richer understanding of mathematics as a discipline and practice, in turn influencing her other research collaborations within psychology. She has also been inspired to dramatically change her own teaching practice with respect to group work, based on conversation and experiences in the EEIJMS meetings. Ben interprets research papers in math education and psychology with a different perspective now that he's been through the data collection process and has learned more about study design. His perspective on social sciences research was particularly influenced after spending one session in an online discussion group with Pooja's research network, learning about the various factors (funding, disciplinary norms, disciplinary politics, etc.) that play a role in determining research directions in the social sciences. This changed how he thinks about the ways that social scientists develop their research programs. Also, in his own classes, Ben thinks about question design in new ways, taking into account what he has learned regarding the factors that impact how students answer questions. This has also influenced his approach to mentoring mathematics PhD students.

These are not outcomes that either of us would have predicted during our first conversation, and this is one of the wonderful qualities of collaboration, especially across disciplinary boundaries. While we can't predict what the next few years will bring, we know that our collaboration will continue to enrich our intellectual, professional, and personal lives.


Benjamin Braun


Pooja Sidney

Credits

Photo of Benjamin Braun is courtesy of Benjamin Braun.
Photo of Pooja Sidney is courtesy of Pooja Sidney.

Building Community in the Classroom

Erica Winterer

At twenty-two years old, I started my teaching career in a New Orleans high school. My oldest student was twenty-one and on my fifth day, a sophomore named Malaysia asked me if I was trying to be Hilary Swank (referring to her *Freedom Writers* portrayal of Erin Gruwell, the American teacher known for her unique teaching method used to inspire at-risk youth to further their education). She wasn't wrong. Even though I knew next to nothing about my students' community, I thought I would make an excellent teacher because I understood the content. Misguided and over-confident, I muddled through my first two years of teaching. I wasn't the worst, but I definitely wasn't the best. My students undoubtedly deserved better.

After two years of teaching, I could finally manage the paperwork, mostly manage upwards of thirty teenagers, and keep the rats from eating the corners off the reward Starbursts; however, I was still blindly flailing through attempts to build "classroom culture." Always a pillar of professional development, but never clearly defined, classroom culture was a slippery, murky creature I would rather avoid than chase after. Every example offered to me seemed like some wizard teacher with a unicorn personality was able to effortlessly inspire groups of teenagers with their nebulous teacher moves. All the magic seemed to hinge on these teachers' personalities which were far removed from mine. I am not a particularly funny or gregarious person. I prefer small groups of people, have very few close friends, and avoid attention. The best choice I made was to stop imitating these examples.

Students valued my authenticity more than my ability to entertain them. We built community by building trust. I demonstrated care for students through high expectations, highly organized lesson plans, and praise for their individual progress. My investment in students' success and our shared responsibility for the course combined to foster and grow a community. I will never be Jaime Escalante (the Bolivian-American educator portrayed in the 1988 film *Stand and Deliver*) and that is fine. We can still build community without magic.

I had to repeat this mantra the first time I saw my graduate advisor, Uri Treisman, teach his freshman calculus class. He is one of those wizard instructors, seamlessly

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integrating expertise from mathematics and psychology to forge a transformative experience for students. A highly respected figure in the community of mathematics, he has long been committed to equity-minded teaching, starting with his work at UC Berkeley and the creation of the Emerging Scholars Program [6]. I spent the first two years as his TA just trying to catalogue (and organize) all the moving pieces of the course. As I read more of the literature, I realized the magic of the course was a combination of expert knowledge, intentionality, and many iterations. Every decision that is made, no matter how small, is considered and informed by research and our collective teaching experience. How should we frame the exam results? If we say XYZ, what will students hear? What do they need in this specific moment? Which students need more challenge? Which ones need more support? Do they all need a win to lift morale? Everything matters. I am now in my fifth year of my doctoral program and have graduated to co-teacher of this freshman calculus course. The course has extra resources (e.g., undergraduate TAs, me as a co-teacher) but we consider it more of a laboratory than a replicable model.

