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Ideas, big and small, for supporting STEM in our communities.

In April 2017, a March for Science was held in Washington, D.C. and several other locations around the United States and the world. I’ve been thinking long and hard about this march and all that it entails. With so many different issues arising from our current cultural and political reality—issues relating to race, gender, economics, access, the environment (among others); I could spend a whole page listing them—the broad issue of “science” or “STEM” seems slightly out of place. And while a march can bring people together, as we saw with the Women’s March on Washington and the myriad satellite marches in January, it also often raises the question of “what next?” As of late, the next step has involved contacting governmental representatives, monetarily supporting action groups, and writing on blogs or social media with the goal of promoting STEM outreach sessions at your local libraries or community centers. Go out in nature with a guide book and identify species. Learn about cloud formations. Read the ingredients in your food and research them—really research them, so you can learn more than fear of the word “chemical.” Tutor a student who is struggling in science at school. Support science outreach sessions at your local libraries or community centers. Go out in nature with a guide book and identify species. Learn about cloud formations. Read the ingredients in your food and research them—really research them, so you can learn more than fear of the word “chemical.” Tutor a student who is struggling in science at school. Support science teachers at your local school. Call or email them to see what materials they need or help you can provide. Listen to their stories and hear their words as they build a community of thinkers and questioners in the students of the next generation.

Teach your kids to question the world around them, whether they don’t have an answer, how to experiment or research to find the answer. If the citizens of this country and the citizens of the world knew and trusted in the power of science as so many scientists do, many of the current political, economic, and environmental issues would be solved. If everyone did one of these things, think how many people would be affected. If everyone did two things, economic, and environmental issues would be solved. Everyone at the rally, everyone was listening and everyone is waiting for the opportunity to speak.

But then the speaker started to tell a story from her childhood: the story of being a Syrian refugee. As the crowd strained to listen, this brave young person described what it was like to face, among other hardships, visits from members of the American and European press. How she stood, time and time again, hungry with her clothes sticking, staring into the well-meaning faces of sleek, immaculately-dressed foreigners. How she felt when her family finally came to the States and found such bounty and opportunity.

By the time she finished speaking, the crowd was so silent I could hear the snow falling on the shoulders of my jacket.

Today’s discourse in the educational landscape continues to discount messages from the people who know the system the best: teachers. Sometimes, like at the rally, it’s because the speaker’s words are too quiet to hear, or are drowned out by the words of others. Sometimes it’s because someone’s words are hesitant and unpolished. Sometimes it’s because the words just aren’t there; with the ever-increasing demand and pressure on classroom teachers, finding the time and space to formally reflect on itself be a challenging task. Most alarming, though, it’s because our culture has increasingly let others speak for teachers and, in parallel, our schoolkids.

Every word in the journal you’re reading is directly from a teacher—unfiltered by researchers, politicians, or consultants. Our editorial team is committed to promoting stories from teachers and classrooms because they inspire, challenge assumptions, and hold us all accountable for what happens in America’s schools. We hope you’ll join us in reading, writing, and thinking more about teaching and learning from the perspectives of the professionals who know it best.

FROM THE EDITORS’ DESK: TEACHERS TELLING TRUTH

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RAISE YOUR HAND

STUDENT ADVOCACY IN UNCERTAIN TIMES

In “Raise your hand,” we ask for short responses to a pressing question facing teachers. These are difficult questions, often without a satisfying answer, but we hope these reflections will help you develop new ideas, build empathy, and start conversations with students and colleagues.

**Question:** Though we’d sometimes like them not to be, our classrooms exist within the broader local and U.S. context in which we live. How is this current social and political climate, where so many people have seemingly conflicting views, entering your classroom? How are you (or people you know) advocating for students? What actions have you taken (or have you seen taken) on behalf of students to support them?

Many of my students are currently enrolled in the Deferred Action for Childhood Arrivals (DACA) immigration program. Political shifts have left students uncertain and fearful. I have students who are struggling with a future where they might lose work permits, a future where keeping their families together is less certain, and a future that might deport them to countries that they do not consider home. I struggle to face my students daily and push them to focus on content when I know they are preoccupied with issues that are so much bigger. I try to remind my classes to focus on what we can control: how we treat each other, what issues we stand up for, how hard we work, and how we support our community. Is it enough? It doesn’t feel remotely adequate.

