeful. I am hopeful that we are energized, that we are looking at other ways to engage in the work of educational justice and to bring more awareness to everything that goes into teaching. I am hopeful because I now have first-hand evidence that collectively, our voices have power. And I am hopeful that we will take this energy and power to continue to push for positive change, in Chicago and beyond.



What would it look like if, instead of forcing teachers, staff, and students into drastic actions, those in positions of power were willing to truly listen to and partner with those of us who are on the ground in improving schools?"

References

- Chicago SpedPac [chicagospedpac]. (2019, October 28). Many at schools on the northside don't fully understand how under resourced schools on the south and west sides are. [Tweet]. Retrieved from <https://twitter.com/chicagospedpac/status/1188882408847876096>
- Sakow, M. (2019). From "strikes" to "collective action": Reflections on a changing mindset. *Kaleidoscope: Educator Voices and Perspectives*, 6(1), 31–33.

Citation

- Park, H. (2020). Collective action: A view from the 2019 Chicago Teachers' Union strike. *Kaleidoscope: Educator Voices and Perspectives*, 7(1), 19–21.



Heidi Park,

a Knowles Senior Fellow, is currently in her seventh year of teaching chemistry and physics at a selective enrollment high school in Chicago, Illinois. She also coaches her school's Scholastic Bowl team, works as

a framework specialist, and mentors new teachers for the district. You can read more of her thoughts on education at her blog, urbanscienceed.wordpress.com, and on Twitter (@heidijpark). Reach Heidi at heidi.park@knowlesteachers.org.



We've All Got Homework to Do

Kit Golan

What do I do with my realization that I have been oblivious to, ignorant of, and complicit in racism?

I'm a transgender man who transitioned back in college; as a visibly transgender man at that time, I had to constantly defend my claim to manhood. It felt like the only way I could do that was to conform to every expectation society placed on me as a man. By the end of college I was burnt-out on defending my identity and reaching for alternatives. After starting testosterone and having top surgery, I'm typically assumed to be a cisgender man by most people, making it my choice whether or not to share that I'm transgender.

The idea of not needing to fight the battle of my identity seemed especially appealing since, as a first-year teacher, there were plenty of other battles I needed to fight (for example: "Don't sharpen your pencil while I'm giving instructions."). So, in my first year teaching, I decided to stay in the closet.

After six years of teaching without talking about my own trans-ness, it became clear my middle schoolers were more trans-aware than I had realized. One transitioned—and they and their friends didn't even know I was trans! The following year, at a Gender and Sexuality Alliance meeting, another asked me if I was trans because he had heard rumors that I was. I realized that, by not talking about my trans-ness outright, I was unintentionally sending the message that being transgender was something taboo, something not to

discuss, and perhaps even something about which to be ashamed.

I realized I needed to come out to my students so the ones who were trans and gender non-conforming could have a visible role model of an adult who was like them. I also feared my cisgender students would grow up thinking they'd never met a trans person because no one "looked like" the trans women they saw in the media.

I wound up coming out twice that year: first to my own classes during a special lesson I created for the GLSEN Day of Silence, and then to the whole school, on stage, during the annual Gender and Sexuality Alliance assembly. I shared the differences between gender identity, gender expression, and sex assigned at birth. I explained the distinctions between cisgender people (people whose gender identities and sex assigned at birth align) and transgender people like me (people whose gender identities and sex assigned at birth don't line up).

My story had major impacts on my school community. One of my students immediately texted his mom that his favorite teacher, me, was transgender—just like his older brother! His mom later told me I had become a powerful role model for him in seeing his brother's trans-ness differently: now he had an image of what a trans man could be like as a successful adult. This made me realize how vital it was to be out and visible—not just for the trans students I might teach, but also for the family members and friends of transgender people.

Following that assembly, colleagues thanked me for sharing my story, expressing that they couldn't imagine my bravery, getting up on stage and sharing something so personal. And my principal stopped me in the hallway that afternoon to thank me, and expressed, "Today, I learned that I'm cisgender. Thank you."

Now, I had two minds about this moment with my principal. On the one hand, I was super proud of myself for educating my principal and my coworkers about these terms. And, as I shared my story, my audience was showing me their homework. I had successfully prompted this moment by sharing my own vulnerability and my expectation that they'd be vulnerable, too.

At the same time, I was angry. I was angry that it had to wait for me, a transgender person, to bring these issues to their attention. It angered me because my principal was in charge of a middle school in Chelsea, in New York City, and didn't even know the terminology to describe gender in a more nuanced and complex way—a necessity of modern society! By not taking responsibility for her own education, my principal had made her gender education my responsibility.

Last fall, I attended a Social Justice Saturday event at Teachers College, and I went to a discussion with Tricia Ebarvia and Dr. Kim Parker from the #DisruptTexts Movement. They asked us to critically examine our media consumption. What marginalized voices were missing? I began to recognize something I'd overlooked: my schooling hadn't included Black authors and bookstores had taught me "their" literature was different than mine and belonged in its own section.