We work with leading psychologists, including David Yeager, to design classroom environments that promote positive learning mindsets. Specifically, we carefully conceive and employ structures, routines, and rituals we think will positively influence students' growth mindset, purpose, and belonging. These structures, routines, and rituals in combination with personal connection and shared responsibility help to create a sense of community in the course. In this chapter, I will share some specific examples of how we try to build connections with and between students, in the hope that they might be helpful in building community within your own course. These examples were chosen based on student interviews I conducted two years after a section of the course ended. They were the course components which most students remembered and which seemed to have a lasting impact. While each course component is based on a combination of mathematics, education, and psychological literature, the intention of this chapter is to simply share strategies we employ and student reflections. For that reason, I do not include a detailed discussion of the academic literature [2, 3, 7, 8, 10].

Community is sustained through the connections between its members. Without these connections, intended messages can be lost, misinterpreted, or ignored. We try to build an environment that fosters connection not only between students and the instructional team but between students themselves. Courses, especially large lectures, can often feel impersonal and students wear their anonymity like camouflage. Instructors are often happy to play along. It is difficult to feel a sense of responsibility to a student you know nothing about, and teaching is one of many demands on our time. We must work purposefully over the course of the semester to disrupt these social norms and practices that isolate students from their professors and each other.

Figure 1. Uri Treisman in a Math Workshop at UC Berkeley, Fall 1978.

Welcome Students

This starts on day one by welcoming students to the course. The purpose of day one is to signal to students that we want to know them, induct them into the mathematics community, and set the expectation that the course is difficult by design. We start by trying to learn our students' names before the first day of class. With class sizes of about 130, this means we quiz ourselves with flashcards made from their ID photos of questionable quality. Clearly, we never get all their names correct that day or even within the first two weeks; we do get enough names right to shock students and let them know we see them. Many students have reported that just using their names made them "feel more comfortable and like the class was less daunting." They have also said that just "calling someone by their name draws you to that person and lets them know they see you as a person—not just a student." Learning students' names is time consuming on the front end, but the return on that investment runs the course of the semester.

We also use the first day to establish common ground in the content. We display their math genealogy, introduce them to their ancestors, and tell them we are now and forever their teachers. We frame the content of the course as their legacy, i.e. something that they are entitled to and do not have to earn. We get mixed reactions—

> *I guess he would list a bunch of old mathematicians and say they were our ancestors? At first, I was like what is this guy talking about? Afterwards, I was like OK, he's just saying if they were able to do it, we should be able to do it.*

> *I do remember feeling like it made me, like a part of a group. Like a part of a very smart group who knew very smart things, and I could do it. Ya know? I'm up there with the, uh, triangle guys.*

He made us feel like math was a part of us. Which was really nice because I know for a lot of people if they find a topic really difficult, they tend to give up on it and say this is not for me, like I'm not meant to be doing this. But, even though it was a simple thing of him being like, look at how all these people are related, it made us feel like—oh, we can actually do this. Or like, we actually have the ability to do this, like, inside of us. It's not just something that I just wasn't born to do.

I kind of questioned the credibility, if it was true or not. But I liked the idea of it. Um, it was just showing that we're somebody in this long lineage of people—at least instilling in us that you're somebody. You're not just here to take a course credit and get out of my class. Like, you're going to be here, and you're going to be my student forever kind of thing rather than you're just going to be here and you're going to move on.

Conducting these interviews two years later, I realized that I underestimated the impact of the genealogy ritual. This simple ritual resonated with students in a way I did not expect—and in some cases reinforced their sense of capability and membership in the mathematics community. Over the course of the semester, Uri references these ancestors to communicate that while we expect students to learn the material quickly, these ideas are complicated and famous mathematicians struggled with them before us. He will explicitly message that there are specific tricks that his advisor passed on to him and he will pass to students. These tricks are not things that they should know in advance or be able to derive through their knowledge or common sense. We want to prevent students from questioning their intelligence if they do not immediately understand an idea. We cannot expect students to feel like valued members of a community if they doubt their own capability and contributions.

