

Supplemental Material

CBE—Life Sciences Education

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BEE the CURE: Supplementary Materials

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Supplemental Materials 1. Interview Protocol for Fall 2021 and Spring 2022

1. What has been the most memorable aspect or experience of the AZ Bee Project for you?
- Why was this memorable for you?

2. Describe any challenges you encountered during the course.

3. Do you feel like the research you conducted this semester served the communities in Tucson and Southern Arizona? Why or why not?
- How does your research in this class support the goals of the Tucson Bee Collaborative?
 - How, if at all, does knowledge about bee biodiversity benefit the local community?
 - Do you have plans to take additional action to support bee biodiversity through personal effort or action after participating in the research? How?
 - Please describe your current level of confidence in using your science skills, knowledge and/or knowledge in helping Southern Arizona communities?
 - How important is it to you to employ your science skills in service to Southern Arizona communities?
 - How important is this for other communities with whom you are affiliated with (e.g., religious communities, ethnic/racial communities, cultural communities, interest-focused communities)?
 - Do you have plans to help any non-science communities in the future using your science skills? How?

4. Did participating in the Bee Barcoding Project influence your relationship to the scientific community?
- Do you view yourself as a member of this community? Why or why not?
 - Did participating in the Bee Barcoding Project influence your relationship to the AZ Bee Researcher community?
 - Do you view yourself as a member of this community? Why or why not?
 - Did participating in the Bee Barcoding Project influence your relationship to the Tucson community?
 - Do you view yourself as a member of this community? Why or why not?

5. If you had the opportunity to stay involved with this project, would you want to remain involved? How?

Supplement: Code Book

Name	Definition	Frequency of use by students	Example Quote
Bee Facts	Students share their favorite new fact they learned about the bee they researched for the CURE	14 of 22	"So I had no idea that there were so many general of bees, but the specific bee one, the bees that we did was lasioglossum, and I had no idea that was the biggest genre of bees. There's like 1700 different species of lasioglossum."
Bee Project Involvement Continuation	Does the student intend to continue involvement with the Tucson Bee Collaborative after completion of the CURE?		
Maybe		12 of 22	"I don't know if I would go and start working towards wanting to just work with the Bee Collaborative. I enjoyed it, but I still am just so passionate about my medical school. I don't think I would change that, but it was still something that was good to know."
No		3 of 22	"Not really. No. That's as blunt as it gets."
Yes		14 of 22	"Yes. I do actually want to continue to be in touch with the Tucson Bee Collaborative. I really enjoy the mission and I would like to continue doing even volunteer work and stuff because I think it's fascinating."
Career Intention			
Career confirmation	Feelings that the chosen career path has been confirmed by events in this course	15 of 22	"I think it definitely made me understand that this is exactly the field that I want to be in. So it just confirmed what I wanted. Because I know sometimes you do things in college and you're like, mm, maybe that's not the route for me anymore, but I definitely feel like this just basically helped me realize that this is exactly what I want to be doing and to continue doing things like this."
Career Goals Stated	Actual statement of career goals at time of the interview	16 of 22	"So right now I want to go to veterinary school, okay, once I finished writing about and I actually want to go into wildlife work with wildlife rehabilitation centers and training, helping wildlife and I'd also like to do field research in the field."

Confirmed non-research	Does not intend to continue in a research-based field	1 of 22	"And so I feel like I'm not going towards conservation biology, I'm going to medicine. And so I feel like the paths are kind of separated a little bit. So it did kind of dissuade me from delving deeper into the conservation biology scientific community, which I was thinking of kind of getting into. And I'm like, "Eh, maybe I should not."
Potential for research	Due to experiences in this course the student has expressed potential interest in research	13 of 22	"I think that pursuing research on the side would definitely be something that I'd be interested in. Some kind of program that. Obviously, as I said, I still want to do nursing, but definitely doing something on the side based off of, I was so nervous, but now I can see that I can do it. I can do research stuff this. Because, I don't know, before I was like, "Oh, that's too much for me. I can't do that. I'm not able to do the research side of things." So, now seeing through this project that I was able to do a research side of things, I think that I would definitely pursue something on the side with more research."
Science research goals	Expressed goals that involve scientific research	4 of 22	"For me, I wanted to be an environmental science major anyways, and doing this project helped me narrow down what specifically I wanted to do with a career. Because it was still very broad. I just knew that's what I wanted to major in. I didn't have a set career. Versus this very much jump started this idea of wanting to do research and actually be maybe a scientist. "
Community engagement			
Action - beyond class	Students engage in the community outside of the classroom environment	7 of 22	"So I help kids and the youth get more into nature and help understand that things outside are just as fun as things inside. So one of the things that we do is we have a bag full of sticks and pine cones and shells, and we just dump it out and we see what the kids like to do and play with it. And parents start to realize, oh, they don't need an iPad. Or maybe I can't lay them outside without a toy and they can play with something. So I think it's just a better connection with our youth and a new generation to become outside, especially when we have a lot of things bringing us inside."

