

Dead Ideas in Teaching and Learning Podcast Series

Season 5, Episode 3: Rigor as Engagement with David Helfand

Center for Teaching and Learning, Columbia University

[00:00:00] **Catherine:** Hello and welcome to Dead Ideas in Teaching and Learning, a higher education podcast from the Center for Teaching and Learning at Columbia. I'm Catherine Ross, the center's Executive Director. Let's get started.

[00:00:24] I'm speaking today with Dr. David Helfand, professor in the Department of Astronomy at Columbia University and former president of Quest University. As a quick reminder for our listeners in this podcast series, we are exploring dead ideas in teaching and learning. In other words, ideas that are widely believed, though not true, and that drive many systems and behaviors in connection to teaching, exercising what Diane Pike called the “tyranny of dead ideas.”

[00:00:53] David J. Helfand, a faculty member at Columbia University for 45 years, served nearly half of that time as chair of the Department of Astronomy. He is the author of over 200 scientific publications and has mentored 22 PhD students, but most of his pedagogical efforts have been aimed at teaching science to non-science majors. He instituted the first change in Columbia's famed core curriculum in 50 years by introducing the course called Frontiers of Science. Now required for all first-year students. In 2005, he joined an effort to create Canada's first independent non-profit, secular liberal arts and sciences university, Quest University Canada, where he served as President and Vice Chancellor from 2008 to 2015. He also recently completed a four-year term as president of the American Astronomical Society and is currently chair of the American Institute of Physics. His first book, "A Survival Guide to the Misinformation" appeared appropriately in 2016. Welcome to our Dead Ideas Podcast, David. It's such a delight to have you as a guest for this episode.

[00:02:10] **David Helfand:** Well, I'm a big fan of this series, so it's delightful to be here.

[00:02:13] **Catherine:** As many of you listeners already know, or if you don't, we're digging into the topic of rigor this fall semester and getting different perspectives on the ways in which the notion of academic rigor can be defined and enacted across higher education settings. Various implicit and what I sometimes refer to as legacy beliefs about what rigor is and its role in teaching have led to some public disagreements. Documented by articles in the Chronicle

of Higher Education, Inside Higher Ed., even an editorial in the New York Times calling for a return to the pre-pandemic quote, "normal of deadlines, required attendance, and stricter grading" i.e. rigor as an antidote to perceive student resistance to coming to class as we all return to in-person teaching and on-campus presence.

[00:03:10] So David, given this controversy, I would love to hear how you as a founder of a university and a revered science teacher would explain to someone maybe from outside higher ed, what rigor in a college course in your discipline or in science broadly means. What is rigor not? Why is it so important to professors and to the academy at large?

[00:03:41] **David Helfand:** Well, my dictionary defines rigor as quote, "the quality of being extremely thorough, exhaustive, or accurate." And interestingly, the usage example is a negative. His analysis is lacking in rigor. The second definition is severity or strictness, as in the full rigor of the law. Well, some, but certainly not all of my assignments need thoroughness. Few, if any, maybe until the doctoral dissertation are required to be exhaustive. And while accuracy can be important, it's certainly not always required in my assignments. As for severity and strictness, these seem to be completely counter to what I hope to accomplish in my classes, which is to sort of re-spark the curiosity about the world that students had when they were five years old, and to stimulate them to ask good questions which to me is much more important than obtaining accurate answers. So for example, since I teach physics and astronomy, we're commonly in worlds very remote from direct experience. We're either on a tiny scale inside the nucleus of an atom, or we're talking about the size of the universe as a whole. And the numbers associated with these domains are either very, very small or very, very large. But one of my goals is to get students to feel comfortable and develop some level of intuition about these scales, even though they're not something they observe directly. That is, I want them to advance to Piaget's final stage of abstract reasoning. And so if a student calculates something from a problem I give them, and they decide the size of a star is 42 meters, and then they write, this answer is crazy because it's way, way, way too small. I give them most of the credit because what I want them to do is to be able to recognize nonsense, which is increasingly important in this world full of myth and disinformation, not to be able to actually calculate the diameter of the star, which is extremely unlikely to ever be useful to them in their future life.

