

WEBVTT

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Jessica Juliuson: The engine biotech experience. Thanks. Sarah.

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Jessica Juliuson: the Mgen biotech experience teacher, Roundtable series. I'm Jessica, Julian, and I'm the director of community and strategy for the Ab Program office. And as always, it's just a pleasure for me to be able to host this roundtable today. These are some of the most fun things that we do as a program office.

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Jessica Juliuson: So we're going to ask you to just introduce yourselves in the chat. Say a little bit about who you are and where you're from, and as a little bit of background for those of you who don't know the A be teacher. Roundtables are designed for our incredible Ab teacher community from around the world as a chance to learn from experts and from each other about topics of specific interest to science and biotechnology teachers.

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Jessica Juliuson: We hope that you find this series valuable, and if you do, please feel free to tag us in social media. If you want to share your thoughts. You can use the tag at Ae prod office.

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Jessica Juliuson: And today's roundtable is focusing on strategies and resources for engaging younger students in hands-on and virtual biotech experiences, with examples of approaches, resources, and tools that can help you engage younger students, either within the classroom or outside of school settings, and if you have great ideas of your own, we want to hear them, so please share them in the chat. This roundtable will be recorded and posted on our website

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Jessica Juliuson: and registered participants will also receive a transcript of this discussion and a copy of the material shared today. So we will hopefully have some time for audience questions at the end of the presentation. So, please, we encourage you at any point to put your questions in the chat. and we'll be keeping an eye on that, and we'll be sure to ask your questions at the end. So I'm going to jump right in by introducing our fabulous panelists today.

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Jessica Juliuson: First, we have Caitlin Calais, who, a vehicle recently graduated from Bellerine University in Louisville, Kentucky.

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Jessica Juliuson: As a biology. Major Caitlin has a deep love and appreciation for science and for the wonders that can show us for her honors undergraduate thesis she collaborated with a to bring labs into middle school classrooms in the us through exposure to laboratory equipment instruction combined with a socio-scientific perspective. Students changed their outlook on science. It was an incredible experience that would not have been possible without the help and mission of engine.

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Jessica Juliuson: Caitlin's goal is to help more students enjoy science, to see how it impacts their daily lives and to feel like true scientists, so welcome, Caitlin. We also have with us today Marlene Orientos, who comes to us from Abe Rhode Island, and Marlene teaches eighth grade science at Jf. During middle school, since changing careers from academic research, and we always love to hear that we always love to welcome folks from business into the classroom. So thank you for doing that.

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Jessica Juliuson: She is also an immigrant who firmly believes that education opens many opportunities. Marlene is passionate about instilling a love for learning and providing authentic science-related experiences for students. 2

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Jessica Juliuson: and last, but certainly not least, we have Jennifer Conklin Frank, who is the head of educator programming and engagement at Harvard University's Lab Exchange, where she supports science educators globally through customized training and professional learning programs. Previously Jenny has served as the director of Educational programs in New York and has also worked as an elementary principal professional developer and trainer, secondary science teacher. And for the

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Jessica Juliuson: buffalo Zoo as a program coordinator. So we'll definitely need to hear more about that pathway Jenny. With her broad experience, Jenny brings a wealth of knowledge and expertise from the education sector. So just a wonderfully rich panel we have with us today. So I'm going to get started by having all of us get to know a bit more about our panelists and their journeys as educators. So, Marlene, I'm going to start with you. for those participants who don't know you

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Jessica Juliuson: please tell us just a little bit about your pathway into science teaching and for school and students, and how you got into biotech and maybe

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Marlene Barrientos: thank you, Jenny, yeah. So Hi, and welcome everyone. I'm Marlene Barrie Angeles. So my husband's company moved us to Rhode Island from Florida, and while I was searching for a research position of France suggest that I should apply to teach science because there was a need for science teachers.

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Marlene Barrientos: So I started as a substitute teacher, and during this time I was introduced to a by a high school teacher, and midway through the school year one of the high school teachers retired. So I was offer his job. So I decided to take the teaching job for a number of reasons.

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Marlene Barrientos: At the time academic research funding became difficult to come by, and as a molecular biologist. I'm very passionate about science, and my goal in life is to make a difference. So I thought, as a teacher I can accomplish both.

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Marlene Barrientos: Still a law for science and my students. They make a difference in their lives. I also fell in love with the present profession, and this is how I went the education route. So currently, I'm teaching it great science. At during middle school we are a title, one school, and serve a very diverse community

students with a wide range of socioeconomic backgrounds.

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Marlene Barrientos: and if most of my students decided to go to college, they'll be the first ones in their families to attend college.

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Marlene Barrientos: So why is it in point to bring bio tech education to this earlier grades? So I think grade 8 is pivotal great. By the time they get to eighth grade. Some have lost interest in science, so it is my job to motivate them again, and so I show them that science is more than just learning facts. And at this point, students have a misconception of what a scientist is. So they often think of a male with crazy hair and a lab code.

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Marlene Barrientos: So I show them that how science plays out in the real real world. And Abe is actually a perfect venue because it is hands on real world labs aspect. And it makes teaching biotech much easier and more engaging and aid labs creates student interest in biotechnology. And so a lot of time becomes something the students look forward to.

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Marlene Barrientos: So it it. It helps me inspire students to go into the field, even if they're not interested in science, and it helps me tell the students why we are learning this, why is it important? So this students will move to high school and citing about their future and their pathway, or what pathway will take introducing a stem career early on, is very crucial.

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Jessica Juliuson: I love hearing that, and I love hearing. that you love doing that with eighth grade students which for those of us who have top middle school or lower secondary students, it's definitely a unique love, and not everybody has the the heart and the stomach for that. And so I love that you're introducing careers so early as well. so thank you, Marlene and Jenny, how about you? what an interesting bio you have! And what was your path into science, teaching school leadership and your current role with lab exchange.

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Jenny Frank: thank you so much. I just want to say how honored I am to be here today. and to get to learn from all of you. so yes, I definitely do not have a traditional path to the classroom as an educator. I began, believing that I was going to be a field biologist and I actually am from Canada, the and

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Jenny Frank: there's like Canadian Michigan border. So I went to school in Canada But I also attended University in Michigan on the border, so I had a really interesting opportunity when I was in and university, which was that I got to intern for the Federal forestry, the Canadian Federal forestry, and work on a project that was around genetically altered viruses and

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Jenny Frank: insects as a way to, you know, prevent the spread and to to control populations. And my job was to test the effect on the aquatic microbial environment. And I know you're all thinking to yourself what an incredible opportunity! Why would she leave such a thing? And Quite frankly.