Action - in class	students engage with the community within the class	21 of 22	"The most memorable part for me was going to the BioBlitz at the Desert Museum and getting to be a part of that, which no one else in my class did that, but I thought that was really neat and a really cool way to feel a lot more well rounded."
Intention	A student mentions an intention or desire to engage with community	20 of 22	"I was talking to [instructor] and I would like to still be a part of it. I know there's some conventions coming up and I would like to do that cause I think that would also help spread the awareness that I was talking about earlier and just letting more people know. And so I think I'd like to keep going and talk about it more, maybe do a little bit more research. I'm thinking about coming back next semester to help the next set of students go through the same thing and guide them through what I just did."
Knowledge - SCE	they believe they know how to impact their non-science community using their science skills	1 of 22	"I definitely more confident than I was before, but I think I'm still definitely in that middle of... I feel I can learn a lot more about our ecosystem and everything, but definitely I feel as if I can talk about our ecosystem to someone who hasn't lived in Tucson and feel confident that they can understand the kind of the diversity that's here."
Knowledge-for community	they believe they know how to impact their community in a non-science capacity	20 of 22	"I think it helps people understand the importance of even just like the tiniest little bee that they see and to understand that they all have their place. And that to not just think about honey bees, to think about the tiniest pollinators and our smallest flowers and milk weeds that we wouldn't have without these tiny of little pollinators. So it, I think helps them appreciate that more."
	Specific example of how students could use their science skills to help the community.		"So I help kids and the youth get more into nature and help understand that things outside are just as fun as things inside. So one of the things that we do is we have a bag full of sticks and pine cones and shells, and we just dump it out and we see what the kids like to do and play with it. And parents start to realize, oh, they don't need an iPad. Or maybe I can't lay them outside without a toy and they can play with something. So I think it's just a better connection with our youth and a new generation to become outside, especially when we have a lot of things bringing us inside."
	Non-specific example of how students could use their science skills to help the community.		"I think, doing more research would be a really, really cool way of staying involved [in the bee project]."

None-Neutral		13 of 22	"We need to spread more awareness to the community, but we also need to be able to back it up and have something to present to them. And so I do, in the sense that we're eventually going to be able to show the community what we've done and really get the word out there. But as of right now, I don't feel like I really did anything."
Self-efficacy	student's ability to engage with the community using their science skills	11 of 22	"Having that ability to be like, "I know how to articulate my research, or my findings, or present it to a wide variety of people." I could have patients that know exactly what I'm already talking about, or people who are like, "I don't even know what a pill is." So, being able to work on those skills, and being able to articulate it to a wide variety of people who have different interests, different levels of education, things like that, I think is going to be applicable to the future, for sure."
Value	student's sense of importance about their engagement with the community	16 of 22	"But I think being involved in my community in that way, and volunteering my time and helping them either collect the bees or work with the university students do work with the materials and go through the process of identifying the bees and sending it off to sequencing, and stuff like that. Having a role in that. It definitely made me feel a bit more connected to my community. Because I'm new here, I wasn't expecting such a concrete connection right away and it's like ... not even the fact that it's published, but the fact that I know that I did that, and that my professor knows that I did that, and the people involved in the collaboration know that, I think gives me a little bit more concrete feeling that I'm connected to my community. So, I'm really happy about that, because I like where I live. I am very pleased with moving here and just being here. Like I said, I've been to the museum. Now I can be like, "I help this museum." And it is just an interesting feeling."
Course elements			
Autonomy	ability to work on one's own	0 of 22	