[00:05:38] So I, I'd say it depends on the course and the particular assignment, but it's rarely the case that all the attributes of rigor, thoroughness, exhaustive accuracy are required. Maybe an accountancy they are, but, but not in a liberal

arts education. Emerson said a foolish consistency is the hobgoblin of small minds adored by little statesmen and philosophers and divines. Well, I think rigid rigor strikes me as very similar to that.

[00:06:06] **Catherine:** So are there things you hear your colleagues talking about as being rigor that you would say rigor is not.

[00:06:16] **David Helfand:** Well, I think as you quoted from that article in the times that it's strict. The word strict is always involves strict deadlines, strict completion dates, uh, strict adherence to the syllabus has laid out by the professor several months before the course even starts. I suppose that fits into the dictionary definition, but it doesn't comport very well with the techniques a one should use in a classroom to cultivate true learning.

[00:06:44] **Catherine:** Right. And I think those are exactly the two sides of the argument that I was referring to at the beginning here. Um, some of the debates in those articles that I mentioned revolve around this tension between caring about students and supporting them as we all did in the pandemic of course, versus what some people call maintaining standards. One of the Chronicle reporters, Becky Supiano asked in her Spring 2022 article, you know, don't most professors care about both students and standards? Do these two have to be at odds with each other? I'm sure you could give some examples of how they're not at odds with each other. But how can we change the perception that showing care and centering support for students doesn't mean that the course isn't rigorous and the teaching isn't rigorous.

[00:07:42] **David Helfand:** Yeah. Well, I certainly care about my students. I, I don't think it's my responsibility to care for my students. I'd probably be terrible at it so I don't even attempt that. But my approach is to be very clear and quantitative and prescriptive about what's required in the course, and the course is nearly 15 weeks long. Within that, I give students lots of latitude. I mean, in a pandemic, they do get sick after all, and rather than deal with a large file of doctor's notes et cetera, I say this is what's required to complete this course. This is what's required to complete the course with an A. This is what's required to complete the course with a C or just pass the course. Within that, I've become very relaxed about deadlines and the sequencing of specific assignments. I do offer scaffolding opportunities.

[00:08:30] You know, pick a paper for topic by this date. Give me a first draft by this date if you want me to comment on it, but I don't require that. And if they don't do it, that's fine. They'll probably not do as well as if they did give me the first draft to comment on. But nonetheless, I think that's fine. I don't think

it's my responsibility to extend their grade school external constraints of the third grade teacher by the time they're 22 years old.

[00:08:53] Part of being in university is learning to cope with exigencies and to perform on time scales of, as I say, months, not minutes. And that's part of what I'm teaching them as well. It's an important part of a university education. Then of course at the end of the semester, if they've really had a lot of problems and I had one such student last semester who through no fault of her own had serious medical problems, there's always the incomplete.

[00:09:17] I can take the course and make it up later, or they can petition to have the course dropped, and that's also. Possible. I just don't see much conflict between the problems that the pandemic or other such external exigencies impose on students and still requiring them to complete a certain amount of work for a grade in a certain course.

[00:09:37] So I define it at the course level rather than the individual assignment level.

[00:09:40] **Catherine:** Yeah, that all makes sense. It does demonstrate a nice balance between that supportive learning environment, but with expectations clearly defined. So I think that's exactly where we hope people will be landing. I do think that in the spring some of the polarization of these opinions and the sort of call out around rigor was because many instructors, at least from what I could glean reading online, were very frustrated with the whole return to campus and return to classrooms and feeling like students still aren't wanting to come to class and they're wanting all these, you know, often referred to as accommodations and they're not engaging even when they do come to class, and I think instructors have worked very, very hard through the pandemic to do every kind of teaching imaginable. And so it's been frustrating to have this kind of experience where the students just don't really see they're there, but they don't seem to be there. And so I think for some instructors, they feel like maybe I need to return to this notion of like mandatory attendance and stricter grading of attendance or participation to counter this sort of lax period we had through the pandemic.

[00:11:05] We know what's good for students in their learning and what they need, and they may need this more disciplined approach to actually start learning again. So I think that's sort of, you know, where the, the debate has been centering.