But it was in this moment of recognizing that I hadn't read influential black authors like Maya Angelou, James Baldwin, or Audre Lorde that I had a deeply uncomfortable realization: I'd never done anything to take responsibility for my own anti-racist education.

That thing my principal had done where she was just a well-wishing bystander but not actually doing anything to proactively promote trans liberation? That's been me and my White identity. There's a parallel here of "Oh no! I didn't do my homework!" But meanwhile, I'm mad at my principal for not having done her homework either.

Whoa.

I suddenly developed compassion for my former principal and her "discovery" that she was cisgender. I realized that, in the same way she hadn't sought out sources on gender, I hadn't sought out sources on race or racism. More was required from me than just relying on people of color to educate me and point out sources and vocabulary to me.



That thing my principal had done where she was just a well-wishing bystander but not actually doing anything to proactively promote trans liberation? That's been me and my White identity."

Examining these two events made me recognize how easy it is to be a part of one oppressed group (in my case, trans people) and, simultaneously, a member of an oppressing group (White people). Just because I might know much about the LGBTQ+ community's experience of oppression, both from my own experiences and from reading and researching about queer history and talking with other LGBTQ+ people, including my community's elders, doesn't mean that I'm educated about all oppression. In fact, I have been oblivious to, ignorant of, and complicit in racism.

I asked myself, "What do I do with this realization?" Happily, I'm a teacher, and I am unafraid of homework.

I found my own experiences as a trans person ignited the fire of my anti-racism work, shifting me from being a sympathetic bystander to an active accomplice willing to show up and do the work to examine my own whiteness. And even more importantly, as a teacher, I found myself willing to push my colleagues to analyze the systemic things that we can change as the adults with power in the building, instead of just encouraging our students to advocate for themselves. I also wanted to model how to be an anti-racist for all of my students, especially the White ones.

I made a commitment this year to read more Black authors, to consume more media produced by people of color, and to ensure that I use my summer to read up on the voices I'd overlooked and missed, so that I can be a better accomplice and a better ally. To be in solidarity with other anti-racists, I must be proactive, rather than wait for someone else to do the work. I must seek out

the sources on my own and do my own homework, rather than rely on others to share their knowledge with me for free.

Representation matters: growing up, I didn't know any trans men. Most of the visions of masculinity I had from society were toxic ones, so when I transitioned, I didn't know how to enact my own masculinity without reenacting some of those problematic behaviors. It's for this reason I decided to be out as queer and trans to act as a model for my LGBTQ+ students and their friends and family.

Now, I recognize that I must also be out and visible as a White anti-racist. It is no longer enough to talk the talk, or even to walk the walk. It is now imperative that I also show my students how to walk the walk. And yes: they'll be assigned homework too, the same way that I was, the same way that everyone should be.



I found myself willing to push my colleagues to analyze the systemic things that we can change as the adults with power in the building, instead of just encouraging our students to advocate for themselves."

Citation

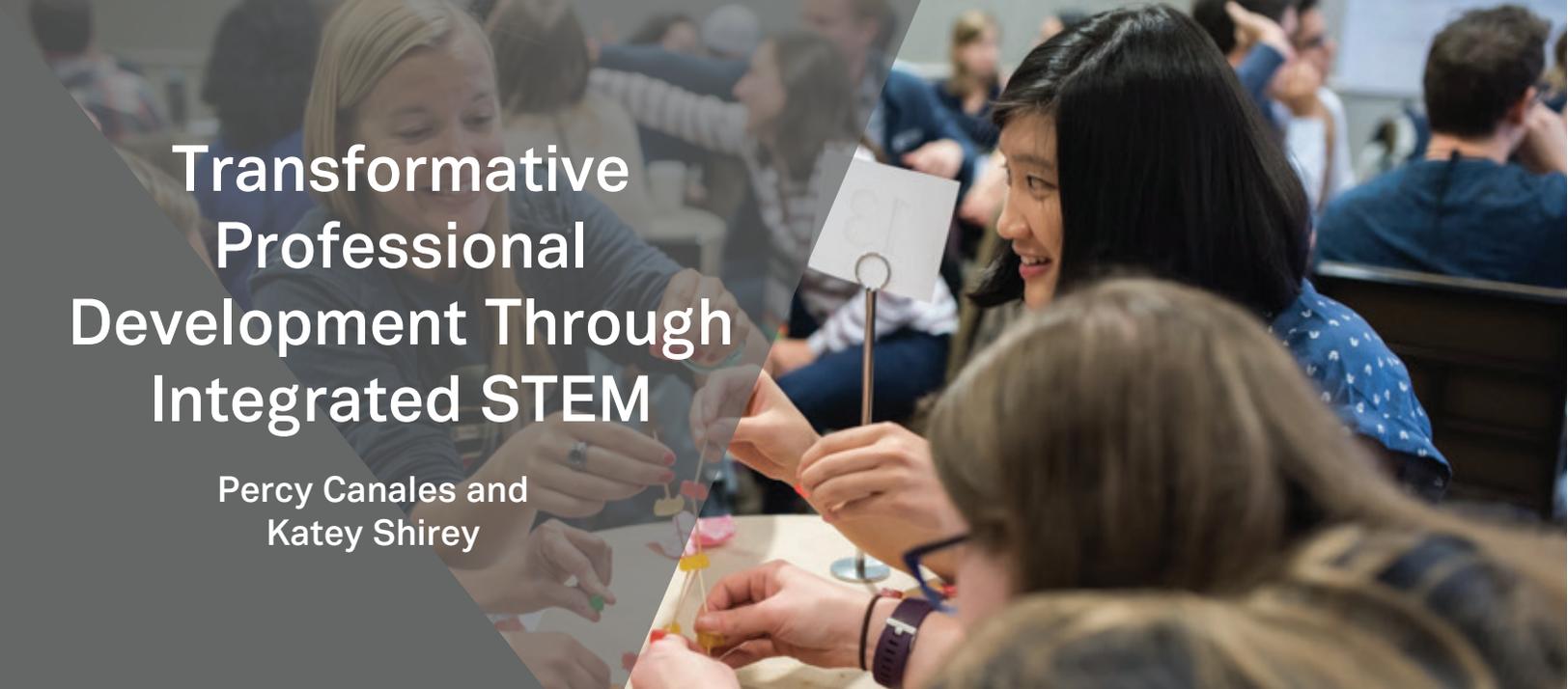
Golan, K. (2020). We've all got homework to do. *Kaleidoscope: Educator Voices and Perspectives*, 7(1), 22–24.