Collaboration	opportunity to work with others	8 of 22	<p>"So we worked with groups of three to four people. I feel a lot of classes you don't really get to build those relationships with people in your class, because it's more individual. And I think one of the most memorable things, I got really close with my group and I really enjoyed my group. And just getting to be there for all the successes that we had, actually being able to identify our bees. We used my bee for our presentation because my bee had a hundred percent match. So, that was really exciting when I was like, "Oh, my gosh, it worked, we did it correctly, we actually got a sequence." So we all got sequences, which is really awesome. I think everyone in our class, I don't think anyone had any issues. But it was just really exciting as a whole class and as a group to be there for the successes and see everyone their hard work payoff, all that we did. Finally get to be able to identify our bee was really exciting, and the most memorable part probably."</p>
Discovery	learning something that is new to the students, instructors, stakeholders	9 of 22	<p>"Especially with my bee being undefined as of now, it's definitely opened it up for a whole another field of like bees to be found, especially with that genetic markers that my bee specifically had. So right now the information about that specific bee is very limited, but the more bees we find, we'll be able to really identify what kind of contribution they're having to Arizona or just the United States in general."</p>
Iteration	opportunity to repeat procedures for improved or more practiced outcomes	8 of 22	<p>"Well, realizing that there is a lot of trial on error made me also realize that the more research you do, you get more accurate results. So you have to build up to that. So you have to overcome those challenges in order to get a benefit, if that makes sense. So by repeating these studies, we're helping other people get a more accurate information on that bee."</p>
Mentorship	Instrumental, psychosocial, and networking supports	5 of 22	<p>"It's just I wasn't expecting it. In my mind I think a college biology class, you're going to have a professor, you're maybe going to have one team that's just kind of there for the credit or whatever. And that [instructor]... I was shocked that Jennifer really cared about us having this knowledge to help us go forward and wasn't just kind of leaving it up to us, because some professors would do that."</p>

<p>Relevance</p>	<p>finding that is of value to the broader scientific or local community</p>	<p>17 of 22</p>	<p>"It was an event they had at the Desert Museum and [instructor] was there and they had a little stand set up. It was like "What is DNA barcoding?" And they had a few of the posters from previous semesters. And I was at a stand where we were showing people how to do gel electrophoresis and they got to try loading practice gels and stuff. And it was really neat and really fun. So it was a way to just get a refresher on that myself and then teach other people and that really made it stick."</p>
<p>Science practices</p>	<p>skills that are valuable across scientific disciplines that are practiced in class</p>	<p>14 of 22</p>	<p>"This was the second bee, the U of A bee. And basically it was half that we would put in the gel electrophoresis and then the other half was supposed to be sent off to a lab for DNA bar coding. I couldn't use the other half of the DNA. The gel electrophoresis was just so that we could see if our bee, if we amplified it correctly, the rest of the DNA was just so it could actually go off to a professional lab so they could analyze it."</p>
<p>Supportive environment</p>	<p>availability and support by others in the instructional environment</p>	<p>7 of 22</p>	<p>"I have not had any other class, and which is surprising because I've been in chemistry labs, I've been in physio labs. And it's not community, it's more individual. I had a partner in my chemistry lab, but I mean, we just kind of each did our own part and came together, but it wasn't a community. And this class was just so fun and really interesting because we were able to come together, not even just my group, but the class as a whole. Everyone was just so excited when you were looking at your bee or whatever, it was just so awesome to see how close everyone got and how strong of a community there was. And everyone was so helpful. If someone had questions, if our teacher wasn't there to answer or the other grad students that were there, someone would come over and be like, "Oh, well, I did this." And it was just really awesome because I feel in a lot of classes, it's definitely not that. Any class that I have here has not been like that, so I was very excited and it was really fun."</p>

Family engagement	student discussion in home environment relating to the course	8 of 22	"I think more time and if there was, I would've loved to do a convention or something or some type of spread awareness campaign or something like that. But I think also more data would help and to help people understand. I went and I told everyone, like my family and everyone, I think that's what I'm doing. And telling them about how many species we have and all of this, how many bees there really are here that they weren't aware of. So in that sense, I felt like I was helping spread the word and bring awareness to people around me."
Feelings	As relates to psychological states in formation of self-efficacy		
Ambivalence	having mixed or contradictory feelings	1 of 22	"And so I feel like I'm not going towards conservation biology, I'm going to medicine. And so I feel like the paths are kind of separated a little bit. So it did kind of dissuade me from delving deeper into the conservation biology scientific community, which I was thinking of kind of getting into. And I'm like, "Eh, maybe I should not.""
Anxiety	a feeling of worry, nervousness, or unease, typically about an imminent event or something with an uncertain outcome	7 of 22	"I was really nervous actually, because I felt like, oh, if I messed up, I just ruined this whole project, you know? But, just getting ... you know, like your hands dirty, a little and playing around with things and doing these things was really exciting to come into class and being able to do that like weekly."
Confidence	a feeling of self-assurance arising from one's appreciation of one's own abilities or qualities	11 of 22	"I don't want to say I'm amazing, but I definitely feel like I have a lot of knowledge about it now that I feel confident sharing my knowledge with others."

