

**Bonni** [00:00:00] The flipped classroom has received a lot of attention in recent years. Today Dr. Derek Bruff gives his unique take on the idea was to have the students do before they entered the classroom and what to do once they get there.

**Production Credit** [00:00:14] Produced by Innovate Learning, maximizing human potential.

**Bonni** [00:00:22] Welcome to this episode of Teaching in Higher Ed. This is the space where we explore the art and science of being more effective at facilitating learning. We also share ways to increase our personal productivity approaches so we can have more peace in our lives and be even more present for our students.

**Bonni** [00:00:51] Welcome to episode 71 of Teaching in Higher Ed. Today I'm pleased to have on the show Dr. Derek Bruff. Derek, welcome to the show.

**Derek** [00:01:00] Thanks for having me.

**Bonni** [00:01:02] I first quote on quote met you or became aware of who you are from your Twitter profile. I'm just going to read what it says you are the Director of the Center for Teaching at Vanderbilt University and your profile also says you're a fan of wheels on chairs. Derek, do you mind sharing what the background is on why you are such a fan of wheels on chairs.

**Derek** [00:01:23] Absolutely so. I'm a big proponent of active learning in the classroom in the very forms and I find that often when I walk into a classroom or when other instructors walk in to a classroom there's a desire to kind of shape the environment to suit the learning needs of that class session.

**Derek** [00:01:44] And so I'm often finding myself wanting to move chairs around and tables around. Maybe we'll do groups of four maybe we'll do groups of six maybe we'll have a debate.

**Derek** [00:01:53] And so I love it when classrooms are flexible enough to accommodate whatever needs to happen in class that day. And so that's why I like wheels on chairs.

**Derek** [00:02:03] Once you have wheels on chairs then you and your students can usually pretty easily reconfigure the classroom to suit whatever activity you're doing that thing.

**Bonni** [00:02:10] I've seen some of the pictures that you have some of the classrooms you've actually had a chance to be a part of designing and I covet those wheels on chairs and I think that's fabulous.

**Bonni** [00:02:20] You have a Ph.D. in mathematics from Vanderbilt and you have the article you recently published about your journey from math major to teaching center director would you share a little bit about that journey with us.

**Derek** [00:02:35] I guess if I really want to kind of unravel my secret origin it was probably third grade even when I realized that math was something I really liked. I remember the moment we learned how to add fractions with different denominators.

**Derek** [00:02:47] And I thought that was just the coolest little algorithm. I didn't know the word algorithm for those in third grade but I thought it was really cool.

**Derek** [00:02:53] And I've actually talked to other folks who could point to that same topic as when they started really frustrated with mathematics but I was a math guy from way back and then when I got to college I started tutoring math and that's when I got bit by the teaching bug.

**Derek** [00:03:07] I was working with my fellow students right who were really struggling in calculus and I would meet with them and kind of help them walk through problems. And I really appreciated how that kind of light bulb moment that would come on and not all the time but often enough that I felt like I was reading useful and could kind of help explain things that were confusing to them.

**Derek** [00:03:25] And so when I graduated college I was I the plan was to become a college math professor. And so I went to ended up at Vanderbilt University where I am now.

**Derek** [00:03:34] But I did my graduate work there as well. And one of the reasons I picked greenbelt was they had a reputation for producing very very strong teachers of mathematics. And so and I got a chance as a graduate student to be the instructor of record for calculus for six semesters in a row.

**Derek** [00:03:54] It wasn't just a TA or a paper grader but I actually got to be in the classroom and you know other than the kind of the topic it was first semester calculus than the textbook. I had a lot of autonomy to teach and to develop my teaching skills.

**Derek** [00:04:10] And so it was later in my grad school career actually I started working at the Center for Teaching here at Vanderbilt where I'm now the director. And that's when I got a taste of working with other TA's other grad students who were teaching in other disciplines.

**Derek** [00:04:23] Even helping them generally working one to one with them to kind of think through teaching choices they were making and I got this sense of what I do now which some would call educational development where I'm working with colleagues and helping them develop and refine their teaching practices.

**Derek** [00:04:40] So when I went in the job market after I finished my Ph.D. I happened to land a spot at Harvard and in that department. And it was kind of an unusual position. It was called preceptor. It was a nontenured faculty position in the math department and Harvard calculus was taught in small sections like it was at Vanderbilt.