Kit Golan

is a Math for America Master Teacher in his 10th year of teaching math at a public middle school in New York City. He is dedicated to crafting experiences for his students that invite them to mathematize

their lives and see math as a tool for making sense of, explaining, and evaluating their lives. Kit also serves as a co-advisor for his school's Gender and Sexuality Alliance and organized a contingent of his MfA fellowship teachers for the NYC Pride March in June 2019. He is constantly reflecting on his teaching practice on his blog teachdomore.wordpress.com and on Twitter (@MrKitMath). Reach Kit at MrKitMath@gmail.com.



Transformative Professional Development Through Integrated STEM

Percy Canales and
Katey Shirey

Teaching integrated STEM is itself a transformative professional development experience that helps teachers learn and leverage practices to expose student thinking.

Introduction

Having taught math for nine years, I (Percy) needed to find more in-depth and individualized professional development and decided to embark on a full-time Master's of Mathematics Education program. I wanted to know everything there was to know about student mathematical thinking, and it was eye-opening to realize that there was such a huge world of mathematics education research that I had never heard about that was helpful for my practice.

Upon graduating, I hoped to build bridges between my math teacher colleagues and math research in order to continually refine our knowledge of student thinking. I wanted teachers to consider what it is that we do as math teachers, why we do it, why the students need it, and how to make our teaching better. However, I soon recognized that, because they were so busy with daily responsibilities, encouraging my colleagues to bring research into their practice was a challenge.

In my 13th year of math teaching in 2016, I joined a new kind of team of teachers, one that I'd never been on before but had heard about for years: an integrated science, technology, engineering and math (STEM)

teaching team. We were responsible for teaching students through three years of a brand new three-block integrated STEM course, and we were supported by external collaborators from the Knowles Teacher Initiative. I was suddenly immersed in developing and teaching the Global STEM Challenges Program in Fairfax, Virginia.

Integrated (or sometimes "integrative") STEM learning is "problem-based learning that purposefully situates scientific inquiry and the application of mathematics in the context of technological designing/problem solving" (Sanders, 2009, p. 21). The integrated portion means we are not just math teachers but science, engineering, and technology teachers too. We came to the conclusion that, in order to make this program work, we couldn't be driven by our own disciplines. Instead, we needed to be driven by student thinking: striving to find out what it is and how to improve it.

Through teaching integrated math in the program and in close collaboration with my team and Knowles collaborators, including my co-author Katey Shirey, my understanding of student thinking improved tremendously, both in and out of the integrated STEM course itself. In particular, I learned how exploring mathematics through its many applications and using multiple modalities for learning helps to unveil misconceptions and contributes to teachers' understanding of student thinking. Together, Katey and I have unpacked my reflections over the years in informal conversations as well as in formal meetings, classroom visits, and planning sessions. As collaborators, we've discussed the many ways that teaching integrated math has shifted my thinking about how students learn. I've

come to recognize that teaching integrated math has had a more positive influence on my understanding of student thinking than traditional, non-integrated professional development (PD). Realizing this is an important outcome, Katey and I are excited to share in this article what we've uncovered and how it might encourage other teachers to try integrated math teaching.