Toward this end we do our best to encourage students to attribute any difficulty or struggle in the course to our intended design and not personal deficiencies. We hope that these first impressions help to sow seeds of trust, but it is tentative; they still don't know us.

Make the First Move

As instructors we need to demonstrate that we care about students and that this is not just some formal, impersonal classroom. Social norms establish distance between professors and students. Often there is an unwritten agreement that they don't bother us and we don't bother them. We both show up and play our respective roles while maintaining a comfortable distance. Intentional work is required to disrupt these social norms that isolate students from their instructors and each other. These are norms in our society which make real teaching difficult. Unless we disequilibrate them, and do so with integrity, real teaching cannot occur. We need to explicitly tell students that we want to know them, and we expect them to know us, while creating conditions for new, more productive norms to evolve.

We know relationships with faculty are important to students and research shows that these connections positively influence students' academic outcomes. However, students intimidated by professors are likely to avoid faculty and instead seek help from their peers or struggle in isolation. For these students, professors' expert knowledge paired with a serious or hyper-professional demeanor makes faculty seem unapproachable. These students miss out on opportunities when they don't make connections with professors, and we miss the chance to know our students, to see first-hand what sense students made of a lesson or lesson-slice, or at the macro-level, how the course is shaping students' interests and aspirations.

This disequilibration starts with us making the first move. There are simple ways we can initiate conversations and connect with students to avoid these missed opportunities. For example, students describe instructors who just ask them, "how are you," and genuinely listen to their response as "caring." Taking the time to ask students about their degree plans and to encourage them can make students feel validated in their academic pursuits, like their potential is recognized. As little as one conversation with a professor can dampen students' doubts and reaffirm their belief that they can be successful in college.

To quote a former student, "It's one thing to say you want to get to know your students, it's another thing to actually do something about it." We do a few things in class that signal to students that we want to know them and care about their progress:

- We make small talk before and after class with individual students. Ask them simple questions like "how are your other classes going?," "how is your day going?," etc.
- We schedule test reviews outside of regular lectures, to interact with students in a more informal environment.
- We learn and use students' names in lectures and discussion sessions (not always perfectly, but they appreciate that we try!).
- We announce to students that everyone is expected to attend at least one office hour.

Every professor is required to schedule office hours; not every professor actually wants students to show up. If we want students to come to office hours or to reach out for help, we need to signal that we actually want them there, that we are invested in their progress. To signal that we actually want students to come to office hours, we notice who hasn't shown up and email those students. Now, I don't think it's necessary to send office hour invites to every student who hasn't shown up, but I do track who has attended. The idea is just to let students know you want to see them. If we email a few individual students, word will get out that we meant it when we said we want to see

everyone in office hours. It is our responsibility to make the first move because students will always follow our lead.

Even two years later, students remembered the efforts to engage with them and open lines of communication:

> *He made the effort to come up to me, ya know, a few times … and say, 'Sophia!', because obviously he knows everyone's name, and like kind of just catch up … He a lot of the time would make the first move. Which is not really a thing you see with professors happen at all … In a lot of other classes, professors just are not going to speak until they are spoken to. Which is, like, a really common thing. But I think Professor Treisman, like, he didn't care. He was like, I'm going to introduce myself to everybody. …*
>
> *I remember now, even in lecture, he would make a really big deal about like, you coming to his office hours. He would say, 'I still haven't seen so and so people' or … he would really emphasize wanting every single person to go to his office hours or make an appointment so he could get to know them.*
>
> *At the end of class he would randomly stand in front of the classroom and just like ya know, that's where he was before and as people were leaving he would just maybe just wave or smile or be like hey how are you doing, how's this and that or something we previously talked about.*
>
> *I think Professor Treisman also made a big deal in wanting to know about the student also. He would, ya know, like, ask you 'How are your classes going? What classes do you want to take?' Or he would say, 'What are you interested in?' … 'Oh you're physics? Are you going to do FRI [freshman research initiative]?' Ya know, he kind of had an idea of how the system works here and kind of would like, ask us questions seeing where we are in that system, like what are we doing that is right. And we would just talk about what's going on, like, how was your morning going, or he's going to a flight directly after class and he has a suitcase with him. Yeah, it didn't have to be complicated with him I think.*