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Jenny Frank: it was because I was lonely. and and I enjoyed the work. But I I just felt like there was something missing, and I had always taught. I I danced all of my life. I taught dance classes. I I did other kinds of things working with learners and students. And so, you know, and my mother was a teacher. Let's be honest. Your mothers have big poll And so they encouraged me, and I went to teaching college, and I absolutely found my. I had like a learning epiphany I was like, this is where I'm meant to be. This is how

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Jenny Frank: I meant to do what I meant to do for the rest of my life. And so when I got out of Teachers College, I I knew that I I wanted to be kind of in the field, and I wanted to be in the classroom, and I landed like the best job ever which was working at the Buffalo Zoo And every day I got to work with animals, work with people that were just excited.

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Jenny Frank: and I remember I programs from 2 year old cub clubs all the way up to adults talking about animals and conservation and the environment and

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Jenny Frank: the excitement that people had to learn and be exposed to animals that was thrilling. But the compassion right like.

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Jenny Frank: you know. How do you know how many people are afraid of snakes? And really they're only afraid of snakes, because they've never had the experience right? And so there I am promising them. I swear it's not slimy. I swear right, touch it, experience it, and I will tell you 95 of people walked away from that experience, completely changing their mindset. Right?

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Jenny Frank: And I think that that's what science can do. It can open this entire world of curiosity and excitement. But it also is just so many opportunities to change your minds and to change your perspective and and your role right in the natural world and and our citizenship And so.

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Jenny Frank: after the Zoo, I found myself in middle school and high school teaching biology, and I made a promise to myself that every single day I was going to ensure that my learners had success, and I decided that success was way. More than just academic success. Success was leaving with a smile on your face, with, you know, a a happy heart, And and feeling like you had

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Jenny Frank: that learning moment where you change something about the way you think and that's kind of where I just really fell in love with.

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Jenny Frank: you know, exploratory learning, inquiry based learning hands on learning whether it was, you know, using technology, and getting students that opportunity to just explore what interests them or the hands on physical experimentation, and I think that's kind of what landed me at Lab Exchange is like

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Jenny Frank: the mission of being able to to go around and say.

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Jenny Frank: I believe we believe that science is a right. Everybody should have equal access to science, education to education period, to be able to say that every day as a mission statement is so fulfilling.

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Jenny Frank: and then to be able to create a platform where kids really get real life experiences access to career narratives, hands on experiences, using virtual labs that they might never get to experience, because they are unfortunately in the wrong, space or place and time right? Their school doesn't have resources that I get to help change that And so that's kind of how I came to be. That's how I'm here today.

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Jenny Frank: And and again, it's kind of like what? What? What fulfills me.

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Jessica Juliuson: I love that, Jenny, and I love that you're talking about. It's more than just academics. It's about the joy it's about the hands on it's and this this kind of call to equitable access, you know, as our world becomes more immersed in stem and in science, in general, science, literacy is something that gives people access to their world. And so it's really necessary that we're opening doors for every student.

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Jessica Juliuson: which is what we're talking about today. And that kind of brings us to us, Caitlin, because you're really at the beginning of this career journey and you've made this choice to kind of get engaged with lower secondary students. So can you tell us a little about your graduate program and what interested you in kind of entering this world.

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Kaitlyn Kalehuawehe: Yes, and like both Marlene and Jenny said, thank you all for being here. I'm very excited. I never thought that I would get this opportunity to be on a teacher roundtable, especially because I'm not a teacher myself, but like, Jessica said. I just graduated from Bellerman University, and I was part of the honors program. And with that we had the opportunity to complete an undergraduate basis where we basically just got to

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Kaitlyn Kalehuawehe: do research and explore a question. And I am a. I was a biology major, and most of the other kids went the more like a lab and like research base. But I kind of wanted to challenge myself and try something new. And so I kind of came to the question of How can we make learning science more fun for students, because I was kinda like looking back on my own personal experience.

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Kaitlyn Kalehuawehe: And I was like looking back towards middle school and high school, and I was like I fell in love with science. But, like my friends, they kinda like sell off, and they didn't see the joy that I did, and I was like, well, how can we change that experience and make it more fun for them?

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Kaitlyn Kalehuawehe: And so, with the help of my advisors. One of them was actually Dr. Currington, who is actually here today in this little round table with us. I got introduced to a Ve. And so with that, I kind of

worked in collaboration with them.

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Kaitlyn Kalehuawehe: and we took some of the Abe lessons, and I took my own personal experience, and I was able to actually go into the classroom and look at student engagement and kind of give these students an opportunity to kind of like see science. And how I did and like give them opportunity to

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Kaitlyn Kalehuawehe: see what they could potentially be so like me going in. Be like, hey? I use this in the college lab, and that this is what I just did last week. But now you're getting to do it in middle school, and you know the kids absolutely loved it, and and also challenged me because I wasn't an education major. So there was a little bit of like the learning curve for me, too. So

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Kaitlyn Kalehuawehe: I was learning alongside the students of like, oh, how to create a lesson plan, and how to put this stuff together because I had that science background. But, you know, putting it all together to kind of like create my thesis was like a fun and exciting challenge. But overall, I was just excited to kind of show these kids this opportunity of silent science. And just

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Kaitlyn Kalehuawehe: I don't know. It was just a lot of fun, and I'm very excited to be here. And so that's kind of my journey.

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Jessica Juliuson: And I love I love hearing about that connection of your graduate program to lower secondary students. And that's something that doesn't always happen, that kind of opening of doors across all these low levels of education. So it's exciting to hear about your experience, and we'll learn more about it a little bit later. And so before we dive into your presentations, I just want to ask. I mean, just to kind of name, the challenge that that many people name, which is, it's too hard to bring this kind of complex

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Jessica Juliuson: content to middle school students or lower secondary students. So what do you see as some of the challenges to introducing younger students to biotech and maybe, do you have any advice or insights that might help address those challenges, and maybe I'll start with you, Marlene, and and we'll move around through our panel.

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Marlene Barrientos: Alright, thank you. Alright. So actually, to be honest with you. I was really excited when I was in my school that selected to be part of the pilot program, but, on the other hand, I was like nervous and and thinking how I'm going to introduce this complex topic, and

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Marlene Barrientos: tools and equipment to the students. I have never seen seen it before. So the entire terminology, the skills, the live equipment, it's all new to them. It's foreign language.

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Marlene Barrientos: So the way I deal with the challenges they brick it in digestible chunks.

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Marlene Barrientos: and I smo, and I also moved a very slow paste.