*Cacia Steensen, Knowles Senior Fellow*

I teach in a rural, mostly conservative area, and I co-advice the GSA (Gay-Straight Alliance). Before the election, those students mostly just wanted a safe place to talk and be themselves. I’ve seen a shift this year. Students feel more compelled to advocate for themselves. We try our best to support that, but their project ideas are not always met with acceptance from the district. Students are struggling to find their voice and place in our community. Other students use derogatory and exclusive language that they see and hear public figures using. I know my support helps, but I also know it’s not enough.

*Beverly Stuckwisch, 2012 Knowles Teaching Fellow*

A large fraction of my students are immigrants and many are undocumented. Each new piece of news sends small shock waves through our student population, and I feel unprepared to help them cope as I’m not even sure how to cope with it myself. Many students try to make jokes about it, but behind the jokes are real fears about what will happen to their peers, their families, and themselves. Other students have lost motivation; they ask, “Why should I take AP Chemistry next year when I’m just going to be deported?” I’m still trying to find my footing in this political climate and figure out how I can help my students. I push them to continue to challenge themselves in school as more education can only help, no matter what happens. I’ve been assisting as many students as possible with the college application process and have met with the Massachusetts Immigrant and Refugee Advocacy Coalition to try to organize a training for teachers at our school around what rights immigrants have and what we can do if a student has an immigration crisis in their family. It still doesn’t feel like enough.

*Shannon Morey, 2015 Knowles Teaching Fellow*

I work in a suburban charter school with a classical curriculum. A colleague and I started a diversity club at the request of students so they could discuss challenging social and cultural topics. At the charge of our charter system, even within clubs, we must draw from historical and classical literature for sources to discuss together. We have centered our discussions on readings from Mary Wollstonecraft, W.E.B. Du Bois, Plato’s Symposium, and other classics. Our students are finding that they are able to draw from these and similar classical sources in order to have rich conversations about contemporary topics such as women’s rights and pay equality, racial inequality, and LGBTQ+ identity.

*Ian Caldwell, 2012 Knowles Teaching Fellow*

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*Ian Caldwell, 2012 Knowles Teaching Fellow*
Why is it that I expect to be as good a teacher on my first day of the job as I would like to be on my last? This self-expectation is not only unrealistic, and expertise that veteran teachers have and develop through years and years of trial, error, and growth. Learning to accept my imperfection as a teacher, and to strategically learn and improve is one reason why I’m called to this profession; accepting that I’m not perfect yet is part of this equation.

A year after coming away from my students, I am excited to get back on Monday morning as a slightly less hypocritical teacher. One who is willing to do the same thing that I ask of my students—to try, to fail, and to grow because it’s okay to not be perfect. In fact, imperfection may even be integral to the process of learning. This perspective gives me a new hope for the teacher I might be one day, not tomorrow, or next year, but 10 years down the road, when maybe I’ll finally know what I am doing.

**CITATION**

STEM through the arts engages students and requires less of a leap than you might think!

How can the arts illuminate the STEM field, or the other way around?

As a biology, engineering, and geometry teacher at a public arts school in Boston, I explore this question daily. In fact, we math and science teachers at Boston Arts Academy call ourselves the STEAM team, which stands for—you guessed it—science, technology, engineering, arts, and math. Many people might wonder why teachers would bother integrating the arts with STEM. I do, too, especially when we’ve seen so few examples of deep arts integration in education. After all, how much does a student really get out of making a pretty poster or reciting a rhyme?

As an artist at heart, however, these questions percolate a little longer in my mind. I like to ask, how could a dancer interpret fractals, or a musician explain Pascal’s Law? Designing curriculum with these cross-disciplinary connections is not as foreign as it sounds! I use the arts to tackle challenges that all teachers face, such as student engagement, differentiating for all learners, and teaching collaboration skills in project-based environments. Any teacher can use these arts integration strategies!

Increasing student engagement

One way I’ve successfully engaged my biology students in claim-evidence-reasoning practice is through mock patient interviews at the end of our neurology unit. Properly scaffolded, students get to demonstrate their understanding of neurological disorders through theatrical expression. For example, as student-physicians, they practice questioning patients, gathering evidence, and defending their diagnoses (see Figure 1). As student-patients, they figure out how to coherently express symptoms of a neurological disorder, such as retrograde or anterograde amnesia, aphasia, or prosopagnosia. I do a fair amount of scaffolding to help students develop a depth of knowledge for the disorders and also empathy for the patients. I perform cognitive tests on the patient. I have seen my students ask patients to draw an image on the board from memory, or even pull in other students to perform tests on the patient. I encourage them to find a balance between scientific fascination and humility when working with life; they hopefully recognize that there is space for humanity in academic pursuits.