The Pitfalls of Traditional PD for Teacher Development and Instructional Change

Learning how to teach integrated math in our school's STEM program has not involved PD as teachers usually define it. While there is coaching and reflective support, we're not experiencing an external intervention of the kind that's usually impressed upon teachers in a typical PD. Instead, we're collaborating as a team to design and to teach the integrated math, science, design and technology course material in a novel environment that is rich for learning about student thinking.

Typical in-service PD and higher education coursework are designed to help teachers acquire knowledge about how students learn and adapt it to their contexts (Darling-Hammond & McLaughlin, 2011). We know that teachers hope to expand their teaching skills, defeat stagnation in teaching, improve student learning, and learn new pragmatic and usable ideas for their classrooms during PD. However, it doesn't take a research base to tell us that PD often receives lukewarm reception from teachers. Teachers' negative reactions to PD is due to inconsistencies between the needs of teachers and the design and outcomes of the PD, which results in low implementation (Guskey, 2002).

PD sometimes ignores research on adult learners, lacks actual classroom-related content, or discounts best teaching practices in its delivery (Borko, 2004; Guskey, 2002). For instance, say you go to a professional development training on student learning through multiple modalities. You might spend an entire hour listening to someone read a Powerpoint presentation on multiple modalities with lots of examples and ideas, and yet you recognize that this instruction is being conveyed through only one modality—oral.

In my experience, three things might happen after training like the one I've described. One, as a "seasoned" teacher, you feel you rarely get anything out of PD, so you tune out the training and your teaching doesn't change. Two, because the presentation was overloaded with information on several current trends in multiple modalities

instruction, you leave the training feeling so overwhelmed that you end up trying none. Three, you leave the PD determined to use one new approach for leveraging multiple modalities in your instruction. However, since you used it to repackage old unit material, the application of what you learned is merely superficial. Teachers who fall into the third category believe that the training included good ideas but become frustrated and overwhelmed because it took a lot to come up with a brand new approach for just one unit. They realize they can't keep the effort up all year, so they revert back to their old packaging and begin to doubt the utility of the material presented at PD training in general.

In PD sessions like the one I described above, we teachers are expected to learn "new knowledge" and incorporate it into our work. PD in this sense is a form of filling in the gaps or adding new practices, so-called "additive PD." Additive PD leads to an emotional response: an overwhelming feeling of needing to do more and profound insecurity about what to actually do. Eventually, we might also experience feelings of defeat because our learning was so superficial that our implementation lacked staying power.

Integrated STEM instruction as a transformative PD experience

In contrast to additive PD, "transformative PD" (Thompson & Zuili, 1999) seeks to make holistic transformations in practice that are more sustainable and useful (Barlow, et al., 2014). Teaching integrated math has been a transformative professional learning experience for me. In our school's integrated STEM courses, we introduce math through the contexts of solving real-world engineering challenges that require a combination of math, science, technology, designing, and problem solving. The contextual nature of integrated STEM instruction provides opportunities for me to learn about and use meaningful applications of math in my instruction, to gain experience with multiple student modalities, and to reveal student misconceptions. Below, Katey and I discuss three of my teaching practices that were transformed by teaching integrated STEM.

Creating meaningful applications for math through connections

Connections is a National Council of Teachers of Mathematics (NCTM) process standard (National Council of Teachers of Mathematics, 2000). Yet, in my single-content math classes, it is rare to see how the students take the content and apply

it elsewhere. Furthermore, it can be challenging as a content expert in math to invent opportunities which lead to deep and meaningful connections from math to other subjects or phenomena.

In our integrated STEM program, however, my students are presented with wildly open-ended problem spaces that require them to work from all STEM perspectives—science, math, technology, and engineering—on one problem. The choices that the students make create connected contexts for math applications as they work without me having to contrive the connections.

For instance, in one project, students are asked to create a chemical heating or cooling device for an application of their own choice. (Readers might recognize the idea at the center of this unit as a common chemistry endothermic/exothermic lab where students optimize a hand warmer.) Student projects have included coffee heaters, reusable self-heating gloves, an avalanche-melting helmet, self-warming baby blankets, and self-cooling t-shirts for the gym. Students' focus as they find rates and functions to describe their experimentally-derived heating curves is much more intense than when I teach math content areas out of context. Because the students are able to choose the application they will explore, they pick something with meaning to them. I've also noticed that students interrogate their data for mathematical patterns more intently when they are invested in a context that they control.

Overall, I've found that when the mathematical application has more personal meaning, students forge stronger connections back to the concepts embedded in the challenge and their new math content knowledge. I always knew this type of teaching would work, especially after reading about the link between context and learning from authors like Jo Boaler (1998), but I never really saw it work until I experienced the integrated context. I used to say "plug in a number" to help my students connect abstract expressions to more relatable numbers, but integrated STEM brings the connection into physical reality. Logarithms are much more concrete when used to describe hydrogen ions present on the pH scale; trig functions more relatable when used to describe the tides, the orbit of the moon, or the rotation of a windmill. Since teaching integrated STEM, I've even started to ask my non-STEM International Baccalaureate® math classes, "Who's taken physics?" because I know that it will be more valuable to connect calculus to physical motion and vectors when possible.