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Marlene Barrientos: So I introduce the vocabulary I model, and then every time I will introduce something new. I always check for understanding, because I want to make sure that just not because I'm saying it. Do they do all of them understand. So I had many checkpoints

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Marlene Barrientos: to see. Do they get this? And do it? Does everyone get it?

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Marlene Barrientos: So they have many different ways to check that with, because at the age where they are, they're very concerned about what their peers think of them. So I will do like a white board, and so that only I will see them their responses. So that will give me a clue of where everybody was, and if the majority got a certain question wrong. They have to go back and

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Marlene Barrientos: revisit that topic again. So it was a lot of modeling, checking, understanding, and very important. Knowing my students strength. By the time we got to this point I already knew

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Marlene Barrientos: their strengths, their struggles. So I was able to differentiate activities. So it was the same learning goals. But I assign driven activities to certain students. So and also I constantly reminded them that the stuff that they're learning it's something I learning college.

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Marlene Barrientos: and the fact that they are learning this stuff right now it is. It's remarkable. So I kept repeating that to them, and the fact that it is something new, and they were doing an amazing job and then letting them know that because it's something new, it is okay to make a mistake.

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Marlene Barrientos: because even though I was a little bit concerned, because it's a loan equipment responsible for it.

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Marlene Barrientos: But they were actually quite responsible. And the fact that I told them. It's it's something. So out of your mind, something you never seen it before. And it's okay. So if you make a mistake, I did not over, reacted. I walk them to step by step and go back. And there are times that I actually had to hold the pipette with my hand and walked

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Marlene Barrientos: them through it. And so it's a lot of patience and understanding. And then we like making them feel safe.

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Marlene Barrientos: and then remind I was their biggest, your leader, and reminding them that I was there to support them and the daily encouragement. And I was feeling very proud of them that they're learning this at this age, and something I learned when I was much older. So that's how I went through my challenges.

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Jessica Juliuson: It's so. it's so important what you're saying about stem identity, and that the way that they're experiencing this is to feel proud, to feel honored, to feel like they're it's this kind of neat opportunity that they have rather than You're not good enough to access this, or you can't handle this kind of equipment that that stem identity is formed so early and so helping them see themselves as responsible, able.

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Jessica Juliuson: unique and and able to access. This kind of special content is, says so much about the kinds of messages you're setting so early. Jenny, how about for you? I know you've talked a lot about differentiation at Lab exchange and thinking about different entry points for students. So what challenges might you have anticipated? And and how are you thinking about addressing those? I cannot agree more. I think that in middle school especially.

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Jenny Frank: you know, learners are transitioning from elementary right. So immediately they're exposed to this science content, which I think they internalize is much more complex, much more abstract.

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Jenny Frank: And it's a confidence killer if you think about it right. All of a sudden you start to hear words like, Well, I'm not good at math. I'm not good at science, and which is bizarre, because, could you imagine students going around saying, I'm not good at reading, we would never accept that. But for whatever reason in our society, we kind of let that slide. I never did. By the way, I was like, you're good at everything. You just got to put your mind to it. But I think that perception right.

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Jenny Frank: seeing yourself in science, seeing yourself as having ability is really what I felt like. I had to struggle with every single day and from a teacher perspective, though I also think you know I'm myself personally is that I never gave kids enough credit

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Jenny Frank: and you know that kids can do anything that they put their minds to, and I firmly believe that. And I'm going to give you 2 really good examples. Number one. When I worked at the Zoo, 2, 3 year old kids, 4 year old kids

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Jenny Frank: are naming off types of dinosaurs. Think about how many kids you know that can name off an incredible dinosaur name that I can't even spell as an adult, right? And so that's incredible to me. A second idea. Harry Potter came out. Look at how many kids who, you know

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Jenny Frank: we're just learning to read. We're walking around with a book that's probably bigger than most of the books I've read in the last couple of months. Right? And they persevered, and what was the thing that they all have in common? It was complete



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Jenny Frank: curiosity, interest, immersion. They just were so fascinated, so engaged by that topic that they were willing to do whatever it was, in order to learn it and and seek out how to to to get to where they wanted to be. And so when I was talking earlier about success in my classroom, that was one of the things that I really worked hard on was, am I

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Jenny Frank: finding ways to give kids engaging and relevant topics, right things that really matter to them? And that's what biotechnology does. Right? Biotechnology is about medicine. It's about the environment, it's about your natural world like, it's real life application of science. And that's a low floor for kids to enter right? They've got

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Jenny Frank: opinion about things. They have an experience, they have a connection. And so for me, I think that biotechnology is the context, the context that educators can use to get kids to really invest, and then to start to ask those questions and then really start to get to the heart of that complex and abstract science.

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Jenny Frank: so again, those are my, you know, my personal experiences. with with barriers. Obviously they could kind of stem from me as an educator.

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Jenny Frank: forgetting and regularly reminding myself that kids can do anything right as long as we're there to support them. And just like Marlene, said, champion them along.

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Jessica Juliuson: I love this. And we can hear there's definitely a common theme kind of running through. some of these ideas and challenges. Caitlin, how about for you? You've been most recently a student yourself. what kinds of challenges did you either experience yourself? Or did you see in the students that you were working with? And and how did you kind of address those?

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Kaitlyn Kalehuawehe: Well, for? Well, one of the challenges I had was like a time constraint thing, but that was just because of like working with the working with the teacher and finding time in my own schedule. And you know the having proper time and resources is a big thing in schools like, if Abe wasn't a thing I wasn't.

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Kaitlyn Kalehuawehe: my thesis wouldn't have been possible at all. And so I think it's really important to like Jenny and Marlene said to champion the students, but we also have to champion the teachers and provide them adequate support and resources, and it doesn't have to be like lab grade equipment. It can just be like simple lesson plans that they can, you know, just introduce the topics and just kind of students. Just talk about it, because I saw that

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Kaitlyn Kalehuawehe: while the kids were really like using the pipets and doing all that stuff, they were just talking to each other and talking to me, talking to the teacher and you just kind of like. Let them run wild and like you just have to let the students ask

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Kaitlyn Kalehuawehe: any and all types of questions, no matter how ridiculous they are. Like I had, like I had kids asking me if they could make green babies, or like dinosaurs and stuff like that. And you know you just like let them go and let them go crazy, because, like we've all said like their curiosity is what guides them and what keeps them engaged. And then that's how they make those personal connections with science, because they're like, maybe I can do this. Maybe I can really challenge myself. And I really

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Kaitlyn Kalehuawehe: a personal challenge of myself was that I was kind of confronted with my own bias, like I didn't think the students were going to catch on as quick as they did, but these students quickly proved me wrong, because they wanted the challenge of like learning about this new topic and learning about biotechnology, and they were ready to face it head on. And they were like, Oh, I'm going to work through this problem, no matter what like, if they were struggling with