**Derek** [00:04:57] And so we had a lot of grad students and postdocs who were teaching calculus. And so my role there were a team of us but we were the course that had four different flavors of calculus. Not only did I teach but I also trained and supervised and mentored more junior teachers in the capitalist program. That again kind of gave me the sense of kind of working with others helping them develop their teaching skills.

**Derek** [00:05:18] Teaching about teaching which I found to be really really exciting. And so after a couple of years I moved back to Vanderbilt got a position as an assistant director here at the Center for Teaching.

**Derek** [00:05:28] That was a pretty big shift right from a faculty role to a staff role from a position within a math department to a university wide teaching center. I

liked exploring what teaching learning looked like in other disciplines as much as I love Mathematics and teaching mathematics.

**Derek** [00:05:42] I also really like engaging with faculty from all the different disciplines and helping them think through what teaching and learning might be in their class. And the other is that I feel like now it is better for teaching. I have had less of a direct impact on student learning.

**Derek** [00:05:55] I still teach one of course a year in the math department some I'm kind of in the classroom and I get to work with scenes that way. But through my work at the Center for Teaching I'm working with hundreds of faculty around campus.

**Derek** [00:06:05] And I think helping them enhance the learning experience of their students. It's an indirect impact but it's really the bigger impact in many ways. And I find that I'm really drawn to that as well.

**Bonni** [00:06:16] I want to ask a quick question about your experience with the TA because that's so early back in in your teaching experience. My university recently really really increased the service levels of their tutoring center and it's I'm just so excited about what they're doing.

**Bonni** [00:06:30] And so I'm hearing more about students who are accessing the tutors. But one of the weaknesses is that the according to students who are being tutored that they feel like that tutor is just again telling them more about what they're supposed to know versus asking them to explain it back to them.

**Bonni** [00:06:47] And I was wondering did you notice that back then that that gosh it doesn't really work when I'm trying to tutor if I just tell them again the same way that their professor might have in the class or did it take a little while longer to kind of figure out the telling versus asking more active learning.

**Derek** [00:07:05] Good question. I think in my case certainly my I mean I started tutoring my freshman year of college and I was tutoring other freshmen who were- I had calculus in high school so I was a little bit ahead of them in terms of the math trajectory and the students who signed up for tutoring largely did so because they weren't understanding the explanations they encountered in the classroom.

**Derek** [00:07:26] And so almost all the time I would have to come up with different ways to explain things to students so that it made some sense. And I

think I probably just kind of stumbled upon the strategy of asking them lots of questions right. Show me how you're working through the problem right.

**Derek** [00:07:44] And I could kind of see where they got stuck and I could ask them well well what if you did this or what if you did that. And so through asking questions I would often kind of help them get to some level of understanding.

**Derek** [00:07:56] And I feel I have to offer a lot of explanations but I think I was often grounded in whatever kind of misconceptions or questions that they had. I remember there was one fellow student who we we worked together pretty regularly throughout my entire freshman year.

**Derek** [00:08:11] And it got to the point where she you know I'd kind of sit there she worked the problems I'd kind of ask asking questions every now and then kind of see if she was on the right track and she said Derek could you maybe just come to my my test and sit next to me you don't have to say anything. Just every now and then say hm or say are you sure about that.

**Bonni** [00:08:28] I love it.

**Derek** [00:08:29] And it was. It got to the point where that was all she needed right to kind of go back and double check and I think things through. So I don't know I think I was my my my takeaway was that I'm asking questions as a tutor is kind of your most your most valuable tool.

**Derek** [00:08:44] And when I worked at Harvard I directed our students study hall there as well for a year. And then we trained in that case it was staffed by undergraduates.

**Derek** [00:08:52] And when we train them to be effective tutors. This was kind of a key piece actually if we had to. We had helped them understand they can't just give students the answers that's something helpful. They have to ask the kinds of questions that will lead the students to the answers themselves.

**Bonni** [00:09:06] Were going to transition now into the flipped classroom although we haven't had an episode yet on the flip classroom I'm sure we'll even have more in the future.

**Bonni** [00:09:14] But you have a different take on it before we hear about your different take what you just defined for people listening what a flipped classroom usually means I know there's lots of definitions but just a general.

**Derek** [00:09:25] Yeah there are lots of definitions. So I think they're connected back to because I first heard Eric Mazur pharmaceuticals professor talk about this years ago and he talked about learning that as this two stage process.

