



Course-Based Undergraduate Research Experiences

Teaching Beyond the Podium Podcast

00:06 Dr. Alexandra Bitton-Bailey

Hello, my name is Alexandra Bitton-Bailey and welcome to the teaching beyond the podium podcast series. This podcast is hosted by the Center for Teaching Excellence at the University of Florida. Our guests share their best tips, strategies, innovations and stories about teaching. Anthony Auletta is a lecturer in the Department of Entomology and Nematology and he has loved bugs since he was in elementary school. As an undergraduate student, he was able to do research on Australian Huntsman spiders, which opened a brand new passion for him, research. In graduate school, he started teaching and discovered not only was he good at it, but he really enjoyed it. The trick for Anthony thus became to find a place where he could do all three. And that is how he landed at UF running undergraduate research courses.

00:55 Dr. Anthony Auletta

Ever since I fell in love with teaching and decided that I wanted to pursue a teaching focus career, I was looking for meaningful ways to combine that love of teaching, with all the things I love about research, you know, that sense of curiosity, that drive to discover something new, and CUREs are a really great way for me to bridge my research interests and my passion for teaching. So CURE is an acronym. It stands for course based undergraduate research experience, it's not a terribly new idea. The idea is to incorporate a meaningful research experience into the framework of a course. So in a sense, it's bridging that gap between the research lab and the classroom.

01:43 Dr. Alexandra Bitton-Bailey

There are several key characteristics to CURE courses. And one of the most important aspects of a CURE course project is that students are not simply analyzing existing data or summarizing previous research.

01:56 Dr. Anthony Auletta

The research project itself comprises between two thirds and three quarters of the course. And one of the really important things about this research project is that it is novel. So the students are not working on a cookie cutter demonstration, or something that already has a known answer, they're actually standing at the forefront of knowledge, generating new knowledge to our field, and hopefully publishable data.

02:25 Dr. Alexandra Bitton-Bailey

CURE courses focus on questions that are important, relevant, not only in the class, but outside of the classroom.

02:33 Dr. Anthony Auletta

So the findings of our research are going to have applications somewhere else, whether that's within our broader discipline, applications to our community as a whole, or for some specific stakeholders.

02:49 Dr. Alexandra Bitton-Bailey

CURE projects are collaborative projects that students are working on in teams that reflect the types of teams they might experience in their own fields.

02:58 Dr. Anthony Auletta

So students are not working independently, they are working in small teams. And as they do so they're not only accomplishing their research goals, but they're also developing a suite of other skills for effective teamwork that will be helpful to them even if they don't go on to research in the future.

03:15 Dr. Alexandra Bitton-Bailey

Students are working on real life projects that mimic the lab experience.

03:20 Dr. Anthony Auletta

So the students are not just doing one experiment and calling it a day. They are constantly revising their work troubleshooting as needed, just like they would in a

traditional research lab. So these elements come together and make CUREs special and unique, separating them from other types of courses that may incorporate research or lab like elements.

03:42 Dr. Alexandra Bitton-Bailey

CURE courses can follow a variety of patterns. But a common thread is that CURE courses function much like what researchers in the respective fields might do and experience. This makes them unique in every field of study.

03:58 Dr. Anthony Auletta

There's really no one way to teach a CURE. And the way you structure your CURE is probably going to depend heavily on how research in your particular discipline works. I'm based in a biological science and the way that I might structure a research based course in that field is probably going to be different than the way someone might structure a CURE in, say, a humanities field or business or engineering.

04:21 Dr. Alexandra Bitton-Bailey

Anthony believes in this significance of the CURE experience. As these courses have a huge impact on student learning. In CURE courses, students develop both content knowledge and skills that will help them in any work environment in their futures.

04:37 Dr. Anthony Auletta

So undergraduate research is a high impact educational practice. There's just so much that students stand to gain by engaging in guided research during their undergraduate degree and that's not just in terms of increased content, knowledge or, or technical skills, but it also helps build critical thinking skills. It has helps students practice effective communication. It can lead to increased self confidence. It can help them get more clarity about their career options, and foster a greater interest in their discipline. And of course, it's also practically useful when students are applying for graduate school or careers down the line. It's a really, really great achievement to have on your resume or CV. So there are all these really great benefits to undergraduate research. And students are eager to get these experiences. And I think a lot of faculty are eager to mentor students in these experiences as well.

05:36 Dr. Alexandra Bitton-Bailey

An added benefit to CURE courses is that they blend our research and teaching into a single endeavor making it possible for us as instructors to expand and continue our research, while opening up new opportunities for our students.

05:53 Dr. Anthony Auletta

The problem is that we as faculty are generally very busy. And we don't have necessarily the time and resources to accommodate large groups of students who want to do research with us. Most faculty may only have space time, or money for one to three students at a time. But there are many more students than that, that are looking for a research experience. And so something like a cure that incorporates that research experience into a structured course can really help address that issue. Because now you have a situation where you can have, let's say 30 students working collaboratively on a research project together under the mentorship of several faculty. And that's just more students than can be accommodated in any one lab in a traditional one on one research assistantship.