[00:11:22] **David Helfand:** I've never insisted on mandatory attendance. My job is to create the most engaging and informative and one hopes, even occasionally, transformative experiences for the students. And the students are welcome to come to class and to office hours and any other way they want to interact with me if they choose to. They're simply wasting an opportunity not to mention their money or their parents' money if they don't. I just don't think at the age of 18 or 20 or 22, it's my responsibility to insist on them sitting in a chair and keeping it warm throughout a class. Now, of course, it's true that this past semester in particular, I and my colleagues noticed a much larger fraction than usual of students who seem to be having trouble engaging with the course. But of course, one thing to do about that is to make the course more engaging. So rather than standing and lecturing at them for 75 minutes to have computer simulations or pencil and paper puzzles and have them work collaboratively in groups. And the peer pressure in that circumstance allows them to rekindle that, uh, engagement, which is otherwise lacking. I sometimes think if we were in the. In the 10th century Bologna model where the students handed over cash directly to the professor for each lesson that might connect the, uh, engagement a little greater, but it's up to students to take advantage of it.

[00:12:45] I, I teach a core class often the one you mentioned, and that means I have all first-year students and I meet with them individually. That is required, I mean, with them individually in the first week or two of the semester. And what I say to them, I know it sounds a little harsh is that it's possible to get a spectacularly good education here, but most of you won't. And I do that to make it clear that the opportunities are there for them. If they take advantage of the opportunities, they'll have a life-changing experience. If they don't take advantage of the opportunities, well that's too bad. They'll probably get a degree at the end, and if that's all they want that's fine, but they will have missed a very precious four years of their lives, probably the only four years when they have complete freedom to explore new things and to expand their intellectual.

[00:13:28] **Catherine:** Yes. That's wonderful. Thank you for that, David. And I'm so happy that you called out the elephant in the room of well if we want them to be engaged, maybe we need to think about our teaching. Are we actively engaging them with the content, with skills that we want them to develop? Because it's not clear in many of the articles that the people who are complaining about this lack of engagement. You know, some of them I'm sure have tried different methods, but some, it seems really just expect students to come and sit and listen to lectures and students are sort of taking a pass on that.

[00:14:08] **David Helfand:** I guess the apotheosis of my experience in this and which convinced me it's essential, and so I do it in all my courses now happened

when I was at Quest. I was teaching a class on planets, on habitable planets, how to build a habitable planet, uh, which starts from the atoms you need at the big bang all the way up to evolving a life form that can ask questions about what it needs to be a habitable planet. And in the course of this, at one point I noted the major discovery of the last couple of decades, and that there are thousands of planets around other stars that our solar system is not in any sense unique and that we continue to discover planets at an enormous rate. And I said, but it's very. Because stars are very bright and planets are very faint, and they're right next to each other. And so one thing we have to know is how planets move. And so you have to figure out how planets move. And I gave them a computer simulation and they were working in groups of four. There were 20 students in the class. So there were five groups of four sitting around their laptops. And I gave them some guiding questions, but I, the simulation was very sophisticated and it had a dozen different parameters they could play with. And the class was three hours long because this was a quest. That's how we do things. And they just set off. And you know, one of the parameters was the inclination of the orbit. So whether the orbit was perpendicular to your line of sight or parallel to your line of sight. And one of the students didn't get that. And so the other three students got up and they threw her on the floor and they, one of them was the star, one was the planet running around it. And the third person lifted her up slowly so she could see different angles meant she saw different views of this experiment. And they went on through these various clues that I had given them, but all just playing with this simulation, just generating data. The hour came at noon time for them to go, and they didn't want to quit. They just kept going. And about three hours and 40 minutes into the class one group got up and they wrote down Kepler's three laws on the board. Now, I hadn't mentioned Kepler. I didn't say there were three laws, but they had discovered what Kepler had discovered much more quickly actually using data from this computer simulation as to the regularity in the orbits of the planets.

[00:16:07] Now, four years later when they graduated, they didn't remember where the four and the pi squared and the G went in the equation. But they remembered that you could use data, you could cast it in a mathematical form, you could use that mathematics to predict future behavior. And that's of course the lesson I wanted to do, that kind of peer reinforced collaborative and exploratory exercise where they have to construct knowledge for themselves, not get it force fed from me is vastly more effective, both for their learning, but also for their engagement.