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Kaitlyn Kalehuawehe: the technique or didn't really kind of address the topic. They kind of kept working at it until they got it. And so

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Kaitlyn Kalehuawehe: that was really mind blowing to see. And then, yeah, I was just kind of blown away by them. So

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Jessica Juliuson: I love that. And I I think it's so important as well. You'd raise this idea of conversations about science and the fact that. And a lot of recent research has been kind of highlighting the fact that how students are either encouraged or shut down during those conversations about science can make all the difference, and whether they want to keep going

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00:26:12.170 --> 00:26:37.170

Jessica Juliuson: or how they see themselves in science. And so some of those casual conversations about how would you even do that? Are where students start to build that interest, and and how we're encouraging and supporting all of our students to be part of those conversations is so key And so before I see we're already a little over time. This always happens. But we're going to dive right into the good stuff. Now, which is our examples. and so I wanted to. Actually I think I'm going to be sharing

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Jessica Juliuson: from Marlene. So I'm going to share the screen. And Marlene is going to share with us how she has approached, introducing both biotech and careers and careers and concepts with her students. through a be so, Marlene, you just cue me when you're ready for me to to advance. This lives.

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Marlene Barrientos: Okay? Alright. So I'm going to be walking you through my biotech or a journey. So next slide.

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Marlene Barrientos: So, how do, how do we connect students to

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Marlene Barrientos: opportunities and skills? So my students, we're actually quite lucky to

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Marlene Barrientos: participate in the A volunteer program where guest speakers from Mjen share their pathway to science careers and provide an overview of the work. So I found that this is quite quite important, because this volunteers

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00:27:36.900 --> 00:27:52.659

Marlene Barrientos: come from very diverse background, and not all of them actually had a direct pathway to the job that they have right now. So it is a very important for my students to see that others

94

00:27:52.770 --> 00:28:03.289

Marlene Barrientos: have struggle just like they are struggling right now, and they were able to do it. So I want them to see the possibility. And also it's very important for them to see others that look like them

95

00:28:03.490 --> 00:28:20.679

Marlene Barrientos: and see that they there is a way to do it, because for most of my students they are the first ones that they will be attending college. So whenever I share a college experience with my students, I often start when you go to college.

96

00:28:21.020 --> 00:28:25.550

Marlene Barrientos: because they probably do not hear that at home and

97

00:28:25.850 --> 00:28:40.330

Marlene Barrientos: I also share my with my students the struggles that I had to overcome as an immigrant. So my students also have this misunderstanding that professionals never had any struggles that they we get. We got where we are

98

00:28:40.330 --> 00:29:01.150

Marlene Barrientos: quite easily, and that's not the case. So I want them to see that there is some that have struggles, but we overcame all those challenges, and we are where we are because of the work that we put in. So the road to where I am is was not an easier one, and I share that with my students.

99

00:29:01.180 --> 00:29:08.170

Marlene Barrientos: I also often repeat that how important education is, and how it's going to open many opportunities for them.

100

00:29:08.570 --> 00:29:23.599

Marlene Barrientos: So this year we were very lucky to participate in the secondary pilot program. So with lawn equipment and reagents, I was able to provide this fantastic, real life lab experience for my students.

101

00:29:23.760 --> 00:29:45.010

Marlene Barrientos: And here's I have a statement from to my students. And so this is why they said about the experience. So one said eighth graders can benefit from this, as they will almost be in ninth grade, and being able to choose what costs they want to do. Introducing this to them, helps them to come to decision.

102

00:29:45.090 --> 00:29:52.460

Marlene Barrientos: and another student said it was fun. And I felt like I was learning something that was useful

103

00:29:53.370 --> 00:29:54.580

Marlene Barrientos: next slide.

104

00:29:56.540 --> 00:30:09.520

Marlene Barrientos: Alright. So how do we introduce back technology to younger students? So it a, it requires to be able to simplify concepts and also make it relevant

105

00:30:09.630 --> 00:30:11.529

Marlene Barrientos: engage in and fun.

106

00:30:11.690 --> 00:30:17.090

Marlene Barrientos: So the way I made it relevant is, I use a pbl

107

00:30:17.110 --> 00:30:29.480

Marlene Barrientos: that gives them a relevance. and it's something that they can relate. So before I started the the Ae labs, we were covering our water, pollution, water quality 2.

108

00:30:29.660 --> 00:30:35.720

Marlene Barrientos: And so our Pbl project was tracking fecal matter in water samples.

109

00:30:36.280 --> 00:30:40.320

Marlene Barrientos: And so that will. That was our culminating project.

110

00:30:40.720 --> 00:30:54.470

Marlene Barrientos: So. And I also use videos and slide shows that have great visuals. So I feel like great visuals enhance the learning of a complex concepts, making it easier and more engaging.

111

00:30:54.750 --> 00:31:17.739

Marlene Barrientos: and I also differentiate the activities. So again, knowing your students and knowing their abilities, is crucial. So, for example, for this activity. that my students did of the first activity. they. It's something that they can relate to. And there's a few of them that actually made Plato.

112

00:31:17.770 --> 00:31:21.729

Marlene Barrientos: and they were learning in points of accuracy and precision.

113

00:31:21.750 --> 00:31:45.169

Marlene Barrientos: So before I introduce the topic of accuracy precision, we did this activity. So I, knowing the strength of my students. Not every student received the same equipment. So the goal was to make Plato using different measurements. So students that I know that they struggle. I gave them the proper measurements, tools.

114

00:31:45.310 --> 00:31:54.219

Marlene Barrientos: and students, that I know that they can be challenged. I provided them with other tools that are not. They were not accurate measurements.

115

00:31:54.230 --> 00:32:14.839

Marlene Barrientos: but through it all all of them had a lot of fun and making Plato. Yes, it was messy, but certainly a lot of fun. And then, when we were done with this, I introduced the concept of obviously in precision in science, so they were able to understand how important it is to have the right tools

116

00:32:14.840 --> 00:32:35.599

Marlene Barrientos: to do a specific experiment. Another way that I differentiated activity when we're learning to pipette is, students are more advanced. They were able to use this 96 well, plate and follow set of directions and the pipette different amounts and mixed colors.

117

00:32:35.720 --> 00:32:58.560

Marlene Barrientos: they were also able to do a pipette art. But students that I know they were, I knew that they were going to get frustrated by looking at all this numbers and finding them. it's kind of like grafting in that every my students were like very good a graphing. So I for those students, I I just assigned the pipe at art, and they

118

00:32:58.670 --> 00:33:05.539

Marlene Barrientos: they were still a comb machine, the same learning goal which was learning how to pipe at different measurements.