Accessing multiple modalities

My integrated STEM teaching team quickly realized



I'm learning that student choice in modalities and application allows the students to tailor the math learning for themselves!"

that accessing multiple modalities when we teach has a profound impact on student learning in our program. Building on multiple intelligences (Gardner, 1999), individualized learning (Dunn & Dunn, 1972), and cognitive science, the term multiple modalities refers to the various techniques that teachers can use in the classroom to address their students' needs as learners. Examples include lecture-based teaching, skills-based teaching, technology-enhanced teaching, individual teaching, group teaching, and inquiry-based teaching (Bransford, et al., 2000). It was clear to the team that we could understand more about students' thinking if we restructured both instruction and assessment using multiple modalities as a lens.

By providing lots of student agency, we found we created a wide variety of teacher-led and student-led learning opportunities. The choices our students get to make mean that their thinking is explored and expressed within their favored modality as they work—which allows me to better understand their thinking. Among our integrated STEM teaching team, "multiple modalities" has become shorthand for the variety of ways that students choose to interact throughout each day and with each unit. By observing their choices and the artifacts we produce, we are able to learn more about how students are processing and learning.

One method we use consistently to provide space for multiple modalities is under-defining our design challenges and problem-solving procedures; this way, students have to proceed within their own modes of working and learning. For instance, our 10th-grade students are asked to design a digital tool for communicating information from a large Chesapeake Bay dataset to local stakeholders. First, they must select information to analyze based on stakeholders' concerns and decide what kind of communication platform they'll design (i.e., programming phone apps,

storyboarding websites, or illustrating a children's book and teachers' guide). I can take advantage of their comfort and interest in the platform they select to discuss with them how they will share the data most efficiently in that mode and for that audience. As a result, students develop a nuanced fluency about the dataset and make decisions while justifying their choices, all while using and communicating appropriate data analysis.

Our STEM classes also capitalize on multiple modalities by using common science representations in math and technology applications across the program. We strive to express quantities and relationships with graphs and algebraic expressions in addition to numbers. We also ask students to write sentences to describe mathematical relationships; reviewing the writing provides insight into students' understanding of the phenomena at hand. These modalities are automatic in STEM and flatten the notion that graphs or equations only belong to one discipline.

I was surprised by how naturally this all developed out of integrated math instruction. I'd learned from Nicholson-Nelson (1998) in her celebrated book, *Developing Student's Multiple Intelligences*, that "by knowing our students' strengths and weaknesses, we can tailor individual projects and activities to help students learn in their own way" (p. 71). I've found that integrated STEM goes well beyond the expectation that I should differentiate the learning experience for my students. Instead, I'm learning that student choice in modalities and application allows the students to tailor the math learning for themselves! I just try to keep up by providing more, different, or contrasting skills and perspectives to keep nudging them along toward mathematical mastery.

Unveiling student misconceptions

In my master's program, I learned about Piaget's theory of cognitive development and the enormous body of research dedicated to student misconceptions in math and science (Confrey, 1990). I had been under the impression that "once the student misconceptions are identified, teachers can work to remedy the faulty conceptions with appropriate instructional approaches" (Gurel, et al., 2015, p. 993). I was taught to look for common misconceptions in student work or assessments so that I could highlight, interrogate, and correct the misconception. But by teaching integrated STEM, I've had more access to student thinking, including identifying misconceptions, than traditional math instruction allows.

Since the STEM program's design challenges are open-ended, students are less inhibited to share what is truly

in their minds. They are more inclined to share their thoughts through their perspectives, in their own chosen modality, and using their own terminology. Instead of looking for a particular, known misconception, I can pick up on ways that students might be misinterpreting a relationship, a concept, or inappropriate tools based on their own words. In my math-only classes, students are frequently tuned into the math that they should be using because it is the topic of the lesson or unit. In integrated STEM, the bounds for what math is appropriate to use are loosened, and students are asked to bring forward whatever math that they need for a given problem or situation. If I notice a misconception, or a lack of skills that might be helpful, I can adjust my instruction to deliver a useful lesson or reminder. For instance, when students discuss data and designs, I often hear them pose questions that might be better answered with different mathematical tools, which I can then teach them in a responsive way. By listening and responding to student mathematical needs, the math I'm teaching is immediately relevant.

I can use the context of the challenge to learn more about student confusions regarding the underlying math. For example, we teach a unit that involves defining the motion of space debris falling from low Earth orbit to teach kinematics, which incorporates both physics and calculus to describe the relationships between position, velocity, and acceleration. Often, we think our students understand the rules that connect accelerated motion through calculus when they can recite "velocity is the derivative of position" and "acceleration is the derivative of velocity"—so we move on.