[00:16:41] **Catherine:** Yes. And that is one of the deadest of dead ideas in higher education that the role of an instructor is to tell students what they know. And unfortunately, it's often present broadly outside of higher ed as well. Many

people perceive the role of a professor as somebody who tells you all the things you need to know, and yet we know from decades of research that that's not how learning happens. Some, a certain kind of learning might be able to happen.

[00:17:10] You can memorize things. You can put them on the test, but it's not the deep transformative learning that we're really looking for. So that's a great example of the difference pedagogical approach can make in that kind of a situation. So how can we challenge students to do their best learning without using these legacy practices that sometimes signal rigor in departments. Things like curving grades where you're getting students to compete against each other, high stakes tests, or super long reading lists, or any of the policies we've already talked about.

[00:17:49] **David Helfand:** Yes. Well, as, as one of your staff members actually pointed out to me a couple of years ago, a gaussian distribution, which is what a curve is, is the signal of a random process. And I don't like to think either my exams or my learning environment is a random process, so therefore I've never curved a grade in my life. It makes no sense to me whatsoever. It also, as you say, stimulates competition rather than collaboration. And when I was president of Quest, I gave lots of talks and lots of venues across North America. And in one panel we had someone from the private sector, someone from the public sector, someone from a non-profit, someone from the financial sector, and they were asked, What are you not getting from university graduates that you most need for your organization? And in each case, no matter what kind of organization it was, it was they don't know how to collaborate with people from different backgrounds with different skill sets to solve problems for my organization. And that's exactly what we do not cultivate when we give large exams with curved grades. So that's makes, never made any sense to me.

[00:18:49] Again though, the most satisfying moment when you're getting students to construct knowledge for themselves is when you hear a student go, "Ah, now I get it" because some peer explain it to them, or it's just sort of popped into their head by looking at their simulation. That never happens when I'm lecturing at them. Someone never says, Ah, now I get it. It only happens when they construct it for themselves. And, and so it's, it's so much more satisfying, uh, to hear that then to see people scribbling writing down so they can regurgitate whatever content you've given them, rather than the process.

[00:19:25] **Catherine:** Where do you think this curving came out of? Why is it so persistent? You know, having developed a university yourself, like, why can we not get rid of this idea?

[00:19:37] **David Helfand:** Well, because unfortunately these, especially in the sciences, the so-called gateway courses are actually gatekeeper courses. And as Carl Wieman points out, they're designed to magnify any previous differences in background rather than to ameliorate them. So if the goal is to figure out which out of 250 people in general chemistry should go on to be chemistry majors, and there'll be about 10 of those a year. Then, you just make a curve and you pick the top 10 students.

[00:20:05] We've discovered in our graduate program, however, that if you just pick the top 10, uh, applicants by grades or by class rank, or by GRE scores, which we've now fortunately abandoned, it's a random as to whether they can actually do original research and become a creative scientist. So it's a numerical number. I guess scientists like numbers, but it doesn't do much educationally either for the best students or for the students who need the most help.

[00:20:34] **Catherine:** Right. And yet here we are. But thank you for a thorough sort of explanation around that. And I love your quotes and Wieman's work of course has made this glaringly clear. I think even result of a curve in your grades is, is evidence of failure to teach. So that speaks to your point about teaching is an intentional activity and if we're actually good at what we do, we shouldn't see a curve.

[00:21:06] **David Helfand:** That's right. And so I do scale my grades. Now the students say, Well what does that mean? I said, well, if I make an exam or a problem set or something like, that's too difficult accidentally, because of course I'm not in your place, and the average grade is 70 or something like that. Well then, I'll add 10 or 15 points to everybody's score, and it's perfectly possible for everyone to get an A in my class. It's never happened. I would know, but it's perfectly possible for that to happen because that would mean each of them succeeded in meeting the requirements of the course.

[00:21:36] **Catherine:** Right, and yet we do still have, you know, departments, deans, I'm not saying specifically here at Columbia, but across higher ed who will tell instructors that they can't give all A's, or that there's a limit. You can only give a percentage of your student's A's because of this terrible fear we have of great inflation.

[00:21:58] **David Helfand:** Well, I must say I share the fear of great inflation, but it's for a different reason. I think if you're making your course appropriately challenging and you happen to have a class of extraordinary students, because I teach in this core course with 600 students and get 20 of them, uh, it's a random process and that could happen. You can flip 20 heads in a row. Then, they can

all get As, but it's never happened in 45 years of my experience. A range of commitment and engagement...