06:44 Dr. Alexandra Bitton-Bailey

Not every student is able to identify and engage in a research internship. So CURE courses make it possible for all students to participate in that kind of work.

06:55 Dr. Anthony Auletta

Yeah, there are certain barriers that students may face when they're looking for a more traditional one on one research, mentorship experience, sometimes we take it for granted. But students may not be able to participate in an extracurricular activity because they have jobs to go to or other obligations on their time. There may also be a lack of self-confidence at play, where students may feel intimidated about approaching a potential research mentor about working in their lab. At times, there may also be certain social or cultural barriers, or just a lack of exposure to what research opportunities are out there. So having the research experience, as part of a course, that students can take to help fulfill their degree requirements, really addresses a lot of these issues.

07:45 Dr. Alexandra Bitton-Bailey

The benefits are not just there for our students. In fact, there are multiple benefits to us as faculty, because by offering up CURE courses, we free up more time to focus on research.

07:58 Dr. Anthony Auletta

And from the faculty perspective, there's a lot to gain as well. I think a lot of us as faculty are in this position where we love our research, we love what we do. But we also love our teaching. And finding a meaningful way to connect the two is not always easy. For a lot of faculty, these are separate silos. I have my teaching program and I have my research program. But through a CURE, you can link those two programs together in a way that benefits not just the students but also benefits you as well, because the students in doing the research project, they're generating publishable data, and those are data that you can use towards your own publications or that you can use in an upcoming grant proposal. It really helps further your research program as well. While at the same time providing all these really great benefits for the students.

08:51 Dr. Alexandra Bitton-Bailey

CURE courses are able to open up new doors for students who may not have seen some career opportunities as possibilities for themselves before.

09:00 Dr. Anthony Auletta

I've had several students from previous semesters reached out to me to tell me how useful this course was in landing them another research position or getting them into graduate school. And even though most of the course focuses on our actual research project, about 75% of it does, there is that other 25% of the course which we spend engaged in discussions and other active learning exercises that really get at the heart of what does it mean to be a good scientist? So we have a session where we invite a diverse panel of graduate students to join us and give advice on how to succeed in graduate school and beyond. Students consistently tell me that that's one of the most useful sessions in the entire course. We also have this science across borders project in my CURE course. And this is one that I developed in consultation with people at the University of Florida International Center. Through this project students are paired with an international researcher and they conduct an interview with that person about research generally, but specifically strategies for engaging in productive collaborations across international borders. So the benefits of working with scientists from other cultures and countries, some of the challenges, and some of the ways to address those challenges. And although some students are sort of intimidated by that project before it begins, afterwards, I've had students tell me that that was perhaps the most useful

experience for them, and that they learned a lot. By having this opportunity to talk with an established scientist.

10:34 Dr. Alexandra Bitton-Bailey

There can be some challenges to implementing CURE courses. The most important one of these is that they present a significant time commitment.

10:43 Dr. Anthony Auletta

I think the biggest challenge for many people, and the one that might prevent them from even trying in the first place, is that it is a pretty substantial time commitment. When you're leading a CURE, you're really wearing two separate hats. You're the instructor of a course, but you're also the principal investigator of a research project. That is a lot for any one person to manage, especially if you're teaching other courses that semester, or if you have other obligations for your research or extension programs. And so my advice for people who are interested in developing cures is to lean into the collaborative aspects of them. Through the CUREs, we encourage students to work collaboratively, but I would encourage faculty to work collaboratively as well. I myself have a 100% teaching appointment here at UF. So I actually do not have my own active research program. So to teach these CUREs, I partner with faculty in my department who do and that makes it much more manageable for all of us, because now we have one person who can handle the educational aspects of the CUREs, designing the assessments, making sure that the activities we're using are useful for the students and another person who can manage the details of the research project, essentially a course coordinator and a principal investigator. And I found that that partnership is really useful, not just in making it manageable for everyone in terms of time, but also a great way to model for the students the collaborative nature of science. And to that end, we often try to include additional collaborators. So graduate students, postdocs, experienced undergraduate researchers, who can join us as part of the class to help students along the way as they're working on their research project.

12:30 Dr. Alexandra Bitton-Bailey

CURE courses can be taught in any field according to Anthony, and will help students be better prepared for future research.