**Derek** [00:09:38] There's the transfer of information from instructor to students and then there's the assimilation of information by the student and then the traditional model and you can kind of think of a classic introductory to physics course right that the transfer stage happens during class through lecture.

**Derek** [00:09:55] And then after class the students go and work homework right to do homework sets the problem sets and they try to mix them all the stuff they heard the lecture on some level the classroom is kind of a shift in time of that process that you take that transfer step and that happens before students get to class.

**Derek** [00:10:12] In class time is then spent on the assimilation step. And as Eric Mazur likes to say that's that's the harder of the two anyway. Right. And so why not do that when everyone's together write the scene together you're there and you can help work through it.

**Derek** [00:10:26] And so I think kind of a classic flip approach is to have students kind of have some sort of first encounter with the material before they come to class. It could be reading their textbook. It could be a video that you find it could be a video that you create. But they come to class having had some first exposure to the material when they're in class. That's a time for that assimilation right.

**Derek** [00:10:45] And assimilation seems a little bit too borg-like to think of it in terms of practice and feedback. I think it's working through ideas. And we need feedback on that process.

**Derek** [00:10:56] And so moving that to the classroom you can kind of think of what used to be a homework set with might be moved into the class time to be worked on together maybe collaboratively during class and so that's kind of what I think of as that flipped approach is that you've got to first exposure that happens before a class and then practice and feedback and during class and then often there's more more after it.

**Derek** [00:11:17] Right some kind of further exploration or more work after class. But it's that that idea of flipping. What usually happens outside of class what

happens in class and vice versa. I think that's where we get the metaphor. Certainly.

**Bonni** [00:11:29] I know one of the tools that you've recommended in your blog and in other articles is from the Center for Teaching at Vanderbilt by Cynthia Brame.

**Bonni** [00:11:39] She has a set an article on flipping the classroom and speaking to let people know that I will post a link to that article and all of Derek's recommendations and links and things like that will be posted at [teachinginhigher.com/71](http://teachinginhigher.com/71). Now we kind of have an idea of what a flipped classroom normally looks like.

**Bonni** [00:11:59] What are some of your criticisms of what a what a typical flipped classroom model might look like what are the limitations.

**Derek** [00:12:06] First I think I'll point out that there's kind of this flipping metaphor going on right which is in some ways a relic. Since things like You're flipping from one thing to another I think for our colleagues in the humanities they may hear this idea of having students do the reading before class and then coming to class to like basketball. Like that's that's a new thing for them.

**Derek** [00:12:27] And that's not a flip. I like to joke that if you think about an English literature course if you were to flipped that you would have students read silently the text together during class and then they would talk about it online after class.

**Derek** [00:12:39] I mean I don't know that you would do that. And so I do think the flip is a relative in the sciences in math and a lot of the social sciences. There's a real strong tradition of lecturing during class. Having that first exposure happened during class and so in those areas that's a class that really does kind of present a different way of doing things.

**Derek** [00:12:59] I joke about the flipping a lot but I actually have a colleague here and Shane in our English department who recently published an article called flipping the flipped classroom where she actually wanted to engage her students in some collective reading during class and she wanted to kind of highlight the reading process itself.

**Derek** [00:13:15] And so she did exactly what I joked about which was have students read together in class which I think it's kind of funny. So I think the thing

about. The flip so there's I guess a couple of things a full classroom one is that there's a common belief that the classroom into how students watch a video before class that you're kind of substituting that lecturer as the as the thing the students before class so you either find videos or create videos spring tasks.

**Derek** [00:13:44] Right. And I would like to think I mean that can be very helpful and useful certainly it can be a lot of work too. Yeah but I think the bigger point is that the things I liked about the classroom is that it is this kind of question and I think were raised that right. Why don't we do the hard stuff together.

**Derek** [00:14:02] And so what I would say you don't have to be a video before class. Having since read your textbook is is often a very useful kind of first exposure. All of that kind of points to the learning process right.

**Derek** [00:14:19] What are the kind of experiences that activity if we want to have our students do that will help them make sense of this material and do something interesting with them. And so that's why I like the classroom as a model because I think it points us to this question about the learning sequence and how we can make the best use of our time.

**Bonni** [00:14:38] I hear a lot of the comments you're talking about the flipping the videos the difficulty in that sometimes but also the helpful parts of doing the hard stuff together.