Confused	lack of understanding; uncertainty	1 of 22	"At first it was confusing. But then when [peer mentor] tried to help me, because he was like, "Yeah, you have to... Maybe we can put your consensus sequence in a reverse," because he said like the Bold did that by itself, like they reverse the sequence. But then he did it on another webpage, and I thought that was interesting because I didn't know there's such a thing for that, only for that to reverse your sequence. I did learn, but then we didn't do anything about it. We didn't publish the sequence, or try to... Because I think there was nothing to do, it was just confusing. And they were confused too, because it was weird. It was just like a weird thing. But yeah, at the end we just stuck with the Subway data."
Excitement	a feeling of great enthusiasm and eagerness	9 of 22	"That's super exciting, because I feel like as an undergrad, there's not too many opportunities where you can improve upon science and really put your findings out into the science community and that's super, really exciting to know that I'm contributing to science."
Interesting-Fun	feelings of having fun and finding the work interesting and/or engaging	13 of 22	"Yes, cool! Super fun! Yeah, I'm fine with it, I love all the questions. Of course, there were questions that I didn't always have the answer to or didn't know how to respond to sometimes. But I've never been to a poster session or anything. I know it was way more fun than I was expecting it to be."
Pride	feeling proud of work and participation	1 of 22	"But it goes back to that pride piece of like, "I'm glad that my name got to be attached to it." I was able to still participate with the bee, even though this bump in the road happened."

Value	consider (someone or something) to be important or beneficial; have a high opinion of	12 of 22	"When you think of research, you only think of the lab portion or at least for myself. And you don't really think about how it affects so many things in your life. And it was really cool to see a different part of the research journey and being a part of it. And I found I really enjoyed doing research more than I thought I would. And I also just found a little bit more interest in bees. I feel like before they were just the insects that you kind of just swat away, but it's really interesting to see how many different bees have so many different effects on the community in Arizona and just the United States and the world in general that I just never really considered before now."
Identities and community affiliations			
AZ local Identity Community	Tucson area or local town in AZ	17 of 22	"I feel like I've always felt really close to the Tucson community just because I've been born and raised here. I've experienced all the things that pretty much Tucson has to offer, but I think just being a part of this brought me into a whole another, like I said, realm of Arizona that I wasn't aware of before. So it makes me feel more inclusive here in this environment."
Bee Researcher Identity Community		15 of 22	"I think I feel like I did enough research and time to say I did make a difference and do enough to influence what they're about, the whole project. So I think I would say that I'm part of it."
Cultural Community Affiliation	Racial/ethnic/religious/etc	1 of 22	"In a way the knowledge that I do gain, I don't necessarily have a team I'm like, "Okay, we're going out and we are going to do this." It's more like I would share it with like family and friends. So I would share knowledge like that or with people in church or youth group or stuff like that."
Individualistic	Strong individual identity	2 of 22	"I grew up here, so I think I'm just burnt out of it at this point. Which is why I have the desire for a lot of things, but no set plans because I'm also intending to move. I think I'm just burnt out of the community, even though I do love it and grew up here. I'm just very used to it."