On mock patient interview day, students enter the classroom rife with excitement. They have looked forward to this day as a way to show me how much they have learned about the brain, and they get to express their learning creatively! I sit amongst the physicians as patients enter our office one by one. Students acting as patients take a seat in the center of our classroom, where all physicians have access to question and perform tests on them. I only occasionally facilitate with questions if the dialogue needs a bit of a push in a certain direction.

One challenge with brain disorders is distinguishing one from another. For example, a person diagnosed with anterograde amnesia is unable to form new memories, while a person diagnosed with prosopagnosia has trouble recognizing faces. Complex questions arise, such as: if a patient does not recognize you, is it because they don’t remember your face, or they don’t remember having met you at all? In these cases, I prod the students to ask ever-more-specific questions or perform cognitive tests on the patient. I have seen my students ask patients to draw an image on the board from memory, or even pull in other students to test a patient’s facial recognition abilities. It is great fun to see what they come up with to test and rule out diagnoses!

Differentiating for all learners

Another great teaching challenge that I address with arts integration is differentiating for all students.

I often have one student ask a question in a mock patient interview that is way off the beaten path. I usually choose to pursue it because I can see the spark in their eye and I am excited about the learning they are igniting. These are the times that I think about how important it is for teachers to have the patience and the humility to pivot to follow the sparks their students ignite.

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STEM through the arts engages students and requires less of a leap than you might think!

By Angela Lou

Headshot by Andrea Cipriani Mecchi

ARTS INTEGRATION IN STEM

KALEIDOSCOPE | SPRING 2017/SUMMER 2017

www.kstf.org/kaleidoscope
I use the arts to tackle challenges that all teachers face, such as student engagement, differentiating for all learners, and teaching collaboration skills in project-based environments. Any teacher can use these arts integration strategies!

in a heterogeneous learning environment. I have found that arts integration is especially powerful for learning when it is coupled with student choice (see Figure 3). When given options in their learning, students can engage with the material on their own terms. You can think of this as the ‘low threshold’ in the phrase ‘low threshold high ceiling’ commonly used amongst math teachers.

For example, at the beginning of the geometric transformations unit, I let students decide how they wanted to demonstrate their understanding. Dancers interpret dilations, translations, reflections, and rotations in short choreographed pieces. Visual artists illustrate these four concepts with captioned comics (see Figure 4). Musicians wax poetic about the geometric transformations. However the ideas are expressed, each student engages in the same material but in very different modes. As you might imagine, creating rubrics for each of these projects would be a total time drain. So I don’t sweat it. The purpose of these options is for students to demonstrate a conceptual understanding of the transformations—not the technical details of how to execute them on paper, which I might assess with a traditional paper-and-pencil quiz. Through these projects, students can therefore meet the material on their own terms. When projects are due, we also get to build community by presenting and appreciating each other’s work!

Teaching students to work together on complex projects

Another great pedagogical challenge: how do we teach students to work together on complex tasks? Many of us choose to assign students to specific lab roles such as recorder, materials manager, reporter, and so on. I have seen teachers take this scaffold a step further with group contracts. These strategies are useful and, I believe, necessary for some class assignments like time-sensitive labs. However, they can also stifle organic interactions by taking important decision-making opportunities out of students’ hands.

One answer I’ve developed to this dilemma is through my biology students’ “Central Dogma Choreography” project. I give students one week to create a three to five minute film that represents the flow of cellular information from DNA to RNA to protein. The week’s work serves as both a learning activity and summative assessment, since students have to identify and fix any misconceptions that arise throughout the choreographing process. In order to encourage complex group work, I add an additional challenge to the mix: students must work together as a class to produce just one film.

When I introduce these parameters, hands immediately shoot up. Will we want narration? What about music? Who is going to act, and how will we physically represent DNA, the nucleus, transcription and translation on film? I allow students time to brainstorm their vision individually and then share out as a class (see Figure 5). Once those ideas start to congeal, other problems arise: who’s on props? How can we synchronise our choreography and music if they will be recorded separately? I let these questions pop up organically, just to the point where students are interested, but don’t have all the answers yet. When given a good balance of scaffolding and artistic freedom (more on scaffolding below), my students tackle the challenge with great zest! I think the most important part for them to understand is that they need each other to succeed, and that each person will and is expected to contribute a valuable skill. I therefore make sure students spend time thinking about how they envision themselves contributing to the project, and have them share these ideas publicly.