Let Students Know You

Even though students appreciated these efforts, it is unfair for them to be the only ones sharing about themselves. We try to share personal anecdotes, stories about our work, interests, and hobbies to disrupt the power dynamic and make students feel more comfortable. As instructors, we may not perceive ourselves as intimidating or unapproachable. However, knowing that students are often intimidated, we must make a conscious effort to build relationships. An important part of relationship-building is letting students know you. Having informal, balanced, personal interactions with students can have a significant influence on the classroom dynamic and student performance. Although it takes work, research has shown that increased rapport with students impacts participation as well as effective and cognitive learning. It's easier to approach someone you feel like you know personally, and students rate approachable professors as more effective overall.

As a teacher of undergraduate students, I recognize that many students walk into class already intimidated by professors, determined to never show confusion. Students look up at professors and see someone who has climbed above them, separate and fundamentally different from themselves. This dynamic simply exists within the current system, and we anticipate it when the semester begins. To make students more comfortable, we try to chip away at this "Us vs. Them" power structure. We humanize ourselves by sharing information about our lives and work. It could be anything that is honest and authentic to ourselves. We might tell students about: a conference that we went to, a paper we read, some of our research, a hobby, a short anecdote, our recent travels.

Sharing personal stories or interests helps to close the distance between us and our students. We recognize that students need to know a little bit about us before they can be vulnerable with their confusion. We try to communicate to students that it is not innate intelligence that separates us, but education, training, and practice—experiences that they can also collect over time. Also, who doesn't like to just know a little something about the people they work with?

In interviews, students emphasized how professors sharing information about themselves humanized them and made the class feel more connected:

> *He also shared his own personal story a lot. Which, um, was pretty good, because that really humanized him 'cause he wasn't just some big authority on campus in calculus, he was also like, he's from the Bronx right? [laughter] Yeah, also a guy from the Bronx, so that was pretty cool.*
>
> *There was, like, one story that I always remember he told … that he was a fan of the baseball team from Brooklyn and they moved from Brooklyn to Los Angeles. Um, and he told the story and it was very funny but, then he just went right onto teaching. But, I think that kind of thing makes a professor a lot less intimidating. You can just tell a story like that, and it's like, you're not forcing it, it's just like … somehow it came up. I don't know how. And you distill it, and then you know, you're just seeing that human aspect.*
>
> *A lot of the times you don't really know a lot about a professor besides, like, Rate My Professor, ya know?*

But it's nice to get, like, the story behind the person 'cause nowadays it's more like … in the students at UT it's kinda like us versus them … where students are tryin' to pass this class, get through it somehow, but more than that it's like … I feel like there's a lot behind professors … there's so many weird amazing things I find out about my professors, even the ones I don't like, and it's like I never learned to appreciate it because I was so stressed out from the class … I guess it's nice to know, like, I dunno, there's much more to a professor.

Help Students Know Each Other

It's not only important for us to forge connections with our students, but we should also foster connections between students themselves. My own greatest fear in undergrad was asking a stranger a question. I was sure the other students in engineering knew everything and asking any questions would just confirm that I was the only one confused. If I had a question, I always ran it by a friend I trusted. I needed to know that my question was reasonable and would not make me look ridiculous. If I asked a silly question, I knew they wouldn't assume I was a silly person.

I conveniently forgot this experience in my first few years of teaching. Despite explaining group work procedures with precision, offering explicit directions and exemplar groups, students rarely took risks or interacted in the ways I envisioned. In fact, without intervention, students often spend an entire semester sitting next to the same people without knowing their names. When working with others, students usually subscribe to the norms of interaction, are nervous to ask for help, and are intimidated by the fear of looking unintelligent. Research shows group work and collaboration benefit learning and future careers; however, a quick Google search reveals people are not naturally good at working together. Putting people in the same space or telling them to talk does not result in higher productivity; the collaboration must be strategic. So, how do we connect students and effectively coach them to work together?