During a recent kinematics lesson in the space debris unit, I heard students discussing acceleration due to gravity with some misunderstandings laced throughout. One student said, "When you throw an object in the air it goes fast then slow and then fast again so acceleration must not be constant." Whoa, I thought, let's see where this goes! Other students agreed and disagreed,



By listening and responding to student mathematical needs, the math I'm teaching is immediately relevant."

explaining their reasoning. Okay, I thought, the students are confusing acceleration with velocity, and speed, which I can address. But to me, even more exciting than identifying their confusion was finding it through their conversation! I didn't have to wait until a difficult question on a quiz or test prompted a long conversation to reveal that my students really did not understand how acceleration affects velocity. Instead, their confusion was raised during a group's discussions while the students were expressing a need and desire to want to find the answer.

Potential Concerns

Katey and I wrote this article with the hopes that other teachers will try integrated STEM for the reasons articulated above, but we also recognize that teachers might have some concerns. For one, teachers might be afraid that they don't have enough knowledge in the other STEM fields to pull this off. Rest assured, your primary content knowledge is adequate to get started, and you'll learn a lot about the other subjects as you go. I have personally learned so much about science and technology from collaborating with my colleagues and listening to what students bring to the challenges, that I consider this a learning opportunity for me!

Teachers might be concerned that they'll never be able to tackle all of the needed STEM content in a math classroom. Fear not, your students have additional assets that they will draw upon: other teachers, other student teams, and other hours of the day. I feel much more secure knowing that I am not solely responsible for resolving all of the students' concerns in an integrated unit. In fact, it might be an asset that I can't resolve all of them—it makes the students take more agency for their learning.

Finally, teachers might worry that if they're not doing the math curriculum in some known order, optimized for maximum efficiency, then their instruction won't maintain rigor or pacing. This is a false dichotomy. Revisiting content throughout the year as an actual project when needs arise gives credence to the usefulness of mathematics; it's not simply a unit that once tested can be forgotten. I've not seen any lack of rigor when the instruction is responsive instead of following a traditional sequence. As math teachers have always known, there is math everywhere and connected to everything, so there is no shortage of appropriate mathematical content to teach. By planning with my colleagues, I can ensure that we will have time to do what I hope to do while staying in sync with the team.



But to me, even more exciting than identifying their confusion was finding it through their conversation!"

Conclusion

Teachers of integrated STEM can learn so much about how students learn and how to support them from teaching this way. Learning math in a STEM classroom context feels genuine to students and creates opportunities to work within multiple modalities, increase their ownership of the learning process, and feel empowered to make decisions. Students are required to express the mathematical reasoning for their decisions and how math is used in various contexts. As a result, I have been able to access a more authentic representation of students' productive reasoning along with their misconceptions.

Through my experience of teaching integrated STEM, I have come to appreciate it as an opportunity for transformative PD; it is relevant to my teaching context, addresses my students and my own learning needs, aligned with math standards, grounded in reflection, and experienced within a community of teachers. For my colleagues and me, this experience has been more beneficial for our professional growth than traditional PD.

For more information on Percy's integrated STEM course, visit <https://edisonhs.fcps.edu/academics/stem>.

To learn more about how this integrated STEM course was planned, visit <https://www.sciencedirect.com/science/article/pii/S2095809917307403>.

References

- Barlow, A. T., Frick, T. M., Barker, H. L., & Phelps, A. J. (2014). Modeling instruction: The impact of professional development on instructional practices. *Science Educator*, 23(1), 14–26.
- Boaler, J. (1998). Open and closed mathematics: Student experiences and understandings. *Journal for Research in Mathematics Education*, 29(1), 41–62. <http://doi.org/10.2307/749717>
- Borko, H. (2004). Professional development and teacher learning: Mapping the terrain. *Educational Researcher*, 33(8), 3–15.
- Bransford, J. D., Brown, A. L., & Cocking, R. R. (2000). *How people learn: Brain, mind, experience, and school: Expanded edition*. National Academy Press. <https://doi.org/10.17226/9853>
- Confrey, J. (1990). Chapter 1: A review of the research on student conceptions in mathematics, science, and programming. *Review of Research in Education*, 16(1), 3–56. <https://doi.org/10.3102/0091732X016001003>
- Darling-Hammond, L., & McLaughlin, M. W. (2011). Policies that support professional development in an era of reform. *Phi Delta Kappan*, 92(6), 81–92. <http://doi.org/10.1177/0031721711109200622>
- Dunn, R., & Dunn, K. (1972). *Practical approaches to individualizing instruction: Contracts and other effective teaching strategies*. Parker Division of Prentice-Hall.
- Gardner, H. E. (1999). *Intelligence reframed: Multiple intelligences for the 21st century*. Basic Books.
- Gurel, D. K., Eryilmaz, A., & McDermott, L. C. (2015). A review and comparison of diagnostic instruments to identify students' misconceptions in science. *Eurasia Journal of Mathematics, Science and Technology Education*, 11(5), 989–1008. <http://doi.org/10.12973/eurasia.2015.1369a>
- Guskey, T. R. (2002). Professional development and teacher change. *Teachers and Teaching*, 8(3), 381–391.
- National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics, grades 9–12*. Reston, VA.
- Nicholson-Nelson, K. (1998) *Developing students' multiple intelligences*. Scholastic, Inc.