[00:22:26] **Catherine:** ...And a well-designed, rigorous course that's focused on transformative learning. That's what will happen, right? It's highly unlikely that you would have all of your students get A's.

[00:22:39] So let's talk a little bit about what keeps you inspired. You've been doing this work a long time. What keeps you motivated to believe that we can really make change in higher education to boost the kind of teaching that we know works, the kind of teaching that changes lives.

[00:23:02] **David Helfand:** Well, what keeps me inspired, one great thing about being in a university is that without any effort on your part you get a brand new crop of students every year, and they're all still 18 years old.

[00:23:14] **Catherine:** I love that.

[00:23:15] **David Helfand:** And usually you find some real gems amongst them and inspire them or boost their future, change their directions. So that's fun. One of my undergraduates from about 20 years ago here, who's now a professor of physics at another institution in New York City, wrote to me a couple months ago, uh, about this elating experience she'd had. This summer student that she'd worked with had written to her and said, "You're the only reason I'm, I'm staying in physics. It was so inspiring. It was so encouraging that I could actually succeed. I could see myself as a scientist through you." And this student mind said, "you know, as an undergrad, I just never understood. It completely mystified me why you made time in your busy schedule to talk to me and work with me. And I just didn't get it for 20 years, but now I get it." So that's another, another piece of it, I guess.

[00:24:06] As for change, you know, I long ago accepted that change happens on geological time scales in universities, but you know, geology, you know, built the Himalayas, and so things actually happen. Just have to be very patient. I mean, when I got to Columbia in the 1970s, I was delighted to see that they had a real core curriculum, meaning that every student in the freshman class was reading a book, the same book, the same night of the week, and discussing it the next day in a small seminar. But I was simultaneously appalled that this intellectual code of arms, as they called it, of the university, consisted of seven humanities courses, zero math courses, zero science courses. So being young and naive, I thought, well I'll just make up some science courses and we have this system now, so that'll work. And 27 years later, I succeeded in adding that.

[00:24:55] **Catherine:** It took that long.

[00:24:56] **David Helfand:** Just have to be patient. That's all.

[00:24:58] **Catherine:** Okay. And live long,

[00:24:59] **David Helfand:** I must say. However, I see a real difference between the junior colleagues we hire now as faculty and what I was like when I was hired. When I was hired, I had not been a TA, I'd been an RA in graduate school, so I had literally never taught anybody anything and I was handed a class with 60 students in it and said, go do whatever you want, but don't spend too much time on it. Because you know your research is what's going to come.

[00:25:22] **Catherine:** Right, you got to get tenure.

[00:25:23] **David Helfand:** Now, almost every application, in fact, every application that makes a short list has had extensive work with their teaching and learning centers, has done work outside the university, has taken courses in education in some cases have, have just done a vast amount more to prepare themselves to be effective and engaging teachers. So just that alone gives me hope. Again, you know, as said science progresses one funeral at a time. So, you know, universities don't change quickly, but the colleagues that we've hired in the last 10 years bear almost no resemblance in terms of their experience and interest and engagement with what they view as a significant part of their role here as teachers compared to 40 years ago.

[00:26:14] **Catherine:** Well, hearing that is certainly inspiring for me having worked in teaching centers for going on, uh, 20 years here. So I am very happy to hear that, and inspired to hear that you're seeing a change in that kind of change. Also, I think several people, including Wieman have called out the fact that having TA support in grad school is really a key to changing higher ed. So I think you're right on that front that it's just going to take some generations to get this going.

[00:26:48] Well, thank you so much, David. This was a delightful conversation and I really appreciate you taking the time to talk with us and to help us push higher education teaching to that better place. And thanks for being part of our Fall 2022 podcast season.

[00:27:06] **David Helfand:** It's been entirely my pleasure.

[00:27:11] **Catherine:** If you've enjoyed this podcast, please visit our website where you can find any resources mentioned in the episode, ctl.columbia.edu/podcast. Please like us, rate us and review us on Apple Podcasts or wherever you get your podcast. Dead Ideas is produced by Stephanie Ogden, Laura Nicholas, John Hanford, and Michael Brown.

[00:27:40] Our theme music is *In the Lab* by Immersive music.