Watching Uri teach, I realized students only fully engage with the content when they feel safe presenting their work and ideas. Since it is easier to feel comfortable working with people you know, Uri starts class by encouraging students to know each other's names. It seems overly simplistic. However, students have told us that just knowing another student's name makes it easier to ask them a question or to collaborate on an answer. I was chatting with a student about this and he said, "Yeah, what am I going to do if I don't know their name? Say yeah, hey you, can you help me with this?"

Beyond learning names, we encourage students to work together throughout the semester, not just on the first day of class. For example, we:

- Make time for students to meet each other/exchange contact information on the first day of class.
- Offer extra credit for the first homework assignment if it is completed in a study group. (Students email us the members of their group, where they met, length of the session, brief description of how it went, and a hook 'em horns selfie of the group.)
- Assign group problems during lecture and instruct groups to spend the first minute on introductions.
- Set the expectation that students should know each other and cold-call students at the beginning of class, asking them to name three people around them.
- Remind students to study in groups throughout the semester and give a quick mid-semester Google survey to make sure everyone has a study group. We might try to connect isolated students to a few different groups to give them options.

This intentional connecting not only builds community but supports students' academic success. It is something I wish my courses had emphasized when I was a student. Listening to our students reflect on how they remembered routines designed to get them to know each other, I realized how easy it would be to underestimate the impact of this simple act. They really valued the formal time during lecture dedicated to helping students connect and noted how it was not something they experienced in most undergraduate courses.

We go to panels and the students are always like, 'Yeah like make sure you're like talking to the people around you in class. Ya know it's super important throughout your college experience. Ya know study groups …' I feel like even before I went to college people always said that. But I think that Dr. Treisman recognized that that's not something people are just going to do. Ya know, like no matter how many times you hear it—oh you should really talk to the people around you and get to know them— that students won't do it.

Starting the first day of class he would call on you and be like, 'hey, who are the people that are around

Figure 2. Extra credit selfie of a study group.

you?' And that kind of fostered more of a community environment than any other classes that I've had before. Calculus is really difficult and if you don't have that kind of support system, you're not used to meeting your classmates and forming study groups, it's really hard to succeed, especially as a freshman.

We had that thing where we would tell each other our names, or he'd ask us who was sitting next to us. That. I loved that … it was just the best … I felt comfortable. And I think when you feel comfortable, you feel like you can ask for help.

In the very beginning it was like, why do you want me to know the person's name next to me? Like, he's just going to sit next to me every day in class, and that's how it is in other classes. It's like those people sit next to you and you never really acknowledge them. And so, in the beginning it was like why are you making me acknowledge this person next to me? And then it became evident, why he was having us work in groups. I think the homework sessions made me realize the importance of that.

I could see how some people would get stressed out and be like, man, why do I have to learn these people's names? But, I think it's kind of an important thing, 'cause especially so in college you get really disconnected. And especially at a school like UT, there's so many students here, like thousands, but you can feel like isolated, um, really easily. So, I think even just knowing someone's name can open up … like, it's more important than just inside the class, maybe outside the class even?

Honestly, I loved that you were forced to talk, not forced, but it was like, he encouraged us to talk to the people around us and getting to know others' names and getting to know people we wouldn't normally talk to. Um, it really helped because in a class like that one, where the content is really hard and it's like you have to spend a lot of time studying and stuff, knowing that there was other people around you and putting a name to their face, and understanding that they were going through the same thing, made it a lot easier for you to actually reach out to people being like 'hey, I don't understand this can you help me?' And then as well, like, it being … was my first semester, being encouraged to talk to people around me really helped me make friends and I still talk to a lot of people from the class. And, although none of us are in the same class [now] it's just … since we were given the opportunity to get to know each other we kind of bonded over the class itself and then it grew into a better friendship which was really nice and I really liked that a lot.