**Bonni** [00:14:48] I wonder if you're also hearing just trying to get students to do something before class that it feels like maybe we used to do more of where you actually read the textbook before you come to class that kind of thing. Are you also hearing that in the model.

**Derek** [00:15:02] And I think so and this is where I think things get a little bit interesting for the Humanities folks because I've long heard humanities faculty say gosh you know I wish students would do the reading. They don't do the reading.

**Derek** [00:15:14] And so while yes it is kind of part of their model that students do the reading before class and come to class and discuss it. If students aren't actually doing the free class prep then it kind of derails what you do during class.

**Derek** [00:15:25] And that's where I think some of the folks maybe in the sciences who have been implementing in the classroom have hit upon some



mechanisms that might help actually kind of ensure that students come to class ready to learn and are and are prepared.

**Derek** [00:15:38] There's also this kind of pushback that the classroom is kind of doubling the workload for students that they have to do all this stuff before class and then they have to do all the stuff during class.

**Derek** [00:15:47] And I don't think that's the right way to go about it either. And that's why I really like this term first exposure.

**Derek** [00:15:54] That's from Barbara Walters book on effective grading and she talks about this kind of first exposure idea. And so I think it's helpful to think what kind of first step in the learning sequence for this topic and and should encourage students engage in that outside of class.

**Derek** [00:16:16] And so that may be like a 10 minute video that they would watch right to kind of have an example or kind of introduce a key principle or maybe it's a short reading that they engage in before class. Something that's going to get them ready for what happens in.

**Derek** [00:16:31] And not necessarily kind of not necessarily what you would have done in class shifted in time. All right. But I think there's a there's value in kind of rethinking what the process is and what's the right kind of first the first step in that process.

**Derek** [00:16:45] And then on some level when should that happen. Right. It may be that the students first encounter with the material should not happen on their own before class. Maybe that needs to be a collaborative group activity during class.

**Bonni** [00:17:00] So thinking about it instead of is this coming before the classroom just automatically in my head because I flipped the classroom this first exposure has to happen then. But thinking first about what that exposure should be and then determining the best mechanism for exposing the students to it.

**Derek** [00:17:21] Yeah. So there's this term from the literature that I found really helpful to think about it. Lots of different scales from an article by Schwartz and Bransford how time is a time for telling and so this is the kind of metaphor I usually use.

**Derek** [00:17:35] Several years ago my daughter was in preschool and they had a science day like preschool. And so all the parents were asked to come and do something science for the students.

**Derek** [00:17:46] And so I was I have to say I was the cool dad who did that diet coke and mentos thing. You know where you take Mentos and roll into the diet coke and you get the geyser of diet coke. And so all the little 5 year olds are those cool thing in the world. And the thing that I notice even with the five year olds was after I did the little demonstration they wanted to know why it worked.

**Derek** [00:18:08] Now I couldn't get too much into the physics and chemistry of that with five year olds but I could say stuff you know there's bubbles trapped in the soda. And when you put them in those in they're all the bubbles kind of come together all at once and then have to escape right.

**Derek** [00:18:18] I could give an explanation but it's the kind of the why question that I think was really interesting because if you take this and kind of take it to a you know college level chemistry or physics class you could lecture for 15 minutes on how the Mentos and Diet Coke thing works and then show them the demonstration. Or you could start with a demonstration.

**Derek** [00:18:41] Ask them to conjecture of why it works. Have them talk about a little bit. Right now the vote on a clicker question or something to try to hypothesize and then get to the explanation.

**Derek** [00:18:53] And I think what you'll find that you do with the latter way is that there's kind of cognitive and motivational benefits that cognitively the students have kind of access what they ate whatever prior knowledge they have. Right. They've they've conjectured a little bit.

**Derek** [00:19:06] And so they're going to be ready to make sense of that explanation when it comes and motivation. They're going to be curious. They're going to want to know why it works. And maybe you do a quick question and half of them get it wrong. Right.

**Derek** [00:19:16] And now they really want to know Well why did we get this wrong. What's the right answer. I love this idea of creating times for telling and that I think really does kind of question this kind of simple model of the classroom where students encounter the material through some kind of explanatory process right.

**Derek** [00:19:34] Textbook lecture or a video but that's the first thing that they encounter as an explanation. Then they come to class and do something with it. I think sometimes students first need to encounter a problem or a challenge or something a little bit mysterious something that they can't quite understand is a little stuck and then that motivates the 15 minute lecture where you are explaining something that at that point they kind of want to know about.

