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You just completed your first year teaching, what three (3) things guided you in deciding to be a science teacher?

I have always loved finding out the answer to the question “Why?” and science always helped me do accomplish this task.

I have also always had a strong interest in animals. I wasn’t sure if I wanted to be a veterinarian or a teacher, but I loved studying biology. In college I added chemistry as a focus, and I began to feel that I was better at teaching chemistry, because it didn’t come as naturally to me as biology, so I knew exactly what topics students are more likely to struggle with in a chemistry class.

Being a teacher runs in my family. Even though my parents are not teachers, my grandmother and many of my aunts and uncles are teachers. Growing up around teachers, I think I saw how rewarding they found the profession. Even after retirement, my grandma continues to help tutor students at a local community college.

What three (3) things were the most challenging for you during your first year (minus the adjustment to online teaching due to COVID-19)?

Being a high school teacher is difficult when you look young like a high school-

er. I never got mistaken for a student by another staff member, but parents would be shocked when I introduced myself as their child’s chemistry teacher. It certainly challenged my confidence during parent-teacher conferences, but it helps if you just laugh through the comments and try to shrug it off.

I taught AP Chemistry during my first year, and I think an AP course is going to be challenging to pick up no matter how many years you’ve been teaching. There is a lot of difficult material to cover in a short amount of time, and it’s hard to accept that you have no control over what questions your students will encounter. My principal sent me to an AP Summer Workshop, which was extremely helpful in planning for how I was going to teach the course.

I joined an AP Chemistry Facebook page, which has an overwhelming amount of material posted, but was really great for those days when I needed someone to talk to because I didn’t feel like I was doing enough. At the end of the day, even though you have that test looming in the future, you just have to focus on teaching the students what you can and helping them achieve understanding.

Lesson Planning: I love planning, and I am a huge planner, but during my first year I had to limit myself to two-week chunks for planning. I always had long-term goals in the back of my head (I want to complete 3 units in first quarter, etc.) but I quickly found out that with all of the interruptions and schedule changes (and pandemics), and the fact that students might need more or less time on a topic or activity than you thought, your plans are only good for about two weeks. You definitely have to be flexible as a teacher and understand that it’s not the end of the world if you have to spend two days on an activity instead of one.

What strategies did you use during COVID-19 virtual teaching to make your lessons engaging? What resources did you use during that time, e.g. Flip Grid, etc.?

I explored a lot of resources during COVID-19, but stuck to a few core programs and websites because I didn’t want my students to feel overwhelmed. For introducing content, I preferred pre-recording and posting videos on EdPuzzle so that I could know when students watched the video, and so that students could pause and rewind to watch the video at their own pace. I used Screencastomatic to record and post my videos when I did notes or introduced a new topic. I used iMovie to splice together videos that I would record on my phone when I did labs in my kitchen.

EdPuzzle is a great website for assigning videos for students to watch. You can track students’ progress and add questions for them to answer during the video, and you can prevent students from fast-forwarding as well. I did a few small group activities using FlipGrid to let students reflect and respond to one another. I used Google Meet about once a week in my classes to go over questions and sample problems and talk to my students. I let my students work in groups a lot when we are in school together, so I also created small group Google Meets for students to use during some activities. I could log on and off to check in and see if the group had any questions. Ck12.org was another resource I used. Their chapter sections are smaller than those in textbooks, and they have questions that correspond to each section that you can assign as well.

With online learning, I was limited to 30-minute classes, so I could use ck12 in a class period without students feeling overwhelmed. For my AP students, I used a program called Albert.io. It tracks students’ mastery of topics, and my students loved the detailed feedback they got after each question.

For my assessments, I used goformative.com. I love that it has a “show your work” question type so that I could give students partial credit for problems involving calculations. We started remote learning just as we were learning about the mole and mole conversions!

Where do you teach? What do you teach? Describe the school, it's resources and anything else that makes it a great place to teach.