Some people might be wondering at this point how we avoid a situation where a only few students are doing all the work. With this in mind, I give students a set of options to work from, and ask them to envision how their choice would make the class’s product come together (Figure 5). Some students may step up as directors and choreographers, while others choose to record music or write lyrics. Others feel more comfortable behind the scenes with props. Whatever their role, they have chosen it and have time to think about how their contribution is essential to the project.

Our extended debriefing process is central to making this week work. I need all students to be on the same page when we discuss our progress, contributions, and expectations each day. There are three main strategies I use to ensure students are ready to work the moment they enter class. First, I set aside time each day for students to think about and articulate their design decisions with each other. At the beginning of each class, students look at the calendar of remaining days along with a list of potential tasks (see Figure 6). The ‘Do Now’ assignment is to write in the tasks they want to prioritize for the following days.

We spend the first 20 minutes of class setting goals and organizing roles, which is facilitated by their ‘Do Now’ (see Figure 6). My second strategy is to have student leaders facilitate these class debriefs. When students lead their peers, it creates an environment where peers start holding each other accountable. Finally, I require student debrief sessions to start with shout-outs to each other. This sets a positive tone before we get into nitty-gritty details of what needs to be done as the deadline looms. Through this extended debrief process, students practice listening to each other and compromising on important decisions.

I’ve actually been surprised to see that the theater students don’t necessarily demand to direct or act in the film. While they are willing to take on these roles, I have been pleased to see people step up and step back as they negotiate their responsibilities with each other. This past year, a trio of directors emerged: a musician, a thespian, and a dancer. A visual artist worked on the costume design, and the rest of the students fell into filming, props, music recording, and editing.

I always stop the students’ work 20 minutes before class ends for clean-up and a whole-class debrief. This student-led discussion is intended to figure out what we need to do and when. Some reminders: PowerPoint, Upload to YouTube, Record Narration, Film Translation, Stitch scenes together (final edit).

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<th>Item/Notes</th>
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<tr>
<td>Central Dogma planning</td>
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<td>Do you want to use DNA animation in the film? How can you contribute your artistic skills?</td>
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<tr>
<td>Theater</td>
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Figure 5. Students brainstorm their project visions and potential contributions.

Figure 6. Students prioritize the work they think should be done that day in a blank calendar. I modify the reminders on the bottom based on their previous day’s accomplishments and their stated goals.
what adjustments will need to be made. With the
deadline looming and idea implementation in full
swing, students learn accountability, complex task
management, and cooperation skills.

Yes but...how? I can imagine a few readers wringing
their hands at this point. No rubric? Letting students
run the show for a whole week? What if the patient
interviews get derailed with irrelevant questions
or overly exuberant acting? As you might imagine,
integrating arts into academics asks teachers to
relinquish some control over their classrooms.
This is scary. As a type-A planner, I get it. There are
days when I fret over how to manage the creative
process—are they goofing off, or do they just need
space to think outside the box? Or, are these two
processes in fact mutually exclusive? The reality
is that there are days when I don’t think explicitly
about big STEAM projects because I need to focus on
standardized testing.

For me, though, the risks are totally worth it. My
goal is to use the arts to improve my teaching
in three ways: increasing student engagement,
differentiating for multiple learning abilities, and
teaching team-work skills. In fact, I feel that I am just
scratching the surface of STEAM teaching. There
are endless directions I could explore. For example,
I could use common language with the arts faculty
to teach growth mindset. In some ways, it is easier
for students to track their own growth over time in
their arts practice. How, then, can I help students
recognize that their growth is not limited to the arts,
but is present in whatever they choose to practice?