119

00:33:05.620 --> 00:33:12.910

Marlene Barrientos: So the goal was still accomplished. So differentiating activities is very important next slide.

120

00:33:15.570 --> 00:33:18.590

Marlene Barrientos: So here's my journey.

121

00:33:18.680 --> 00:33:47.329

Marlene Barrientos: again. It's introducing topics that my students have never seen. And before the end of the before the beginning of the school year I introduced the metric system, but they have never seen the the prefix micro, and they seen leaders, but not micro. So we stop on Milli. So when I was introducing this, I wanted them to see how small is my grow. So I use this website, the learn genetics, Utah, where the students can slide.

122

00:33:47.330 --> 00:34:00.379

Marlene Barrientos: And I see from a coffee bean all the way to the E Coli. So when they got to the E. Coli. I asked them to stop because we were tracking fecal matter, and we were just talking about E. Coli.

123

00:34:00.380 --> 00:34:20.430

Marlene Barrientos: but I told them that we are going to be looking. What's inside the E Coli, which is the DNA? And then? And I said, Okay, this is in the micrometer. So then I ask them to keep sliding all the way to the DNA base pairs which is in the Pico meters something even smaller. So I wanted them to see how small

is really small.

124

00:34:20.900 --> 00:34:33.989

Marlene Barrientos: And then I introduced the proper use of micro pipette the parts of the micro pipette the different sizes, and to make them easier for my students. I use a masking tape.

125

00:34:33.989 --> 00:34:56.630

Marlene Barrientos: and I actually put the masking tape on the micro pipette. And I wrote on T. 20. And the volumes that are allowed between the p. 20, p. 200, p. 1,000, to make it easy for them rather than saying, Oh, p. 20, and not all the micro pipes are the way they see here. Not all of them say that it is between a 0 and a 20. So I wrote it down on a with a masking tape.

126

00:34:56.630 --> 00:35:04.820

Marlene Barrientos: The I did the same thing for the micropipetted tips, so that they I see this way we able to be able to see

127

00:35:04.820 --> 00:35:28.660

Marlene Barrientos: the blues are only used for this type of for the p, 200 or p, 1,000. So And then we practice setting up the volumes. And then I went over pipette rules, and before I move on to practicing pipettes again I did a check for understanding. So every time I introduce something I always do a check for my go

128

00:35:28.690 --> 00:35:48.470

Marlene Barrientos: check for understanding, to see if everybody is at the same page. So then we move on to practicing by padding and we practice first of all feeling the stops, the first and the second stop, and the Jack button. And then they did this lab, the able lab

129

00:35:48.470 --> 00:36:17.330

Marlene Barrientos: where they use this sheet that actually laminated it. So I can use it year after year, when the students worked in groups of 2. So 2 students did the first 2 line and the other the 2. And they actually use this as a reference for their pipetting art, and so they had so much fun doing their pipetting art that it was like they. It seems like they wanted to continue doing it, so it was so much fun for them.

130

00:36:17.520 --> 00:36:18.810

Marlene Barrientos: And next

131

00:36:19.920 --> 00:36:30.869

Marlene Barrientos: so this is the end of my journey. And it was introducing the students to gel electrophoresis. So in seventh grade they learn about the DNA, but most of them

132

00:36:31.100 --> 00:36:47.789

Marlene Barrientos: probably forgot all of them. So I had to review the DNA structure, and I had to make sure that they truly understand the concept of galactic phrases. So before we actually did it, I am assign a virtual

133

00:36:47.930 --> 00:37:14.299

Marlene Barrientos: simulation of G electric races, and I found one that is quite simple, that I assigned to

some students that I know they will struggle and is the learn genetics, Utah, which is quite simple, and walks you to all the stops to a jealous phrases. But logic change also has an amazing gel, electr, for that is a little bit more advanced. So I I assigned that to more to my more advanced students.

134

00:37:14.820 --> 00:37:39.489

Marlene Barrientos: and then, when we were doing the pipetting practice, my more advanced students were actually able to make the buffer, and before we did the buffer, I asked them, have you ever made orange juice from concentrated orange juice. And so everybody could relate to that. So I said, Okay, so in a similar way, scientists also have to dilute some solutions.

135

00:37:39.860 --> 00:38:06.730

Marlene Barrientos: So I was quite surprised that they were actually able to do this. And I remember I learned this in college, and this is eighth graders doing it. So I was really pleasantly surprised. So And they were able to make their own jails with my other low, level students. I they didn't make the buffer, but I we made the jails as a class, so I asked for a volunteer to come to the front.

136

00:38:06.980 --> 00:38:34.170

Marlene Barrientos: and then, since the we're already familiar with the joint voices. Through that simulation I asked them, their classmates, to help the volunteer. What was the first thing they needed to do to make a jail. What was the next thing? So it's kind of again testing them about their knowledge. So as a class, we made the jails, or we made one jail, but they still had to experience to make a gel. Then they practice loading wells.

137

00:38:34.170 --> 00:38:51.039

Marlene Barrientos: and again every time. I always model for them, and then they get to do it on the on, and finally they run the jail. So the day before they actually run the jail again, I walk them through the entire process, asking them questions. Make sure that everybody understands

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00:38:51.110 --> 00:38:57.449

Marlene Barrientos: but one of the things that my students had mentioned, that if we, if I had to do this again next year.

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00:38:57.460 --> 00:39:05.599

Marlene Barrientos: They will rather practice pipetting and the actual electrophoresis gel rather than the plate

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00:39:05.690 --> 00:39:22.219

Marlene Barrientos: they it was a big challenge it for most of them to actually be able to load the jails in the gel for free. So so if I have to do this again, I will probably not do the plate, but instead, do a practice gel in the jail electrophoresis.

141

00:39:22.540 --> 00:39:28.460

Marlene Barrientos: And that's my journey to this amazing Ae pilot program. Thank you.

142

00:39:32.730 --> 00:39:59.130

Jessica Julison: Thank you so much, Marlene. I think that's amazing. And just so, you all know. for those of you who registered with us. You'll get some bonus slides from Arlene, which she actually used with the students. So they're attached to her slide deck. So you'll get those as well. But of course we didn't have time

for her to share all of those today. So I'm going to turn directly, because we are running a little bit over. I'm going to turn to Kaitlyn and Kaitlyn. I'm going to ask you to tell us a little about your project with middle school students and how you introduce Dave to them.

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00:40:03.010 --> 00:40:07.730

Kaitlyn Kalehuawehe: Yes, okay, let me get this sharing.