**Bonni** [00:20:01] I wrote a chapter once about instead of trying to fight against things that bother us that students do they don't read before they come to class or they're on their cell phones and texting while we're trying to teach them something that is fighting against that to use the Aikido method -martial art where you use that force and then turn it back around against them.

**Bonni** [00:20:21] So if they're going to be on their cell phones anyway why not pick up the cell phone and get them engaged in some way with a polling system or something like that. And in terms of the reading you're really doing that instead of me they don't read that textbook.

**Bonni** [00:20:32] And trying to heighten that curiosity and that hunger for wanting that explanation and then perhaps if the textbook is the place that we think to go as one of the means for solving that mystery that you've just introduced them to. I love that idea. Times for telling.

**Derek** [00:20:49] One of the of courses I teach from time to time as a linear algebra course. And so I like to and like I said the time for telling thing kind of operate kind of within a quiet session or within a unit or within even a course.

**Derek** [00:21:01] And I use that kind of at the court level among other places. So in the first day of class or with your algebra course we don't start that kind of usual process is to start kind of here's a matrix and here's how you multiply two matrices and here's how you know. Here's some of what your equations and here's how you do the computations associated with that.

**Derek** [00:21:20] And that's all important stuff but I think it's it's it's a kind of a it's a frustrating way to start the course because it's not that interesting and it's very kind of computational in nature but it doesn't help students understand like why would I take what you're eligible. What could they do with us.

**Derek** [00:21:35] And what are the concepts like. The thing about Linear Algebra is that actually the concept gets really hard and I don't like to kind of wait till weeks for it to kind of surface again.

**Derek** [00:21:46] So what I'd like to do the first class is we looked at the board game Monopoly and I kind of pose a challenge. Like what are the best places to buy on the board game Monopoly. And they kind of have to think about it a little bit. I felt like you know a photocopy of the gameboard books.

**Derek** [00:22:02] They were all looking at it kind of figured out well you rolled the dice and you started going and we were on the board. And you buy places and you lie in places and when people land on your place you could either charge them rent. Right.

**Derek** [00:22:13] And so eventually they kind of come up with well you want to buy properties where you get a lot of money for the market. But you also would buy property singlehanded on the walk. Right. What are the properties that get landed on the most.

**Derek** [00:22:27] And that's kind of an interesting question and then we start to model that. Right. And so I say OK well nothing complicated looks. Imagine you just had four states.

**Derek** [00:22:35] And now we're just kind of moving around these spaces and what we do is we kind of go through this modeling process trading very very simple ways for most of the rules of Monopoly. Then we add in a few rules to get a little more complex and we kind of get to the point where we realize we've got a nice model that we can kind of see over time frame where which which properties that landed on more often.

**Derek** [00:22:57] You can kind of think of this you know you're the little the carrier or the shoe whatever and you're just kind of going around the board an infinite number of times you just go in and go in and go in which are the ones that you want to know more often.

**Derek** [00:23:08] And the beauty is that you solve that problem with matrix algebra. You can model it with matrices and then you can kind of predict what the long term behavior is using this thing called a Morecroft pain.

**Derek** [00:23:20] And there are some nice theorems around this that allow you to do this kind of mathematical prediction. And so by starting this way I think it helps them one by the end of the first hour they don't really know how to do things they barely understand what the Matrix is.

**Derek** [00:23:34] But that's not the point right. I want them to start to see kind of where we're going with all this. And I wanted to see a question that I hope is a little bit interesting to them. It seems a little bit relevant maybe that they don't know how to answer yet and they don't at this point and it will be several weeks before we develop the mathematical machinery to actually help them answer that question.

**Derek** [00:23:57] We talk about a few other applications that are similar. Right. You can model populations moving around places with the same kind of technique. And so by the time we get to markov chains you know four or five weeks later now we can answer that question.

**Derek** [00:24:10] And now I think we've created that kind of time for telling where now they want to know what they can do with more protein and they and they get good at using a great example that's kind of a course time for telling right.

**Derek** [00:24:22] But even at a smaller scale I wouldn't necessarily want them to kind of go through that on their own before they can declare their case. We couldn't want to do it together. Right. I want him to get stuck together.

**Derek** [00:24:31] I want him to have each other to talk to as they're getting stuck so that they can start to do that kind of trajectory that will lead to the time for toning down the way.