So far, I have used the arts as a currency to engage
my students in math and science. Another STEAM
avenue to explore is how and when to apply
scientific thinking to the arts. I wonder what might
happen if STEM skills cross-pollinate the arts world.
What kinds of design connections could students
make if we asked them to think like engineers
when creating an arts piece? Or could students use
their arts to take a stance on public issues, such as
urban planning, genetic engineering, and space
exploration? With STEAM thinking, the possibilities
are endless!
Google Apps for Education. While the teachers and administration had put a ton of work into being trained and teaching students that year, the fact was that several of the teachers still needed a lot of assistance. For the incoming freshmen, it was still their first year with the Chromebooks. Additionally, since this was my first experience in a rural district, I hadn’t realized how uncommon it was for rural students to have internet at home (or anywhere nearby). Because of this, those students pretty much only interacted with their devices at school. For some of them, their Chromebook was the first computer they had ever used. They were still struggling to learn how to type and how to use Google and I was expecting them to conduct research, write a response, and turn it in—all electronically and all in one period. It was just too much, too fast.

When initially planning for students to work on the computer, I naively thought they’d have no problem working from multiple tabs at once—reading a primary source in one tab, answering questions on a separate Google Doc, turning their assignment in at a third link. It was yet again unnecessarily confusing and complicated. Not only would students get distracted within an assignment like this, they would also end up opening even more tabs with games and social media. They were much less capable of multitasking than I had predicted, even when the multiple tasks were all related to the same assignment. Students who were still learning how to use the computers were completely lost.

As I realized how wrong my assumptions were, I decided to survey my students so I could get a better idea of how they really felt about technology use in the classroom. Surprisingly, they were quite honest.

Over the past three years, I’ve taken a step back from using technology so aggressively and instead have focused on how to use technology to enhance student learning or improve efficiency.

and forthcoming. The vast majority of students recognized that they would need to be able to master appropriate technology use for their future careers (Figure 1), yet did not feel strongly that their teachers were properly preparing them for that inevitability (Figure 2). One student recognized ways in which technology could make his work easier, saying, “Reading from a book requires far more time to find the information you need. With a computer, you can simply type what you need in the search bar and you get all the information that you need.” Other students expressed that they didn’t particularly enjoy working on the computer, especially when it came to just saying things like, “I am less distracted when I read actual books.” Students were generally upfront about the computer acting as a distraction to their learning, with 75.4% of students saying that they found themselves distracted by games and social media at least some of the time (Figure 3). In talking to others in my school, I discovered teachers weren’t using the computers all the time every day because they either didn’t need to or in order to accomplish the goals they set for students or they wanted to spend more time getting comfortable with technology before rolling it out to students. They had much more teaching experience than me and had more quickly realized that the simple addition of a computer didn’t automatically trump what they had been successfully doing for years. Many of them were just getting comfortable using computers themselves and rightly wanted to make sure they were masters of a piece of technology before expecting their students to start using it. Teachers who lived in the district understood the lack of internet access and would try to make sure students had time to do tasks that required a connection while they were at school. At the time, students might have thought that using the computers less in these classes meant they didn’t understand the importance of preparing to use technology in the future, but in reality, these teachers were very deliberately trying to avoid many of the frustrations I was facing in my classes. They put student learning first, and added technology when it fit well and when they felt comfortable with it themselves. Usually this meant waiting until they could attend professional development, collaborate with a colleague, or spend time fiddling around with the technology on their own.

Over the past three years, I’ve taken a step back from using technology so aggressively and instead have focused on how to use technology to enhance student learning or improve efficiency. Instead of thinking of the Chromebook as the answer to everything, I focused on how to use technology so aggressively and instead have focused on how to use technology to enhance student learning or improve efficiency.
I’ve taken this approach to technology use in my classroom, I have seen a transformation in my students. Now that everything is all in one place, students are less confused and distracted. Since I’ve taken this approach to technology use in my classroom, I have seen a transformation in my students as well. Now when I present an assignment or activity on the computer, students rarely ask to do it on paper instead because there are clear reasons why technology use improves the assignment. In my district, students have started getting Chromebooks at the middle school as well, so computer literacy as they enter school as well, so computer literacy as they enter my classroom is rising. I’ve learned not to expect my students to be masters of multitasking when they first enter my room. Rather, it’s actually my responsibility to help teach them how to multitask with technology. This is definitely a big challenge. Confiscating student cell phones when I catch them texting or playing a game doesn’t solve anything because they can easily open a Google Chat or game on their computer screen and appear as though they’re working. Instead, I need to encourage students to try to juggle all of this technology responsibly. Allowing students to try to balance these things and then addressing significant problems when they arise is the best way to help them develop good habits with technology.