I teach at Carroll High School, a private Catholic school in Dayton, Ohio. I teach an introductory level chemistry course and one section of AP Chemistry. Starting in the fall of 2020, I'm excited to say that I will also be teaching a microbiology course. I came into a fantastic science department. The department heads are so dedicated to maintaining a high standard of science education at the school. They have been extremely helpful, always checking in to make sure that my first year was going well and making sure I had everything I needed and more.

The department heads put in so much work to allow students to present incredible research projects on Science Day at the school, and provide many opportunities to allow students to earn recognition for their work. My predecessor left behind many materials and labs that I have been able to use and reference. These materials were especially helpful for AP Chemistry.

The Carroll community is really like a family, and I feel like I hit the jackpot my first year of teaching. My coworkers are so much more than coworkers; they've been incredible mentors, friends, and have become a second family to me. I was drawn to private school education, because it is important that you feel like you belong to a community where you work, and to me, faith is an important quality I look for in a community.

There are a lot of great things about where I work that make me proud to be a science teacher at the school: we've just installed two new science labs in the school, I've had the opportunity to apply for grants to purchase materials to enhance inquiry learning in the classroom, there are numerous opportunities for students to develop and showcase research projects and earn scholarships and special awards for them, and there are several math-science co-curricular activities that

students can be a part of including iGEM, TEAMS, and Science Olympiad. What is most important to me though is the community the school has formed that features amazing students, parents, faculty, and staff.

How did you build relationships with your students?

The best way to build relationships with students is to be yourself. If you are yourself, admit your mistakes and own your faults, your students will be able to be open and honest with you. I'd heard that it is easiest to start the year as a "harsh" teacher and ease up throughout the year—a "Respect is earned, not given" mentality—but that style would not work for me. I'm not a very scary or intimidating person, and I am not going to pretend to be scary or intimidating to my students!

Chemistry can be an intimidating subject for high schoolers, and I don't want students to feel like they can't ask for help when they need it. When we went over the syllabus on the second day of school (day 1 we played a game that is kind of like the "Heads Up" app to emphasize the importance of asking questions), I emphasized my expectations for the year. One student said that I "seemed pretty laid back" and she liked that (which I found funny because I was still filled with nerves and excitement about my first year "on my own") and I was honest and said, "I like being nice and laid back, too. If you all are able to hold up my expectations throughout the year I promise that won't change. If not, then I might have to become more strict." My students met and exceeded my expectations.

Larry Page, a co-founder of Google, says, "You treat people with respect, they tend to return the favor to the company." Never forget that students are people, so you need to treat them like people. If you give students respect, in most cases they will give it right back.

In what ways did you differentiate lessons for your students?



PHOTOS COURTESY MEGHAN MULLIGAN

Megan's classroom features student work everywhere.

It is rare that you will be able to reach all students in one lesson, because in a class of 30 students, you have people who learn best in 30 different ways. Some students just need to take notes once, and they are good to go. Others need to manipulate models, draw pictures, and move around the room to understand it. The best teachers I had were those who taught the same thing four times in four different ways, so I try to do that as well.

In a given unit, I might have students take notes by direct instruction maybe three times, because there are students who learn best by taking notes! I'm not going to just give notes and give a worksheet, though, because then I've failed to help 90% of the class. In a five-day week, I try to do five different types of activities. I try to find models, games, and manipulatives for the class to use, and if I can't find them, I make them (the laminating machine has become one of my best friends at the school). Making stations around the room for groups to visit gets students up and moving.

Having students make comic strips about a topic gets them thinking about the topic in a different way, and when they make connections to something that

means something to them, sometimes that topic clicks.

I try doing a lab once every two weeks so that students can see, feel, and smell the topic we are uncovering. Some of the labs are messy and take a lot of prep, like doing a flame test while studying emission spectrums, but others are dry and easy, like “Can you color a mole?” where students use chalk or a crayon to draw a picture and determine if they used a mole of chalk or crayon to create that picture by measuring the difference in mass.