**Derek** [00:24:41] And so I do think and there's some research there's an article by a team of education researchers at Stanford who looked at a neuroscience class and they could have compared students who did Hands-On their activities for exploratory videos versus students who did explanatory videos first and then hands on their activities.

**Derek** [00:24:59] And the students who started with the kind of concrete experimental activities actually did better at the kind of assessments that they that they gave them a little bit later. And so I don't think it's universally true that you want to start with a kind of experimental piece.

**Derek** [00:25:14] But I think some things you do and I think you need to think carefully about the topic and the students and again that question of what's the sequence that's going to help students really start to kind of get into this material and start to make sense of it.

**Derek** [00:25:26] And so sometimes if an explanation to start with sometimes that's a problem maybe sometimes you want to start that process during class and sometimes you want a thought process before class.

**Derek** [00:25:36] I can see though that you're in. Sorry I'm going to repeat what you just said. I'm starting to get that you're teaching me as we go. But when we just adopt the flipped classroom and it just becomes I picture this line down the center of a pager or down the center of a spreadsheet and on the left are all the things I do the students do before they come to class and on the right.

**Derek** [00:25:59] And I'm sure I've gotten into that pattern myself and my course design I'm just thinking of it as dates that are plugged into a calendar and for me I'm always meeting in person on Mondays and Wednesdays and then they have to have done the the outside of class before we would have met on that Friday.

**Derek** [00:26:16] So they don't spend their weekend or stay up you know total all hours trying to get it done the night before it's due. I try to fight some of that but I'm sure I've gotten too locked into that and instead the focus is on first exposure and what's the best place and time to do that and starting with that you're emphasizing so much of getting them to start to ask why and lighting up the curiosity in their minds.

**Derek** [00:26:40] I want to be realistic about this too right. I mean some of this you know I'm a busy guy right. I've got to teach my class. I don't want to necessarily kind of reinvent the wheel every Monday Wednesday and Friday.

**Derek** [00:26:50] So I kind of have my default right. But I think even when you've got defaulted you have would be false. Right. And so I think for a lot of kids and a lot of cases the model does offer a good kind of default.

**Derek** [00:27:02] But then also when you have the bandwidth to kind of think concretely OK this topic right for this reading what's the sequence that's going to work here. Vanderbilt I'll teach you whether it's Monday Wednesday Friday class or Tuesday. There's a glass. I have a hundred and fifty minutes a week in the same room with my students right through the year to about 75.

**Derek** [00:27:23] I do want to think really carefully that's a pretty precious commodity right. And so to think really intentionally about what I can do in that limited time to help them kind of engage with the material the most in the example that you used of the Monopoly board game.

**Bonni** [00:27:37] Tell me about then what it looks like when they do have those skills a few weeks later. Does monopoly come back and are they asked to then actually use those skills and applying it back to the question about the board game in which places are best to buy yes.

**Derek** [00:27:53] So I will say on the first day of class I do give them an answer to the question in this case because it's the first day right and I don't want them to think like math is totally mysterious. There's still a kind of little black box piece in the middle where they don't know how I got from point A to Point B and that's what we develop over time.

**Derek** [00:28:10] So they get a little bit of an answer originally but then when we come back to that topic later in the semester you look at other boring look at other applications of this. You know we do some population modeling.

**Derek** [00:28:23] And in fact at the end of the semester they do application projects where I ask them to work in usually have to and to pick some application or some ability or else to protect the things that we've we've looked at during the semester and at that point they've got a few kind of big options.

**Derek** [00:28:40] But this Markov Chain modeling this is one of them and so usually I have a few students who didn't try to apply that to some their situation right. Baseball's really the model the way that if I didn't already do that but you know I had students who did a full bottle of Candy Land. Right.

**Derek** [00:28:56] And you know in states there. So that's what I'd like to do is to kind of bring them back to that eventually. And you know on some level the kind of textbook questions they generally get pretty good at. Right.

**Derek** [00:29:10] I mean they can they can solve that but I want to have them have that opportunity to go beyond the textbook questions. And I found these application projects a really useful tool for that because they're kind of bigger than a class session. Right.

**Derek** [00:29:24] And students have to do a little bit of original work and often connected to something that they were interested in. I can't say to my students we're like huge cumulated fans but in other cases students have found ways to connect the linear algebra which is pretty abstract stuff to problems in areas that they actually kind of find personally interesting.