I’ve convinced one-to-one computing is the wave of the future for our classrooms. But I also think it’s important for educators to understand when students will actually benefit from computer use. With specific technology standards now in the Common Core and many state standards, it is easy for teachers to feel pressured to use as much technology as possible. I propose that educators ask themselves a couple of key questions before integrating a new app, website, game, or other piece of technology into their lesson (Figure 4). Will student learning be enhanced by the use of this technology? Will this technology reduce time spent on logistical things like grading? If the answer to both of these questions is no, it’s okay to stay low-tech for the day!

At the beginning of this school year, I found myself with another new prep: Concepts of Advanced Algebra. Having a new prep for a teacher can sometimes mean a year of constantly feeling behind without a “baseline” from which to start. Creating homework assignments, assessments, anticipating and responding to student struggles that you haven’t seen before—it can be exciting, but it can also be exhausting. For me, I was excited about having a course in which I could try centering my classroom around carefully scaffolded and rich discussion-worthy problems. This variation of Problem-Based Learning (PBL) moves away from direct instruction and encourages students to author their own mathematics with help from one another. Phillips Exeter Academy has an entire curriculum focused on such Learning (PBL) moves away from direct instruction and encourages students to author their own mathematics with help from one another. Phillips Exeter Academy has an entire curriculum focused on such problems when they arise is the best way to help them develop good habits with technology.

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confident that taking a PBL approach would help students build the thinking skills they need to be successful outside of my classroom.

However, when the school year started, I realized that learning wasn’t occurring like I had hoped. Students were resistant to the new strategy. They were frustrated, and when their struggle stopped being productive I didn’t know what was causing the issues. I decided to change course and try teaching strategies with which I was a bit more comfortable. I wasn’t ready to completely abandon the hope that all students were capable of thinking critically and discussing challenging problems with one another, but clearly what I had going on wasn’t working. I needed to see PBL in action.

Around that time, our cohort was planning our fall meeting in Phoenix—home to 2012 Fellows Mary Chin and Ian Caldwell’s school, Arete Preparatory Academy, which uses Exeter’s problem-based curriculum. Mary and Ian had invited all Fellows interested to come to their school—this invitation perfectly fit my needs.

Through visiting Arete, I wanted to better understand what structures and routines Ian and Mary used to help all students learn in a problem-based setting. Each of these experiences gave us a different lens to view how a problem-based curriculum was implemented in the school.

From seeing the students and classes in action, I saw how conversations and discussions were at the heart of many students’ classes. In the “great lessons” class I observed, students led the discussion around Dante’s Inferno. Even in staff meetings, it was clear that discussion was valued over other learning or delivery styles. This helped me realize that students are not blank slates when they walk into my class—they have had varying experiences with discussion in prior classes. I needed to know more about their experience to ask better questions and find discussions to better understand what discussion skills students brought into my classroom. In addition, I needed to make my expectations for discussion in math more clear. I needed help to build a picture of what a productive discussion includes.

Watching Mary and Ian teach also helped me see how this style of teaching looks in the “real world” and see beyond the theory. Before implementing PBL in my classroom, I had several concerns about whether I would be able to do this with my students. Homework completion was non-existent, and some students were prone to distraction. In theory, I thought Harkness would only work if students did their homework each night and if they had the ability to stay on task for 55 minutes at a time. When seeing Mary and Ian’s classroom in action, I saw that was not the case. Talking to Mary and Ian, they mentioned that not every student does their homework each night and, like most classrooms, there would be a student or two off task while working in groups. It was encouraging to know that students were at those points in the lesson, homework was non-existent, and some students were prone to distraction. In theory, I thought Harkness would only work if students did their homework each night and if they had the ability to stay on task for 55 minutes at a time. When seeing Mary and Ian’s classroom in action, I saw that was not the case. Talking to Mary and Ian, they mentioned that not every student does their homework each night and, like most classrooms, there would be a student or two off task while working in groups. It was encouraging to know that these were things that many teachers struggled with but that did not prevent teachers from having high expectations for their students inside the classroom. Each teacher had different strategies to keep student engagement strong in class. As I watched Mary and Ian teach, I was able to see how their decisions in the classroom helped keep student work productive. For example, while I was there, Mary “froz” the class to capture their attention mid-problem. This technique required students to focus their attention on Mary or another student, clarify a common misconception, and then return to their small group to continue working. These small but significant decisions helped me develop strategies for encouraging productive work in class.