no association to a community	statements regarding feeling no association to any community	5 of 22	"I've been here for a few years, so no. I grew up Arizona, but not specifically in Tucson. Not quite a fan of it other than the last few months, so yeah, no."
Personal identity	Statement of personal identifiers (race, gender, sexual orientation, demographics, etc)	3 of 22	"I'm native American. So it's my culture and my history and I'm just so amazed with all of it. And so seeing that I'm like, I want to go all the time."
Science Identity Community	Statement of feeling like a member of the science community	20 of 22	"After every lab, I was like, "This is so cool. I feel like I'm part of the science world". And I think it's also too, cause everything clicked for me. And in my previous science courses, it's kind of like, "Okay, learn this, do the test", but this course, I actually learned and I think it'll stick with me for years to come. So I think that that alone made me feel more like I was part of the science community because it clicked for me."
Social Communities	friend groups	2 of 22	"I definitely want to help, especially at the U of A. I'm involved in a club that works a lot with social change. So I would love to bring some of the leadership and some of the hands on things that I learned from the research project to bring type of research to social change and be able to make some of those changes on a different level."
Local Research	Statements about why local research is important	21 of 22	"I do know that there are a bunch of [older] people who find it a hobby to look at new stuff and bees in particular, I do know that there are a couple of them that go to the Desert Museum for that specific reason. So they get more research or more information in regards to things that they love to look at. They would be able to enjoy it a lot more and know how diverse the bee species are in Arizona particularly."
Collaborative with locals	Statements regarding collaborating with local community members	13 of 22	"So just knowing that we had so many people from TBC that we were on Zoom calls with and things like that who were very interested in our research, that it was very important to them made me feel like this is important work that we're doing. And I think what further helped me was just that one Saturday that I got to go to the Desert Museum and do the BioBitz and talk to others who were very involved with the, with the community and the scientific community that was very important."

Consumer Of	Attends local museums, outreach efforts	3 of 22	"And then I got to learn more about the bee collaborative. I didn't even know it was a thing at the Sonora Desert Museum and I've been there so many times. So it was really nice to learn about that."
Important local environmental impact	Statements regarding the importance of local research for having an environmental impact	12 of 22	"The whole ecosystem that's present in the desert is like, it's so diverse, it's so cool. So, yeah they're out there pollinating all the local plants, and of course they're going to be really important to agriculture as well from pollinating food plants."
Important to local groups	Local research can be important to local interest groups	17 of 22	"I think the research helps the Tucson bee collaboration by just being able to identify more bees in bold and really be able to identify how it is affecting Arizona and the Southern United States and how that specific bee is affecting us here. And if it's affecting anywhere else that the bee collaboration is working with."
Local Venue	Importance of local research to local venues	0 of 22	
Outcomes			
appreciation for local place		2 of 22	"But then as I've been growing up here, I think it's kind of interesting that Tucson is... The food here, and then the bees, and actually it's... I don't know, I think it's very pretty, the desert. So, I've been trying to appreciate it more, and this made me appreciate Tucson more."
Camraderie	mutual trust and friendship among folks who work together	5 of 22	"We're working in groups, so I was thinking of groups of three or four before my other lab partners we're all as equally excited about it's kind of like I'm very beginning. Yeah at the end of it, I feel like we all have this sense of accomplishment together. We did this nice, yeah, definitely a real community feel the classes."
Decreased fear	Decreased fear of insects and/or research	1 of 22	"Knowing that this is my community, and that I had an impact on them and I learned a lot about this area is interesting to me, because I used to be really afraid of bees to be honest. And I'm still probably a little hesitant towards bees if I see one, but it's given me a deeper appreciation, not just because I can be like, "That's my bee." But just knowing that there are so many different types of bees and they have different jobs."

developing credentials	putting on resume or LinkedIn	3 of 22	"this is stuff that I can use in my future when I get a job in the field, and I have experience now I can use that as leverage on resumes going forward."
increased collaboration skills	gaining skills in collaborating with other students and/or community members	3 of 22	"I'm very someone who, I was always not such a team worker. I was someone who would like to just do my work and make sure I can get the best grade I could. But I realized that the more input that you get [from others] can actually help and benefit your own work, even if you're not doing a group work activity."
Increased communication skills	Student report of increased abilities to communicate to others	2 of 22	"Just telling other people about it. I know I talk about it a lot at work and I told the customers about it. So just kind of like a little experience."
Increased knowledge	gaining scientific and local knowledge	9 of 22	"Anything that I did, whether it was out of textbooks and just out at the Arizona State Museum or whether it's somewhere else. I feel I always am constantly helping my knowledge in this class."
Increased local interest	ex. Visits to museum, seeking more knowledge about local flora and fauna, taking action to increase knowledge or expressing interest in increasing involvement or knowledge	6 of 22	"Simply just because of the conservation and the ecology of this area. Just knowing that there is such diversity here, and that I was a part of identifying that in some degree, gives me more of a appreciation for the place that I live in. Beyond that, just knowing I have more of a connection than I had before after this project and probably going to pay it a lot more attention. Next time I go to the museum I'm like, the names of people and seeing if people are walking around and doing their thing, and stuff like this. Beyond just the classroom too, the local connections."
Increased tolerance of challenge	When a student reports what they would do to seek help or troubleshoot in the future, we can infer they have an increased tolerance to obstacles. As related to research.	5 of 22	"I think what I learned the most is that sometimes you just have to accept what it is and just start over and don't lose hope about it because if that would've happened, say it was reversed and that would've happened the first time around, I would've been like, "Okay, that's fine. We're going to do it a second time anyways, that gives us a chance to redeem ourselves", kind of a thing."