**Bonni** [00:29:45] I'm so curious to know if the candy land you're referring to is the candy land of today that my small children are playing with or if it's the Candyland of my childhood which I think is far superior it seems to have had a dramatic shift.

**Derek** [00:29:59] Yes yes. And you know what was it. It might of been Keeneland chutes ladders. I'm a little bit fuzzy on this but it was definitely one of those two.

**Bonni** [00:30:07] Either one. I hope the original Candyland is my hope. I can't help but wish. Is there anything else you want to share about that time in the classroom before we go on to the recommendations segment.

**Derek** [00:30:19] So kind of a general comment about the philosophy and then maybe kind of a about kind of what to do with the time in the classroom. I think one of the reasons that the flipped classroom as an idea has really generated a lot of conversation in higher education is that for a lot of faculty it directly confronts their mental model of what they do in the classroom.

**Derek** [00:30:41] I walk in I'm a professor I profess I. I give students the first exposure I explain things to students. I lecture during class right. This is our mental model so many of us of what we do in the classroom and so the idea that you would take that and move that outside of the classroom and then do something completely different during class.

**Derek** [00:31:00] For some faculty that's exciting right. Like oh I don't have to lecture anymore. We can do active learning we can do small groups we can do probably 40 and we can do all the fun stuff in class and the first faculty is really worrisome. If I'm not lecturing during class what am I going to do. How we're going to make good use of that kind.

**Derek** [00:31:16] And do I have the skills it takes to kind of navigate that. And so in contrast I don't have a service learning or team based learning or some kind of other pedagogical models out there. I think it's a little bit easier for faculty say you know what I to ask that right for me that's for some other discipline.

**Derek** [00:31:35] I think for a lot of folks the classroom does kind of confront like how they do what they do. And so they almost have to have an answer to it. And so for the folks who are worried about what to do during class I do think that there are some simple structures that you can implement against some kind of defaults that you think kind of go through. My favorite is clickers and peer instruction.



**Derek** [00:31:54] So giving students a multiple choice question usually conceptual in nature having them all worked on it individually and then vote using some technology. I can see the distribution of votes and often I've asked the question that's kind of hard enough and a lot of them don't get it right. Then I have them pair up and talk it out right. Put your heads together try to come up with the right answer.

**Derek** [00:32:14] And so they discuss it in small groups and then they revolt. And often I see some movement towards the right answer. I teach math right. All of my questions are right answers.

**Derek** [00:32:21] That is not true in other disciplines but you can use the same model I think for questions that have more ambiguity but then you've got this nice bar graph and you can see oh you know what a third of you think the answer is B and two thirds of you think the answer is C. Now we have a class discussion.

**Derek** [00:32:36] Right. Why do you think it's B its C. How did you rule out A right. These are the types of things you could do during that and then get to that time for telling. Right.

**Derek** [00:32:44] So at some point right you know either the students are going to articulate all the right reasoning for the right answer or if they're still kind of struggling with that you might kind of kind of give them a little bit of explanation there at the end or give your take on it at the end of the sequence but it's a nice kind of structured sequence right.

**Derek** [00:33:00] It's a lot like this think pair share idea how students think how the pair up and talk it out and then you have the kind of class discussion where you try to surface the student reasoning and kind of direct that conversation towards a more robust reasoning. And structured you can kind of do every day right and you could apply it in a kind of small and big way.

**Derek** [00:33:21] But that's because that's how it is for the question of what am I to do if I qualify to start with that structure I think there are a sequence of what you can do to try to build off about it.

**Bonni** [00:33:31] And if anyone listening is this is early in your listening to the show we did have an episode from Peter Newberry from University of San Diego University of California San Diego sorry.

**Bonni** [00:33:42] Those are two different schools were my California friends and I'll put a link in this show notes and [teachinginhighered.com/71](https://teachinginhighered.com/71) to his episode which really aligns nicely with what Derek does shared.

**Bonni** [00:33:53] But if you want to learn more about clickers and peer instruction not be a fun episode to follow up with after this one.

**Bonni** [00:33:59] Well this is the time in the show in which we do recommendations. My recommendation is really twofold. It is having to do with the challenge of teaching large sections and hitting multiple sections of the same class.

**Bonni** [00:34:12] I recently have had my students get into their major project groups for the class that I'm teaching three sections of the semester and it's always been a challenge in the past to remember who has sent me in their team charters and who has yet to send them.