When I returned to my school, I made a few changes to how I implemented problem-based learning in my classroom:

- I was more intentional about building up participation and collaboration skills. After witnessing how omnipresent discussion was at Arete, I knew I needed to do some normalizing specifically around discussion for my class. Using some resources Dr. Sauer shared with me, my class read an article about the philosophy behind problem-based learning and talked about what the classroom norms would look like. From there, I focused on one aspect of what I should see/hear in class and told students I would be taking notes when they were participating in one of the productive ways we discussed. This became a type of “hybrid participation quiz.”
- I broke up class time. I planned out at what points during the problems I anticipated students needing additional clarification, or points where I really needed all students to be on the same page for during the lesson. When it was clear that students were at those points in the lesson, I would implement the “freeze” strategy I saw in Mary’s classroom to get their attention, re-direct or clarify and then allow students to keep working.
- I made space and structures to encourage students to take notes on their learning. When talking to students at Arete, I noticed many annotated their notes in and out of class—a practice that I modeled for students but did not explicitly expect from students. I realized from my observations that I wanted to provide more opportunities for students to reflect through taking notes. Rick Barlow, a 2013 Teaching Fellow, had talked about grading student-self-counterconnections to homework at the 2016 KSTF Summer Meeting, and this seemed like a great way to integrate reflection into my classroom. When I returned to my school, I purchased 25 graph menus that were special “reflection pens.” Each hour, I had students return to their seats for the last 10 to 15 minutes to debrief as a class. This was time for them to grab a green pen and write down notes next to each problem we discussed. I modeled this with my own green marker on the whiteboards around the room as well and provided peer review after the students were given their own reflections at certain places. It was these reflections on their problems that were graded each day.

From going to Arete, I re-realized that learning happens in a context. “Context” covers a variety of aspects of our educational communities, but in this case, I saw how one strategy in theory looks in the context of a classroom. I have long been enamored with problem-based learning and could envision doing it in my classroom, but the actual implementation in my context was rough. Going to Arete Academy showed me how the teachers and community created a context that allowed problem-based learning to be effective. Equally as encouraging was knowing that my students and I could create a context that would make the strategy effective for us as well.

I truly consider teaching an art form: instead of clay, oil paint, or charcoal, teachers work with complex instruction, project-based learning, or engineering design. Furthermore, just like artists visit galleries and share studio spaces to push their thinking about their work, teachers also benefit from similar collaborations. Even within my department, like Mary and Ian, I have observed Spanish teachers to see how they engage students and break down that “fear” barrier students can bring into the classroom. Speaking with English teachers has challenged me to think more deeply about the types of contributions students can make in classroom discussions. While I took a day off from school and traveled to see these teachers at Arete, there are fantastic “artists” in each building from which teachers can learn. My own challenge is to find these teachers closer to my classroom in Minnesota, see these teachers work in their context, and understand how these strategies and philosophies can be adapted in my classroom.

**CITATION**

TEACHERS’ LOUNGE: TEACH AWAY YOUR STUDENT LOANS

BY KATIE WADDLE

Find out how to navigate loan forgiveness programs for teachers.

When I started teaching, I had student loans from both my undergraduate and graduate degrees. I had multiple subsidized federal Stafford and Perkins loans from both institutions, a federal Teacher Education Assistance for College and Higher Education (TEACH) grant, and an institutional loan from my graduate program. I had also qualified for the Assumption Program of Loans for Education (APLE), a California-specific program.

Banks know that they can make a lot of money off of student loans (in a lousy economy many people fall behind on payments), so they are a valuable asset to buy and sell, and as a result I had multiple lenders servicing my Stafford loans. To deal with all these parties, I was completing no less than seven different sets of paperwork at any given time. And yet I never paid a single penny of the roughly $60,000 I owed. (And I’m not in jail.)

I want to make sure to point out that the system is not fair. Math and science teachers (and some other shortage areas like special education) are eligible for Perkins loan cancellation and higher levels of Stafford loan forgiveness; my friends who teach English and history are either not eligible at all or not eligible for as much money. Your benefits will vary based on the institution you attended or the state you live in. I received a special institutionally-based loan, and qualified for a California-based loan forgiveness program for educators. Your credential program or state might not have those benefits. I teach at a low-income school, and your school might not be on the list qualifying for the great service they provide society, but we’re not there yet.