- Sanders, M. (2009). STEM, STEM Education, STEMmania. *Technology Teacher*, 68(4), 20–26.
- Thompson, C. L., & Zeuli, J. S. (1999). The frame and the tapestry: Standards-based reform and professional development. In Darling-Hammond, L., & Skyes, M. (Eds.), *Teaching as the learning profession: Handbook of policy and practice* (pp. 341–375). Jossey-Bass.

Citation

- Canales, P., & Shirey, K. (2020). Transformative professional development through integrated STEM. *Kaleidoscope: Educator Voices and Perspectives*, 7(1), 25–30.



Percy Canales,
a math teacher in Fairfax County (Virginia), has 15 years of math education experience ranging from junior high to college settings. In addition to teaching STEM, he currently teaches the IB Higher

Level Math classes at Edison High School. Reach Percy at pcanales@fcps.edu.



Katey Shirey,
a Knowles Senior Fellow, is the Knowles Teacher Initiative Knowles Academy Program Officer and a member of the Knowles Engineering Leadership Team, where she brings her experience as a high

school physics teacher and sculptor to her work with teachers and students. Reach Katey at katey.shirey@knowlesteachers.org.

Teacher's Lounge: So You Think You Can Publish

Briana Clarke

Realizing a long-term goal of publishing a science curriculum.

It is so easy to be inspired—and just as easy to be detoured by life. This is why it has taken me over two years to complete and publish a physics curriculum. Two years has also given me enough time to reflect on why the road to publishing is less travelled.

Purpose

- Write a great lab.
- Write a second great lab.
- Write 10 great labs.
- Get a thought to share with a larger community.
- Share labs.
- Realize labs are not nearly as “great” as you thought.
- Give up temporarily.

Discovery. Observation. Experimentation. This is what made learning physics so satisfying for me. I wanted to share my love of physics with my own students by piquing their curiosity with as much hands-on engagement as possible. However, on a \$300 budget, which came out to little more than \$3 a child at my “project-based school,” experimentation was nearly impossible.

Thanks to funding provided to Knowles Fellows from the Knowles Teacher Initiative, I was able to build out a curriculum including solar panels, robotics, and other

materials over a couple of years; before that, however, one resource I could always depend on was PhET Interactive Simulations, a non-profit open educational resource project produced by the University of Colorado at Boulder. Their physics simulations allow my students to design and execute experiments or simply learn through discovery year-round—for free! The only problem was that if students weren't focused, they could stay “engaged” by playing around for an hour without learning key concepts. Therefore, I designed several labs to guide them through the simulations. By the end of my first year, I had developed 10 labs and thought, “Why not do something more?” In my second year, I finished writing 20 labs and pitched the idea of a book at the Knowles Teacher Initiative Summer Conference. Once I started sharing my work with others, prudence (and fear) caused me to run for help.

Process

- Get reinspired.
- Ask for student feedback.
- Rewrite questions.
- Read student answers.
- Rewrite questions.
- Write 10 more labs.
- Ask mentors and peers for thoughts.
- Restructure labs.
- Add pictures.
- Make fonts, headings, and sections uniform.
- Learn about copyright and publishing.
- Give up temporarily . . . again.

I was excited at the thought of publishing a book made for under-resourced classes. However, what I had were

a bunch of decent labs stapled together. In attempts to make a cohesive product, I began designing a repeatable structure for labs: observe, infer, explain, model. I clumsily sorted and labelled questions.

Still unsatisfied, I reached out to teachers in my Knowles network for pedagogical and financial support. I was provided funding to have my work reviewed, edited, published, and marketed. A Knowles Senior Fellow who had previously created his own curriculum served as an expert reviewer. In the first of a series of consultations, he introduced me to the 5E Instructional Model, a curriculum framework vetted by the education community that would anchor my book in best practices to make my work marketable (BSCS Science Learning).

The 5Es framework uses alliteration to make an easily repeatable format for developing curriculum and engaging students. I adapted the 5Es so that in each lab, students practice: engagement through questions or free observations, exploration via data collection, explanation of relationships between variables when analyzing data, elaboration of their learning by applying concepts to a real world scenario or practice using new found equations, and engineering design principles to connect concepts to design solutions.