**Bonni** [00:34:28] So a couple of steps that I took one was inside of my task manager which is in my case omni focus I have for each one of the groups waiting for team charter and then the students are in that group so I can check them off as it as they come in and it's an easy way to spot check who hasn't sent theirs in yet.

**Bonni** [00:34:47] Well the groups were all formed this week as you might remember from past episodes. We only have 50 minutes in each class session and I needed to make sure we discussed the topic for that day and also get them into their groups.

**Bonni** [00:35:01] So I quickly took a picture of one of the groups and that way I didn't have to wait until they sent in their team charter or follow up later and see who was in your group again. I've automatically got a picture. I know who's in which group and I can enter that in to that task manager as well.

**Bonni** [00:35:17] What is your recommendation for people today.

**Derek** [00:35:20] Well mine is a little less practical right now. This semester I'm teaching a course on cryptography codes and ciphers and one of the couple of the individuals that we talk about in that course are Charles Babbage and Ada Lovelace who did some really important work in cryptography but also computer science.

**Derek** [00:35:40] Babbage's sort of designed the first computer but wasn't able to build it because he didn't have the resources and then Ada Lovelace actually wrote the first computer program but couldn't run it because there wasn't a computer right. Babbage didn't build it. But she still gets credit as being essentially the first computer scientist.

**Derek** [00:35:55] And that has led recording this actually on October 13th which is Ada Lovelace Day. It's kind of world wide celebration of women in STEM fields science technology engineering and mathematics.

**Derek** [00:36:09] And I have to say one of the key players in Ada Lovelace Day who I think is fascinating is this. She's an animator. She works on movies. Sydney Padua and she has this really fun graphic novel called The Adventures of Babbage and Lovelace and it essentially imagines Babbage and Lovelace as the kind of crusading being punk adventurers.

**Derek** [00:36:31] Kind of solving problems with math and computer science and you know large machines are steam powered and it's really funny. I was reading a bit more of it last night. Lots of lots of footnotes actually and really funny footnotes very well referenced. She loves finding primary sources about Lovelace and Babbage and their contemporaries and working them into these somewhat silly adventures. So that's my recommendation.

**Derek** [00:36:56] The Adventures of Babbage and Lovelace. A fantastic and somewhat silly graphic novel.

**Bonni** [00:37:01] Is it a historical fiction is that where we might group it.

**Derek** [00:37:07] I guess the thing is that Ada Lovelace actually died fairly young and Sydney Padua has written that she kind of feels like that's a real shame like she and Babbage that have gone on these adventures.

**Derek** [00:37:20] And so it kind of imagines a pocket universe kind of a parallel world where it's all kind of based on stuff that actually happened and if you read the footnotes you can get again a lot of those original sources but she have a lot of fun with it but some very silly things.

**Bonni** [00:37:33] That looks like such a wonderful book I've got it open right now and I'm going to be adding it to my to be read list.

**Bonni** [00:37:39] Thank you so much for the recommendation and it's been so fun following you on Twitter I'm going to put the ability for people to connect with you on Twitter in the show notes and hope people will do that and continue to learn from you. Thank you so much for investing your time in the Teaching in Higher Ed community.

**Derek** [00:37:55] Well thank you so much for having me on today.

**Bonni** [00:37:58] I'm so grateful to Derek Bruff for being on today's show and sharing all of his wisdom with me as I mentioned throughout the episode. If you would like to get the show notes to this episode with the links of our recommendations and other articles that Derek mentioned you can do that at [teachinginhighered.com/71](http://teachinginhighered.com/71) and this is the time in the show when I remind you if you have yet to rate or review the podcast it's such a great way to get others exposed to the show because it moves it up the iTunes Radio.

**Bonni** [00:38:32] That's how those algorithms work. So if you would go to [teachinginhighered.com/iTunes](http://teachinginhighered.com/iTunes) you can rate the show and give it a review and help others discover the show. If you have feedback or suggestions on future topics or guests please do that at [teachinginhighered.com/feedback](http://teachinginhighered.com/feedback).

**Bonni** [00:38:50] Last but not least if you have yet to subscribe to the weekly update. That's where you'll get the show notes automatically in your inbox along with an article on teaching and productivity. You can do that at [teachinginhighered.com/subscribe](http://teachinginhighered.com/subscribe). And I'm looking forward to talking with all of you next time on the next episode.

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