This article will give you information about subsidized and unsubsidized direct loans, subsidized and unsubsidized federal Stafford loans, Perkins loans, and TEACH grants specifically. I am not an expert, a financial advisor, or a wizard—I’m just a regular teacher like you. Official websites out there can summarize all the necessary information for you (see below). If your situation is at all complicated (e.g., you have gaps in your teaching time, you started teaching before 2004, etc.), I encourage you to go to those websites and/or call your lender.

How do I know what loans I even have?

To start with, you need to get organized. When I finished my master’s degree, I was not even clear on what loans I had or what company was servicing them. My loans kept getting bought and sold, and I wasn’t paying attention.

Luckily, there’s a website for that. The National Student Loan Data System (NSLDS) has a record of every loan you got and where it is now (see Resources). If you have a loan that is special to the school you attended, like I did, it will not be on that list. But all direct, Stafford, and Perkins loans will show up there.

I made a big spreadsheet with all my loans to keep track of all the information, and I cross-referenced it to the NSLDS page (see Figure 1). That way I could keep track of all the various ID numbers, logins, people I’d talked to, email addresses, account numbers, and of course, my progress in making everything disappear. This proved invaluable because I needed to keep track of these things for five years.

What am I eligible for?

The next thing to figure out is your eligibility. Each type of loan has different requirements. Are you a math or science teacher? Is your school on the list of low-income schools? It’s NOT only Title I schools. For a math or science teacher teaching at a low-income school, you get a max total of $17,500 worth of direct and Stafford loans (subsidized or unsubsidized). If you have more than that, you will have to start paying the rest, but you should NOT make payments on that $17,500. I am not going to create any problems by trying to summarize all the particulars here; you’ll have to do some close reading on the applicable websites.

Do I just not pay?

You can’t just stop paying, though: you have to get your loan servicer the memo that you are teaching. Your account needs to be “in forbearance,” meaning...
The fact that there are government programs out there to help you with your student loans indicates that 

you are being further compensated (beyond your measly piddling salary) for providing a public service.

principal before I found out they needed the current principal’s signature). But you know, if the federal government needs that, who am I to question it?

I encourage you to be extremely careful with this paperwork. You will still have to submit it five times (or more!), but hopefully it will eventually get approved. You have to get Perkins paperwork for cancellation from your institution.

So You Got Yourself a TEACH Grant

My graduate school colleagues and I found the TEACH Grant to be the most inscrutable of all the loans. While I did not fall in this trap, I had friends who had their TEACH Grants converted to direct loans for the most bizarre reasons. My favorite is a friend who had their signed paperwork returned, the signature circled, with a note that said “no signature.” My understanding is that a different company is servicing the TEACH Grant now, and so I hope these problems no longer exist.

What else is there?

Ask around at your school or the institution where you got your master’s degree if there are state- specific or institution-specific programs. I took advantage of California-based APLE, which I came to imagine as an office somewhere in Sacramento where one person sat all day under a pile of 3,000 manila folders. They processed things years after you submitted them. I didn’t know I had been accepted into the program until at least a year after I applied. They were hilarious to talk to on the phone. And then they periodically at totally random times of year sent checks to my loan company, no questions asked. It looked like the program may be over, although the website seems to be at least three years out of date now. Maybe your state has something like that?

Final Thoughts

I hope that you leave this article thinking, “Man, this is going to be a little tricky!” and also, “I really need to get my ducks in a row,” but at the same time, “I think I know where to start,” and “I’m sure glad all these programs exist.” I emphasized the things that will be difficult about this process because I didn’t want you to face them alone, but also because I know you can handle them. You make worksheets for a living; I think you can handle doing a couple yourself.

The fact that there are government programs out there to help you with your student loans indicates that teaching as a profession is valued. You are being further compensated (beyond your measly piddling salary) for providing a public service.
ABOUT KSTF

The Knowles Science Teaching Foundation (KSTF) was established by Janet H. and C. Harry Knowles in 1999 to increase the number of high quality high school science and mathematics teachers and ultimately, improve math and science education in the United States. The Knowles Teaching Fellows Program, the Foundation’s signature program, awards five-year Fellowships to promising early-career, secondary science and mathematics teachers, and supports them in their efforts to improve education in their own classrooms and beyond. The KSTF community includes more than 300 Fellows who taught science, math and related subjects to over 25,000 high school students during the 2016–2017 academic year. For more information, visit www.kstf.org.

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