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00:40:08.670 --> 00:40:14.120

Kaitlyn Kalehuawehe: Do. Okay. is everybody able to see this? Okay? Okay? Awesome.

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00:40:14.700 --> 00:40:33.700

Kaitlyn Kalehuawehe: Okay, cool. Okay. So like, I mentioned for my undergraduate thesis. I did mine on promoting engagement through socio-scientific inquiry at the middle school level with a B, and so basically going into my question of how can we make science learning science more fun?

146

00:40:33.700 --> 00:40:43.590

Kaitlyn Kalehuawehe: I wanted to target middle school specifically, because that was the age that I started to ask questions about the future and about the real world

147

00:40:43.590 --> 00:41:06.380

Kaitlyn Kalehuawehe: about like, why are we learning what we learn? And how do I make connections to the real world? And then I thought it wasn't until I reached higher grade levels like high school and college that I started to make the connections between science and it's social and ethical applications. So had that been introduced earlier in my education, would it have changed my impact on science and learning it?

148

00:41:06.880 --> 00:41:27.890

Kaitlyn Kalehuawehe: So when we kinda look at student engagement. It's not an isolated process. It's a combination of a whole bunch of things. And I really like this picture because it kind of just shows that it's everything is like interrelated. So you have the behavioral aspect, the emotional, the cognitive social. So there's a lot of things that you have to target with engagement. So we have to kind of

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00:41:27.890 --> 00:41:37.029

Kaitlyn Kalehuawehe: target our teaching of science that way rather than it being the strict, like learning facts, reading a textbook, doing that. So

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00:41:37.080 --> 00:41:58.899

Kaitlyn Kalehuawehe: I wanted to kind of change how we learn to kind of address that. So that brought me to SSI or Socio scientific issues, which was something that my adviser kind of introduced me to. And basically, SSI are complex issues that have ties to science and society which create dilemmas and are prone to multiple solutions.

151

00:41:59.120 --> 00:42:11.920

Kaitlyn Kalehuawehe: So basically, you have an issue that is based in science. Content, that is, has a relative like science idea. But it has social, economic, political and ethical implications.

152

00:42:12.090 --> 00:42:17.000

Kaitlyn Kalehuawehe: So the framework, which was kind of developed mostly by saddler.



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00:42:17.010 --> 00:42:29.710

Kaitlyn Kalehuawehe: with these, SSI's science alone cannot solve this issue. So basically with SSI, you kinda have the students understand that

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00:42:29.780 --> 00:42:33.879

Kaitlyn Kalehuawehe: science can impact their everyday life and that you have to kind of

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00:42:33.990 --> 00:43:02.870

Kaitlyn Kalehuawehe: use your problem solving and use decision making to kind of find the solution that would best fit, and then also with it, because there's not a single solution. It also allows students to kind of respect and celebrate like different perspectives. So this kind of like format that it follows is you kind of end like encounter a focal issue? You introduce the topic to the students, and then you develop it through the science, ideas and practices, and then kind of implement more of the social aspects of it.

156

00:43:02.870 --> 00:43:05.690

Kaitlyn Kalehuawehe: and then you kinda like tie it all together at the end.

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00:43:06.330 --> 00:43:35.909

Kaitlyn Kalehuawehe: So with this idea of SSI, that kind of brought me to a B, and so. Luckily, I went to Development University, and that is where Kentucky Abe is housed. So I was able to actually loan the research grade equipment I was able to use the pipettes and the gel electrophoresis and basically turn that middle school classroom into, you know, an advanced science lab like the one I used in college, and I. With that I saw the connections between Ade's goals

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00:43:35.910 --> 00:43:44.520

Kaitlyn Kalehuawehe: and the goals of like SSI, and also the next generation, science standards which were just recently developed to kind of like

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00:43:44.540 --> 00:43:51.050

Kaitlyn Kalehuawehe: really target, you know, a new way of teaching science and a kind of promoting

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00:43:51.140 --> 00:43:55.060

Kaitlyn Kalehuawehe: more interest in science and interest in science careers.

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00:43:55.560 --> 00:44:19.769

Kaitlyn Kalehuawehe: So the specific topic that I focused on was gene editing because Abe had a specific lesson called Designing Babies with Crispr and I had previous experience with Gene editing as a bio major, and I really liked it. And I really liked learning about Crispr. I had a professor who like, really worked with it like in depth, and taught me all about it. So I was like, this would be a really cool idea to introduce the students.

162

00:44:20.020 --> 00:44:44.410

Kaitlyn Kalehuawehe: And so the learning goals of the lesson that we did was to kind of introduce Gene editing, but also go over the potential benefits and the risks of it, because with Crispr it can be a controversial topic because of like the ethical and the safety concerns. You know, it's even banned or like discouraged in other countries, because, like, Wow, this is an amazing biotechnology. But

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00:44:44.410 --> 00:44:51.010

Kaitlyn Kalehuawehe: should we be able to use it? Is it acceptable, you know, kind of like? Those are the questions that we kinda like encountered.

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00:44:51.550 --> 00:45:18.729

Kaitlyn Kalehuawehe: So for my work that I did, I worked at a suburban middle school in the greater local area. I worked with a class of seventh graders. There were 26 students, and then I also worked really closely with their teacher and their teacher. Didn't hear about Ab before this, and she also didn't have any prior experience with Crispr or Dean anything. So we really worked closely together to kind of bring this lesson to life, and she really relied

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00:45:18.750 --> 00:45:26.809

Kaitlyn Kalehuawehe: more on me for the like gene editing aspect of it. But she kind of helped facilitate discussions and kind of like

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00:45:26.900 --> 00:45:35.939

Kaitlyn Kalehuawehe: guide the lesson more because she knew her students more than I did. But I was very grateful that she let me like into her classroom, and allowed me to like teach.

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00:45:36.520 --> 00:45:53.219

Kaitlyn Kalehuawehe: And so, basically, what I did is I took the Abe lesson of designing babies with Crispr, and I combined it with the ava biotech experience tools of the trade. So basically, the day, one day 2 lesson of pipetting and Gelo gel electrophoresis.

168

00:45:53.480 --> 00:46:21.869

Kaitlyn Kalehuawehe: and I kind of modified them to be suited for middle school, because based off of the one that I had, it was more target to the high school level. So with modifications made with like me and the teacher and my advisors, we were able to make it work. And so we had lab based applications, collaborative discussions. The students did reflective writing assignments. Which is that discussion diamond that they did. And then they did instructional activities.

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00:46:21.870 --> 00:46:24.550

Kaitlyn Kalehuawehe: And so basically, I kind of just like combine the 2.