During all of these activities, you still need to differentiate for individuals to meet their needs, but by doing a variety of activities, you often find a method that works best for that student and can lean into that skill while doing other things that make differentiating a lot easier. One really simple example is a kinesthetic learner I have in class. If he becomes disengaged, he puts his head down and will fall asleep, even though he can have endless energy if he is interested in something. I have to get him moving in some way to avoid him becoming disinterested. I always place him by a counter in the classroom so that he can stand up when we take notes so that he can move more during the lesson. He can pass papers out while I explain something, and even though he looks busy and like he is not paying attention because he’s passing back papers, he hears more that I say than he would if he were sitting at his desk.

Another thing that I’ve found helps most students is teamwork. Sometimes the best person to answer a student’s question is another student. Most of the things I do in class involve students working as a team. I can walk around the room and check in on the teams and individuals, and if a student feels confused, they do not have to sit there and do nothing while they wait for me to come to them. Sometimes there is a question that no student in the team knows the answer to, but when I come to the team, we can work through it. One of my favorite regular team assign-

ments are POGILs from Flinn Scientific. These activities are fabulous for helping students make connections.

What teaching resources did you use to guide your teaching?

I’ve found NSTA’s website to be extremely helpful in finding activities and resources to enhance student learning. Whenever I feel stuck, like I can’t think of an activity to help students, I usually check out their website. Many of the activities I use come directly from that site, or I’ve modified it based on what I find.

American Association of Chemistry Teachers (AACT) is similarly helpful, and I find lessons to use or modify for my classroom. Having a few go-to sources is really important when you are developing your lesson plan for a topic for the first time.

BreakOut EDU has been another resource that my students and I have fallen in love with. I was able to purchase 4 BreakOut boxes with a grant I applied for last fall, and another teacher in my school was able to apply for a grant to purchase four more. These are one of the activities that I feel has differentiation already built into it, so students are already accommodated!

At the NSTA Area Conference in Cincinnati, I purchased the *Uncovering Student Ideas in Physical Science* formative assessment probes, and I look forward to using those next year at the beginning of units. Flinn Scientific POGILs have also been a resource I regularly use in both intro and AP Chemistry. I absolutely love POGILs and I enjoy listening to the student conversations that occur as teams work through the activities. Another resource I have gone to for advice and support is the AP Chemistry Teachers group on Facebook. Finding one of these professional groups on Facebook to join that is specific to your content area is extremely helpful because it is nice to have a group to go to that really understands and have lived through your struggles.

It’s hard to describe the anxiety you feel when your students are taking an AP

test. You aren’t worried that they won’t do well because you know they can succeed, but you still feel this indescribable anxiety, and it is nice to have a group that knows exactly what you are talking about when you can’t find the words to express how you feel, and who can reassure you and share their wisdom.

What project/lesson are you most proud of that you implemented during your first year of teaching?

I have my students do projects each quarter to give them an outside-the-box activity that can boost their grade if they aren’t good test takers, and gives them an opportunity to focus on something that may not be directly related to chemistry.

For the first quarter, I did a “Meet the Scientist” project where students researched and made a creative product about a minority scientist of their choosing. I had students make podcasts, children’s books, websites, journal entries, scrapbooks, and other unique products about their scientist. Students then went around the room in groups and did a sort of gallery walk of all the products.

In the second quarter, I did a project that was a little less intense and more straightforward because I know students have exams to worry about. Students decorated a periodic table element tile and became an expert on one element to present to the class. I enjoyed this one because I could then decorate my classroom with their tiles.

Third quarter, I gave students a “What if/ I wonder” project where they thought of any question that begins with “what if” or “I wonder” to research, answer, and develop an infographic. I got some amazing products, and it was really cool to see what students thought of. Some were outlandish, like “I wonder how much Ramen could be made with all the water in the ocean?” or “What if all the water on earth was Jell-o?” and some were more serious, like “What if time travel were possible?” or “I wonder if a 100% sustainable lifestyle is currently possible?”