<p>Insect appreciation</p>	<p>statements regarding finding insects more interesting and/or valuable</p>	<p>17 of 22</p>	<p>"Before, I mean, I wasn't super obviously aware of all the different types of bees or I don't know, I was little scared of bees. But now I think that I'm able to see that they do a lot for the community. My bee especially likes to sleep inside of the cactus flowers and pollinate all the cactus flowers, which obviously. And then once they go into the flowers, then it kind of collects onto them and then they're able to kind of drop and then more grow, which is super cool just to see the process and how they are needed in our ecosystem, in the community, which I really wasn't really aware of before. I just thought they just stung you and whatever and pollinated flowers, but it's just really interesting to see that they do so much more for the ecosystem and for the community."</p>
<p>More care and caution</p>	<p>statements regarding taking more care and caution when out in natural environments</p>	<p>3 of 22</p>	<p>"Probably to not rush things. I think at times I was like, "Oh, we're behind other group so we better hurry up." But I think it's just important to go at your own pace so you don't mess up. Because a lot of these processes, you have to be really careful because if you run out of a certain material, you can't just get more of it. "</p>
<p>Need for more confidence</p>	<p>While a student may be nervous about completing a task they ultimately are competent and realize that they should have had confidence in their abilities all along.</p>	<p>2 of 22</p>	<p>"You're like, "Oh my God, they must be super smart or something." I don't know. When you don't know is easier to think, "Okay, this is just way too difficult." And I would say even for myself, looking at internships and stuff like that, sometimes you see like, "Okay, there's a research thing going on." You're like, "Yeah, I probably won't get this one." It's because you're you don't know enough about it or you never had the experience. So you're more likely to say, "No." Because you don't know, but now I feel like I have an idea of what to do in a research setting as it relates to team and reading stuff."</p>
<p>Positive affect</p>	<p>positive feelings associated with CURE outcomes</p>	<p>13 of 22</p>	<p>"Just in general, just being involved, just feeling out like I was involved in research and science just felt really cool."</p>

Research Self-efficacy	statements regarding feeling like they are able to accomplish research tasks or goals	16 of 22	"Well, I'm trying to study forensic science, and then once we did this I was more interested in the DNA analysis, and actually being in a lab, and taking... In the chromosomes, taking the DNA. I thought that was pretty interesting, and this class made me... It made me feel like I was doing it, like I was in a lab doing DNA... Well, I was doing it. But, it did encourage me to go in the DNA route. So, I think it was interesting. If I hadn't taken this class, then I wouldn't know if I would be in the same path or not."
Relationships		17 of 22	
Negative Instructor	negative feelings toward the instructor	0 of 22	
Negative Peer	negative feelings towards peers	0 of 22	
Negative Peer Mentor	negative feelings toward peer mentors	1 of 22	"If I'm being honest, the tutors were kind of either just together by themselves, or they were just walking around just watching, and I just didn't really feel like they were the ones to approach. I don't know. I just didn't feel comfortable with them."
Positive Instructor	positive feelings toward the instructor	8 of 22	"she did a really good explanation of having us watch videos before and then having a little presentation before we started getting hands on for that specific part, each part. So when we did the PCR and when we did the gel electrophoresis, when we did the grinding up of the leg, each part, she kind of showed us a small portion of it and then we went and did it ourselves and then obviously had people walking around in case we had any questions. So that was super helpful. I feel like if we didn't have one of those steps, it would've been a little bit more difficult."
Positive Peer	positive feelings toward peers	11 of 22	"I think that's what was so great about being in groups. We were able to discuss and help out whenever somebody was stuck or they didn't understand or anything like that."