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00:46:24.860 --> 00:46:51.309

Kaitlyn Kalehuawehe: And then these are some pictures of the actual Powerpoint that I use during the lesson. And so with the seventh graders. They didn't have any prior knowledge or exposure to jeans and gene editing in general. So I had to kind of start at like the base level of like what genes are, and then kind of like build on that, not going to in depth, because I only had 2 days to kind of like build on it. But I just kind of kept it very surface level.

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00:46:51.420 --> 00:46:58.740

Kaitlyn Kalehuawehe: And then we talked about Crispr. And then on day one, we worked on pipe heading. and I also

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00:46:58.800 --> 00:47:17.179

Kaitlyn Kalehuawehe: throughout the process of them doing pipetting, I would introduce like examples of it. So we have this example of gene editing that they use for like in medicine, or, you know, treating cancer cystic fibrosis stuff like that, because that was able to help kind of like make those connections better for the students.

173

00:47:17.180 --> 00:47:34.830

Kaitlyn Kalehuawehe: And then on day 2 is when they were able to do the gel electrophoresis. And that's where I really showed them like, Hey, this is how we see the DNA. And then this is how we make sure that you know the gene editing that we did worked, and they were able to load the gels, and we ran them, and they read them, and they saw them, and it was great.

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00:47:34.950 --> 00:47:41.720

Kaitlyn Kalehuawehe: And then, to kind of tie it all together, I was able to use the example of Frankenstein.

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00:47:42.020 --> 00:47:54.800

Kaitlyn Kalehuawehe: So I kinda made the analogy that like, Oh, bring it sign is a example of gene editing and a certain way, and like Oh, how did the public view. It? Was it good? Was it bad? And that kinda like

176

00:47:54.830 --> 00:48:11.050

Kaitlyn Kalehuawehe: gave the SSI elements of the conversation going? And then in the bottom, right. Here is a picture of the discussion Diamond, that they did so. Each student got a corner and they got to write down their own thoughts, and then they came together as a table, and, kinda like.

177

00:48:11.140 --> 00:48:12.439

Kaitlyn Kalehuawehe: put it all together.

178

00:48:12.810 --> 00:48:29.520

Kaitlyn Kalehuawehe: And so basically for the lab portion, they were so excited and they were so quick to learn, and we're very motivated. And they picked it up so quick and that they were encouraging and motivating each other like I rarely had to like help.

179

00:48:29.760 --> 00:48:42.889

Kaitlyn Kalehuawehe: Like students, they were helping each other, and so they were just kind of like leaning more on each other than me and the teacher, and they were very excited. They wanted to run more gels and keep going and keep doing, and they were sad after I had to leave after 2 days.

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00:48:43.090 --> 00:48:44.500

Kaitlyn Kalehuawehe: and then

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00:48:44.840 --> 00:49:05.019

Kaitlyn Kalehuawehe: throughout the process they were asking me so many questions, and it was quite overwhelming. And I was like, Oh, I was very well because I didn't think they were going to ask so many questions. So here are just a couple of them, and I kind of collected all of them, and I went through, and there were different types of questions that they asked. They had, like social application, based questions like.

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00:49:05.160 --> 00:49:21.429

Kaitlyn Kalehuawehe: Oh, could it be used for cosmetic purposes. And then they had questions that were more science, and then they had some that were more content, based in like gene editing. And then they just had those like random curiosity questions about making green babies or dinosaurs and stuff like that. But

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00:49:21.500 --> 00:49:41.299

Kaitlyn Kalehuawehe: it might not seem like it. But these questions showed that they were really using their skills using those science skills. So they were using reasoning, critical thinking, they were applying their learning. And then you could also see with these questions that they were having interest and increased motivation to learn more about the topic.

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00:49:41.990 --> 00:49:55.079

Kaitlyn Kalehuawehe: And so here's a little example of the questions, and the thoughts that the students write so you could see like some of them had a lot say, some, not a lot. But yeah, they really liked this

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00:49:55.150 --> 00:50:04.990

Kaitlyn Kalehuawehe: discussion, diamond thing, and you know, some kid through some dinosaurs. But overall I saw that the students were not only

186

00:50:05.810 --> 00:50:25.770

Kaitlyn Kalehuawehe: addressing the topic, but they were thinking beyond themselves. They were recognized the complexity of the issue. And we're contemplating all the different implications of gene editing, and they were able to see when it's right and what it's wrong, and also the different fields that genetic could be used for.

187

00:50:26.740 --> 00:50:46.650

Kaitlyn Kalehuawehe: And also here's some quotes that I heard from the students. They felt like a scientist for the day, and that, you know, we should only use Gen. Editing, if you know, to keep people safe. And just all this great stuff and overall, you could just see that they were really engaged in all dimensions, and that they were applying their learning in a social context.

188

00:50:47.470 --> 00:51:04.930

Kaitlyn Kalehuawehe: And then I also was talking really closely with the teacher, and she absolutely loved the idea of SSI. She loved Abe, and so she kinda like took that. And from then on she was like, I think I'm gonna include more current events and issues into her major units. And kinda like.

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00:51:05.650 --> 00:51:15.259

Kaitlyn Kalehuawehe: have that little moment of connection to kind of get the students learning more because she loved how they asked great questions and were so

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00:51:15.440 --> 00:51:18.610

Kaitlyn Kalehuawehe: involved when it was novel and new.

191

00:51:18.990 --> 00:51:34.640

Kaitlyn Kalehuawehe: And so also she liked the idea that you were mixing lab and reality with the AV equipment, and that the students weren't distracted at all. Any I know. With middle school you could have very like short attention spans, but they were in engaged the entire time.

192

00:51:34.940 --> 00:51:39.509

Kaitlyn Kalehuawehe: And then also there was like a sense of excitement to learn science

193

00:51:39.700 --> 00:51:57.169

Kaitlyn Kalehuawehe: in the future. And I've also heard back from the teacher like, after I completed that lesson, her students were really engaged in the weeks following, and that it was so popular that I was invited back to the school to teach even more of the seventh graders, and I got to do that. And it was so exciting and awesome.

194

00:51:57.280 --> 00:52:26.689

Jessica Juliuson: But basically I'm gonna jump in just because I make sure we have time for for Jenny as well. But I have to say that was probably my favorite thing of the day reading some of those questions that the students and that kind of infectious engagement. So there's more in her deck, and I'm going to encourage to follow up and we'll include Caitlin's contact info. If you want to ask her questions. but I'm going to turn it over to Jenny so that she can share a little of what's going on at Lab Exchange to support lower secondary. Jenny.