With remote learning and the anxiety students felt about the transition, I decided not to implement a fourth quarter project this year, but I was going to have students make a digital scrapbook of chemistry concepts that we have covered as they relate to “real life.”

During our unit on bonding, I had students develop a children’s book that addressed the three types of chemical bonding. The project ended up taking more class time than I anticipated, but I was so proud of the products that resulted from it. Students were able to choose a partner to work with, or were given the option of working alone. In the end, everyone shared their children’s books, and we even made and voted on superlative awards for the children’s books. This project was one where I noticed numerous “light bulb moments” that students had as they developed their books.

What goals have you set for yourself for your second year of teaching?

Next year and moving forward, I want to have more communication with parents about what we are doing in class. The communication I have had with most parents has been positive, and I think that increasing that communication will definitely be beneficial, especially after having done remote learning this past year.

I would like to work on making my labs more inquiry based. During my first two quarters, I did more supported, guided labs to get students comfortable with equipment and handling materials. During the third quarter this year, I was able to do a few inquiry-based labs, but then when we moved into remote learning during the fourth quarter, I went back to heavily-guided labs because I felt my students were extremely overwhelmed trying to get the hang of this new way of learning.

For my AP class, I am going to try moving more towards a flipped classroom set-up; I found that this year my AP class actually really liked having online, recorded lessons because they could pause and rewind and go through the notes at



Students collaborating in Meghan’s class.

their own pace. I think this would alleviate the pressure of trying to “cover” all the material in class, as well, and give more opportunities for students to work through problems and ask me questions in class.

What was a lesson you learned from one of your students this year?

If they feel like giving up, it means they need you to believe in them twice as hard. Atomic orbitals and electron configurations was the first topic I went into that I knew would be difficult (but not impossible) for students to grasp. I put together about 100 booklet-style notes packets with sections for each of the orbitals, Hund’s Rule, Pauli Exclusion Principle, and the Aufbau principle. It took a long time to fold and staple these packets by hand, but I knew that the organization of the packet and the fact that it was handwritten (and I was hand writing on the board as well to make sure that I did not rush through this topic) would force students to engage during these notes more than the typical guided notes I would use during direct instruction.

The second time that we pulled out these note packets in class to work on, about halfway through I had a student put her head on her desk and say “I can’t do this. It’s too much.” At first I was re-

ally peeved; it was one of those moments where I felt that I put all the effort I had into preparing a lesson and making this as painless as possible, and this student wasn’t even going to try. But after a deep breath, I recognized that this student had tried. She’d given it her all, but this particular topic and this particular way of learning was not her style. She is a bright student who struggles to recognize her ability and intelligence. I knew she would understand this topic with more time and different activities that were planned for the week. So I didn’t ask her to put her head up; I didn’t make her feel bad; I just let her do what she needed to do and rest.

The next day, I was handing out copies of the notes that I had printed for students who were absent. I gave this student a copy as well, saying, “I know notes felt super overwhelming for you yesterday, so I made you a copy of mine so you still have them. I think you are going to do really well with the activity we’re doing today.” She visibly teared up and said, “Thank you, you are so sweet,” and she was able to fully participate in the activity and begin to understand electron configuration. If a student ever feels like giving up, show them that you are willing to help, and they will feed off of your confidence for them.

What is one piece of advice you’d give to first-year science teachers?

Find your support system in your school. Don’t be afraid to branch outside of your department and get to know others. Collaborating with other teachers is so fun, and sharing activities and student work is a great way to find the strengths of your students. If you are having trouble with a student, talk to other teachers to see how they have come to understand what works for that student. Students often find a teacher that becomes “their person.” If you talk to that teacher, they can often help you, give advice, or be a third party if you need to talk to the student to intervene about grades or behavior. Teaching is a team sport!