Positive Peer Mentor	positive feelings toward peer mentors	10 of 22	"They were there pretty much every single class is definitely a repository to the lab and they work there circling the entire time checking in periodically with everything. Kind of laughing around checking in on every step, so a lot of interaction. It was really supportive."
Science Skills	A skill a student performs as part of the class.	22 of 22	
Bioinformatics	use of DNA subway, Blast, Mesquite, and BOLD; expressions of efficacy, proficiency, or improved skills using the above tools; mentioning trimming consensus	5 of 22	"But then when [peer mentor] tried to help me, because he was like, "Yeah, you have to... Maybe we can put your consensus sequence in a reverse," because he said like the Bold did that by itself, like they reverse the sequence. But then he did it on another webpage, and I thought that was interesting because I didn't know there's such a thing for that, only for that to reverse your sequence. I did learn, but then we didn't do anything about it. We didn't publish the sequence, or try to... Because I think there was nothing to do, it was just confusing. And they were confused too, because it was weird. It was just like a weird thing. But yeah, at the end we just stuck with the Subway data."
Hands on	includes positive statements of students perception of skill attainment through mastery experiences including personal achievements of success or completion of tasks at the bench or in the analysis phase	18 of 22	"I was excited. I didn't know that we were going to do so much hands on stuff. I was excited just to be able to learn how the DNA is extracted and all of that. But then once we got to actually making the gel for the electrophoresis and doing all the pipetting and mixing the solutions. Yeah, it was awesome."
Science communication	skills related to scientific communication, skills related to presenting and writing about their assignments, skills related to preparing poster presentations, publishing on BOLD	9 of 22	"It's so interesting, you got to engage, just like, with just a lot of different people today. There were people who knew way more about the other topics and other people know nothing about the topic. So it was really cool and you know, getting to engage with the people who collected the bee that we identified. And then people who are actually working in the research on the receiving the research that we did so it was really cool! All together it's neat to see how many people it takes to get to one identification."

Wet lab	skills related to understanding the wet lab processes necessary to complete the bioinformatic tasks; skills that require students to participate in wet bench preparation of samples	15 of 22	"I think the most exciting part for me was probably either the gel electrophoresis lab or the PCR lab just because those were really out of my element. They were something really new and exciting to do, because it's not something you would normally do in a biology class, especially a first year biology class."
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Supplemental Materials 3. Science self-efficacy and science identity items used in pre- and post-surveys.

<i>Science self-efficacy (Question stem: Please indicate how confident you are in your ability to...)</i>
Use technical science skills (use of tools, instruments and/or techniques).
Generate a research question to answer.
Figure out what data/observations to collect and how to collect them.
Create explanations for the results of the study.
Use scientific literature and/or reports to guide research.
Develop theories (integrate and coordinate results from multiple studies).
<i>Science Identity (Question stem: Please indicate the extent to which you agree with the following statements...)</i>
I have a strong sense of belonging to the community of scientists.
I derive great personal satisfaction from working on a team that is doing important research.
I have come to think of myself as a scientist.
The daily work of a scientist is appealing to me
I feel like I belong in the field of science.

Supplemental Materials 4. PSCE constructs and items used in student pre- and post-surveys.

<i>Scientific Civic Value (CV)</i>
I believe I should make a difference in this community using my biology skills.
Making a difference in this community using my biology skills is something that I value.
It is important to me to find a career that provides an opportunity for me to help this community using my biology skills.
I have a responsibility to help solve this community's problems using my biology skills.
I believe that I have a responsibility to support this community using my biology knowledge.
I believe that I have a responsibility to use the knowledge that I have gained in biology to serve this community.
<i>Scientific Civic Self-Efficacy (CE)</i>
I am confident that I can contribute to improving life in this community using my biology skills.
I can positively impact this community with my biology skills.
I am confident that I can apply my biology skills to solve real problems within this community.
I can make a difference in this community using my biology skills.
I have biology skills that would help this community.
<i>Scientific Civic Action (CA)</i>
I often apply my biology skills when engaging in community service.
I plan to help with a community event or organization using my biology skills.
I can use my biology skills to help with a community event or organization.
<i>Scientific Civic Knowledge (CK)</i>
I know how to use my biology skills to help my community.
I can think of ways to apply my knowledge in biology to help my community.
I can think of ways to apply my biology skills to help my community.

Supplemental Materials 5: qqplots for mixed models used in this study