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00:52:32.370 --> 00:52:40.739

Jenny Frank: Thank you very much. These are incredible learning experience. And it just makes me so incredibly excited to see that

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00:52:40.740 --> 00:53:05.729

Jenny Frank: you know, kids in the middle school are getting opportunities. to to really do real life science. I just It gives me goose bumps, I think for me. I just wanted to kind of remind everyone that this is off of Lab Exchange. You know that we have an incredible wealth of resources always available. that direct you exactly to the Abe

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00:53:05.730 --> 00:53:30.729

Jenny Frank: supported content again, our mission, our goal, is to make science accessible, no matter where you are and what your circumstances are so I recognize that not everybody is so fortunate to be located next to a physical Amgen location. And so for those who aren't that's where lab exchange can really support and and fill in there. So again, this page just really

198

00:53:30.730 --> 00:53:55.729

Jenny Frank: simply links you, connect you with those resources, talks a little bit about web investigations, and then, of course, excellent education, and professional learning for teachers. And I think that that's one of the things that I've taken away from Abe. Programming is just the wonderful support that educators have. And that's to me is the reason why this program has been so

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00:53:55.730 --> 00:54:20.719

Jenny Frank: so successful. And you see, comments like that from kids and teachers alike. So I just wanted to remind everyone. another thing, you know is that we are. we've just hired on a content specialists in middle school. And so in addition to the interactive and the simulations that we have at Lab exchange. Currently, we are going to be expanding

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00:54:20.720 --> 00:54:45.980

Jenny Frank: to include middle level investigations. And you know, we are collaborators, not competitors. So lab exchange. Our library is still that one stop shop, you know. I I know that a ton of people use things like

that and Concorde consortium just to name it few off the top of my head. We collect all of those, and we put them here on our space on our website.

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Jenny Frank: But what we've noticed is that really life, science, biotechnology. Those are really not available, you know, right now in Ed Tech. And so that really is our mission. That's where we are. Our team. In addition to our library, is trying to fill that space.

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00:55:03.010 --> 00:55:27.999

Jenny Frank: and and I just wanted to remind you that what makes lab exchange pretty unique is that not only do we have simulations that allow kids to interact with variables right? And and learn through inquiry rather than like being told the science. to sense make is that our experiences are like virtual labs right hands

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Jenny Frank: on. You're in a virtual lab using the equipment in a similar way manipulating things. I think that's what makes us really unique. And again, we could never have done this without our participation with the Ab. Program.

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So a couple of things that you could use today. And and just some really.

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00:55:47.600 --> 00:56:13.959

Jenny Frank: you know, big beliefs that I have about middle school is that I think the earlier we can expose kids to stem the better right because stem is exciting. And I used to say I had the best job ever. I was a science teacher. When people used to ask what I taught, I said, I have the best job ever. I'm a science teacher. It is just naturally interesting and curious. and I think that you know, as educators.

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00:56:14.290 --> 00:56:39.289

Jenny Frank: you know, showing kids a library like this where they can explore topics and kind of go down the rabbit ball right? And it's quality, and it's vetted is one really great way for self directed curiosity. and learning to happen. Something else. I think biotechnology and lab exchange brings to the conversation is that it's real world. And right now, what I'm showing you is 758 narrative

207

00:56:39.290 --> 00:56:58.490

Jenny Frank: from different stem scientists and people in the field talking about their stories, their struggles, the challenges. They're learning paths. What a great way to open up a conversation and teach kids that like you don't have to travel the path that everyone

208

00:56:58.490 --> 00:57:10.350

Jenny Frank: things they have to travel to get. I'm a perfect example myself. I have a strange path. I definitely flew all over that path. But look at all these stories from people all over the world.

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00:57:10.350 --> 00:57:22.300

Jenny Frank: different interests that look like them, that came from the same places that they came, and how they've overcome to become successful in stem this in middle school

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00:57:22.430 --> 00:57:32.380

Jenny Frank: just pure gold, in my personal opinion. So I think that's the last piece or the the second last thing, the last thing that I would suggest

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00:57:32.390 --> 00:57:41.590

Jenny Frank: in middle school, which I found always to have great success was with is the idea of responsible citizenship.

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Jenny Frank: If I have ever met a middle school who wants a middle school, or who wants to change the world right like they just I myself. I picketed that at sixth grade that girls deserve the soccer ball just as much as boys did during recess. we all deserve equal access to sports. but I just wanted to highlight one of our collaborators. I think you're going to start to hear in the conversation more. The idea of challenge facing

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00:58:06.710 --> 00:58:13.909

Jenny Frank: learning. The Biomimicry Institute has an incredible collection, and I'll paste that link in

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00:58:13.910 --> 00:58:33.889

Jenny Frank: in the chat for you. They are just amazing. But look at all these design challenges, and what they've done is they have use lab exchange to really publish the work of these learners. we have a case study tool. You could do this tomorrow in your own class. But look

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00:58:33.890 --> 00:59:03.290

Jenny Frank: at the quality of work and look at what they're talking about, and and the inspiration from nature. Again, biomimicry makes perfect sense. But coming up with these incredible solutions to real world issues. They could be the next change makers. And that just gets me. Just so jazzed and so excited. Look at this. There's the team. So I'll stop there lab Exchange. We have a ton of things available for middle schoolers.

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00:59:03.290 --> 00:59:11.340

Jenny Frank: But again, my parting message, just keep them curious. Keep them excited, and make sure that their hearts right

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00:59:11.440 --> 00:59:17.160

Jenny Frank: has a big feeling, a big moment. That's all we need to do in middle school education.

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00:59:17.360 --> 00:59:42.359

Jessica Juliuson: Jenny. Thank you so much, and that's such a great note to end on. I think we started with joy and inspiration. And we're ending with joy and inspiration and thinking about these students who are going to grow, to change our world and to be part of our world. So we're already over time. So I just like to thank all 3 of you, Marlene, Caitlin and Jenny, for providing us with these incredible resources and ideas. we will be sharing these out with everyone who registered. And I want to just note

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00:59:42.360 --> 01:00:06.499

Jessica Juliuson: that we will be pausing our roundtable series until next September 2,023, just to give our program office staff some much needed time off. but we will be reconvening in September. please reach out to us. If you have other ideas for roundtables or something. You've tried that you would like to present. Let us know about it. Thank you all for being here today for everything you do for your students all over the world. And of course, as always, I want to thank

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01:00:06.500 --> 01:00:19.410

Jessica Juliuson: the Amgen foundation for supporting the engine biotech experience. So for all of you have a wonderful rest of your day, and thank you for joining this Abe teacher. Roundtable. Thank you.