Stereotype Threat, Belonging, and the Importance of Community

Students are usually aware of negative stereotypes related to their identity and their awareness often amplifies as they age. Stereotype threat refers to the psychological impact of stereotypes that allege inferiority of marginalized groups in a certain domain [1, 5]. In a situation where a student assesses their group's stereotype as relevant, a student may feel an extra psychological burden relative to their peers who are not in the same group. This activation of stereotype threat is dangerous as it can lead to disidentification with academic subjects and undermine emotions that intrinsically motivate students to learn. For example, Catherine Good demonstrated that stereotype threat can suppress the test performance of even the most qualified women in college-level mathematics [4].

Evidence points to the potential of stereotype threat to interfere with a student's problem- solving capacity in our classrooms. We should acknowledge this and work to create a classroom environment that mitigates the effects of stereotype threat by promoting feelings of belonging. Gregory Walton, Geoffrey Cohen, and David Yeager, among others, have produced extensive work around this topic [7, 9]. The previously-described strategies to facilitate connections with students should help with this but we should also encourage students to interpret threats to their belonging as a common experience that is shared, normalized, and transient among the undergraduate population. To create this effect, we explicitly message to students that the course is difficult by design and that students struggle through it every year. We also try to share our own stories of academic struggle and we bring in a panel of past students to discuss how they struggled, persisted, and then excelled on the final exam. Again, our goal is that students attribute experienced struggle to the design of the course and consider it a normal experience rather than any perceived deficiency on their end.

Our students really appreciate these shared stories of struggle, both from me and Uri, and our former students. In the interviews I conducted, they expressed how these examples gave them perspective and normalized the struggle they were experiencing. Here are a few comments from those interviews:

> *I remember my freshman year, you were saying, back when you were doing engineering, you had people tell you at one point that you shouldn't do engineering anymore. And, I, recently because of health issues had my GPA drop and last semester my advisors were like you should just withdraw from the semester and do it over again. And I was like, no, I really think that I can still do this—it doesn't matter*

my GPA dropped a bit because of health things … it's still possible. So, thank you for telling me that.

I remember one day we had a review session and he invited three people and one of them told her story about she herself was coming from a high school with less than enough calculus experience and she was scared and wasn't doing as well as she wanted. And then she's up here, success story, like, she's doing great. It provided a sort of encouragement … he's not just telling us that we can be good at these things … he's bringing an example for us … the effort just made me feel like it was worth working hard for.

When you're struggling it feels like you're just going to be there forever. Whenever he had his students come and talk to us, I was like, OK, there's an end to this madness. Everything's going to be all right. They did fine. Somehow, one way or another, we're all going to be fine. I guess, it made me not lose hope because I feel like … struggling in math class was like losing hope and gaining hope, losing hope and gaining hope.

Make It Your Own

While the strategies outlined in this chapter have been effective for us, they make up only a small slice of our course. These examples were offered as potential ways to begin building community, not to imply this is all that is needed or the only way to do it. There are essential elements woven into the fabric of our course: established trust, shared responsibility, expert content, and pedagogical knowledge, etc. I suspect the described strategies would not have the same effect if they were implemented in isolation or without a certain level of established trust between instructors and their students. That being said, I would remind readers who are interested in building community within their classroom and feeling overwhelmed that there is no expectation of perfection. We all enter the work from different points with different resources; however, it is important we keep working to disrupt those social norms and power dynamics that separate us from students and students from each other.

Our K–12 system is woefully inequitable. The ways we choose to operate our courses, especially freshman courses, can either reify or redress the imbalance of opportunities students experience in high schools. In New Orleans, I was once talking with a student about why it was so sad when teachers chose to leave our school. Bijon told me, "Ms. Winterer, white kids don't care when their teachers leave because they know they're just going to get another good teacher. They're like 'hey girl see ya later!' But, when our teachers leave, we don't know what we're going to get." We don't know where our students are coming from, but we can do our best to make sure all of them feel like they belong in our classrooms, mathematics, and our institutions. That starts with making connections and building community.

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Credits

Figure 1 is courtesy of Lana Fukisawa/Department of Mathematics, UC Berkeley.