12:38 Dr. Anthony Auletta

When we think about CUREs. Most of the examples that are out there are from the STEM fields, particularly in the biological sciences and the physical sciences. But I would argue that CUREs are appropriate for any discipline, including engineering, business, the humanities, the arts, any field that involves scholarly research in some way is appropriate for a CURE. And I think CUREs are especially beneficial for getting students that early exposure to what it's like to do research in those disciplines. And so, CUREs are most effective, I think, when they're targeted at students who are early on in their academic careers. That will give them time to build these foundational research skills through the CURE class, and then apply them later on in their undergraduate degrees to other research experiences, such as a one on one mentorship, or research internship, or some other program.

13:36 Dr. Alexandra Bitton-Bailey

To get started, Anthony recommends reaching out to Dr. Anne Donnelly from the Center for Undergraduate Research.

13:43 Dr. Anthony Auletta

The UF Center for Undergraduate Research has worked extensively over the last several years to help faculty build CUREs in their own disciplines. And the center director, Dr. Anne Donnelly is especially interested in helping faculty develop these CUREs so that we can see CUREs across all colleges and all departments at the university. There are also a number of other resources available freely on the internet, including a resource known as CURE net, which is a centralized collection of resources compiled by professors across the US who are teaching CUREs.

14:18 Dr. Alexandra Bitton-Bailey

Anthony says just keep trying, just like in our research, things will work out as they should but be flexible and keep trying.

14:25 Dr. Anthony Auletta

We have to approach it with the same mindset that we would approach a research project, which is we have no idea if it's going to work out. But that's okay, because if it doesn't, we'll troubleshoot and adjust and try again, until we land on an approach that that does work. And that's definitely what I've been doing. The first time I taught a CURE, there were certain components of it that just didn't go smoothly. And that may be

in part because of the COVID 19 pandemic that interrupted my first CURE but I've learned from those experiences and I've adjusted how I structure the course.

14:58 Dr. Alexandra Bitton-Bailey

CURE courses, generate loads Have excitement from the students, the idea of creating something new and meaningful, really resonates with students.

15:06 Dr. Anthony Auletta

So in my experience, students enter these CURE courses with a lot of enthusiasm. For most of the students in the class, this is their first research experience. And they're really excited to be part of that. And they're especially excited to be part of a research project that they feel is going to go somewhere. Again, a lot of courses that incorporate research don't necessarily incorporate novel research. And so the students can quickly lose their motivation, if they feel like the research project they're working on doesn't really mean anything. If it's just, you know, cookie cutter experiment, and they're just going through the motions because they have to do something for the course. In contrast, the research and a CURE is, is novel, and the students are helping generate new data. And that can be a little intimidating. But for a lot of students, that's also really, really exciting.

15:58 Dr. Alexandra Bitton-Bailey

One of the key challenges in CURE courses is very much the same as you might find in other courses. The loss of motivation or discouragement. And that requires a bit of work on the instructors' part.

16:11 Dr. Anthony Auletta

As the course goes on, there are some challenges. Students can lose their motivation if the experiments don't work right away. And in research, the experiments often don't work right away, takes a bit of troubleshooting to get where we need to be. And so a challenge involved in teaching CUREs is helping students maintain their motivation during those parts of the project. And another challenge is that as we start working on the research project, the students can feel at times a little overwhelmed, especially if we're using analysis techniques that they may have never used before. In the CURE class that I'm teaching now, our research project focuses on genome sequencing. To assemble our sequences into a full genome, we are actually using the university's supercomputing network, Hyper Gator, which is a fantastic experience for the students.

But for students who may not have a lot of background in genomics or computer coding, it can be a little intimidating, because it's a lot of new information coming at them very fast. And so part of teaching the CUREE is really helping students through some of these challenges, helping them keep their motivation and helping them not become overwhelmed.

17:27 Dr. Alexandra Bitton-Bailey

What Anthony loves best is when the students finally realize this is their project, they are making a difference. To him, that moment is magical.

17:38 Dr. Anthony Auletta

My favorite part of the cure, whenever I teach it, is that moment, about halfway into the course, where you can see the students start to take ownership of the research project. A lot of students start off very cautious, perhaps even a little intimidated about the prospect of doing this project. But at some point during the semester, they become comfortable with the methods we're using. And you can see that switch. When I taught the CURE online last fall. Initially, students were really really quite intimidated about working with Hyper Gator because you can't just click a button to make things work in Hyper Gator, you have to type in commands using the command line interface, which for last students was something that was totally novel to them. But at some point, about halfway into the semester, I could see students typing questions into the Zoom chat. And before I or my co instructors had a chance to answer them, another student had already typed into the Zoom chat, a potential solution. And the students before we even had a chance to do anything, they themselves were working together to troubleshoot the problem. And so that moment where the students were taking ownership of the research project, working together to troubleshoot and come up with solutions, without really needing us as the instructors there much at all was really the pinnacle of excitement for me in that course, because that's one of the things we really want students to get out of it. We wanted them to build that confidence, build those technical skills, those communication skills, and this was a perfect illustration of all those things coming together.

19:14 Dr. Alexandra Bitton-Bailey

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