Next, my Knowles reviewer suggested applying NGSS-aligned objectives to each lab. This helped me rephrase questions to give students a clear end goal. The objectives also gave me and other teachers a chance to identify the concepts students would learn. As a final touch, I was told to input photos and screenshots of the labs for ease of engagement. In addition to insight on curriculum, other Knowles colleagues gave me commentary on the physics itself to make sure students were learning sound science.

Publishing and packaging

- Get re-inspired.
- Submit work to the copyright office.
- Research publishing options.
- Decide to self-publish work with Amazon.
- Hate the look of the cover.
- Hire graphic designer.
- Republish with a new logo and cover.
- Make a website for work.
- Self-market via word of mouth and conferences.
- See sales. Celebrate.

Once I finished writing a cohesive manuscript, I sent it off to the US Copyright Office and researched publishing options. I was shocked by the small

commissions paid to authors by publishing houses (though I shouldn't have been), so I decided to publish with Amazon Kindle Direct Publishing. I knew I would rather do more work and have a say in the sale of my work than share my profits with publishers who would do nothing. Amazon made it unbelievably easy to publish and print my book.

I celebrated my first week of sales before I decided the work was, once again, not good enough. "Never judge a book by its cover" might be an apt sentiment when it comes to people; however, it bears little weight in an industry dependent on flashy marketing. In a school with one color printer, I rarely thought about aesthetics, and it showed in the book's original plain white cover. It was clear I needed to hire a professional—so I hired a graphic designer who made both a logo and a cover to match the quality of the content of the book (see Figure 1).

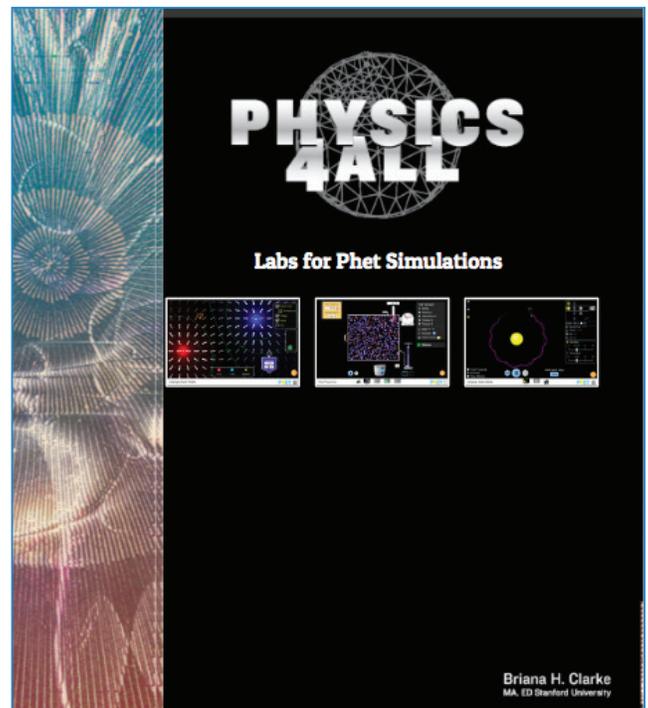


Figure 1. Cover of *Physics 4 All: Labs for PhET Simulations* after the graphic design upgrade

The new logo was also useful in making pamphlets, business cards, and a website, giving the book a fighting chance in an increasingly competitive field. Thankfully, Squarespace and Vistaprint made it easy to copy, paste, and upload everything. They even helped me make my first QR code so that I could add my "media marketing" badge to my entrepreneur sash (see Figure 2).



Figure 2. QR code for *Physics 4 All: Labs for PhET Simulations*

Of course, the journey is not over; after all, a book doesn't sell itself. Now, I am off to conferences, thanks again to the generosity of the Knowles Teacher Initiative. I am happy to report that as of March, interest in my book has grown both through Amazon and on Teachers Pay Teachers. I hope the story of my experience encourages other teacher-authorpreneurs to pursue their own writing and publishing goals. Take a weekend, even a personal day, to map out the steps you need to take and reach out to your own professional community for support. Will it be easy? No. But will it be worth it? Yes.

References

BSCS Science Learning (n.d.). *Learn about BSCS's 5E Instructional Model*. Retrieved from <https://bscs.org/bscs-5e-instructional-model/>

Citation

Clarke, B. (2020). Teachers lounge: So you think you can publish. *Kaleidoscope: Educator Voices and Perspectives*, 7(1), 31–33.



Briana Clarke,

a 2016 Knowles Teaching Fellow, teaches physics and engineering in Oakland, California, in addition to writing curricular resources. Her goal is to make physics curriculum accessible to all, particularly

students and teachers working in low-income and low-resources classrooms. For more information, visit Briana's website at bit.ly/physics4all or reach Briana at briana.clarke@knowlesteachers.org.

Knowles Teacher Initiative

1000 North Church Street • Moorestown, NJ 08057

856.608.0001 • www.knowledgeteachers.org • info@knowledgeteachers.org

