Foothill College Math Department Book Club (FHMDBC)
Meeting 4 Preparation: April 2022 (held in May)

Quick reminders for our book club

1. This year, winter - spring 2022, we read:
   Grading for Equity: What It Is, Why It Matters, and How It Can Transform Schools and Classrooms
   by Joe Feldman (16 chapters for a total of 260 pages)

2. Previous documents for our 2022 FH Math Faculty Book Club:
   - FHMDFBC WS2022 Homepage
   - FHMDFBCWS2022 Doodle Poll to find meeting schedule (Google Doc)
   - 12/30/2021 Winter 2022 Planning Meeting with Nicole Gray (Google Doc)
   - 11/29/2021 Winter 2022 Planning Meeting with Ram and Carolyn (Google Doc)
   - FH Math Dept Book Club Interest form (Google Doc)
   - FH Math Dept Book Club Invitation (.pdf on Google Drive)
   - FHMDBC_WS2022_Meeting_1_Preparation (Google Doc)
   - FHMDBC_WS2022_Meeting_2_Preparation (Google Doc)
   - FHMDBC_WS2022_Meeting_3_Preparation (Google Doc)
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Updates and news

1. Nicole is still waiting for a response from Kurt's office. She will send another reminder by the end of the week.

Individual Preparation

1. Reading:Pilar 1 Accuracy (Chapter 7 - 8)

2. Address Writing prompts:
   a. Question 1 from "Questions to Consider" page 91

   b. Did you enjoy group work as a student? Do you assign group work in your classes? Do you grade students on their work in groups? Do you anticipate making any changes based on what you've read?

Pairs Preparation

1. Pick a 3rd writing prompt to consider
2. Meet to discuss what you have written

Good quotes - as you read if you find a quote that resonates with you feel free to include it here. You can also add quotes from our discussion.

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Pair 1: Jennifer and Sarah

Jennifer's Responses

Question 1: For teachers: If you've assigned a 0, was it intended primarily to affect students mathematically or psychologically? Knowing that it is mathematically unsound as well as inaccurate, does that change your opinion of it? Would it change your opinion if you discovered that there is no evidence that receiving a zero motivates students, but in fact it often D motivates them?

On an individual problem, a zero was a mathematical rating. But on an assignment, it was more of a psychological rating, like "Hey, what are you doing? You didn't even turn this in. Better change your ways or see me or something." I am a big fan of effective communication, so it's weird that I have accepted for so long the crazy ambiguity of using a score or a grade to communicate a thought. Even if I have a thought when I do that, I won't remember later what that thought was because it was context specific. And the student couldn't know it either. I regret in this moment that I participated for so long in that kind of ineffective communication for so long, continuing to do so even while simultaneously exploring positive interventions like "Not Yet" and "Approaching Standard."

When I've assigned a 0, it was often wrought with my own emotions. I would experience either a sense of helplessness or resentment/anger or relief when I put a 0 on a page. I think those emotions were tied to some underlying beliefs. I think helplessness stemmed from a belief that the student had significant knowledge and skills but that I had no option but to give them 0 since they put nothing down. Resentment/anger stemmed from the belief that the student wasn't holding up their end of the bargain, that they weren't showing up to class or doing their homework. Relief stemmed from the experience of fatigue that comes with trying to to assess work on a 100 point scale. Feeling so, so fatigued from that work, I sometimes felt so much relief at just having to not think at all and just put a 0 on a blank page.

Before Canvas, students couldn't really "see" their grades. So a 0 on an assignment wasn't really much of a psychological weapon until I gave out progress reports. So a student wasn't confronted day in and day out by their dismal average. Even after we used Canvas, I tried to not use the gradebook. But my anxious students begged me to, telling me that they felt more anxious not seeing that grade. But when I use the Canvas gradebook, I experience a catch-22 when students don't submit things. It's great that I can easily send a nudge (with clear and encouraging messaging) to students who didn't submit. But I have trouble coping with the inaccurate messaging of grades. If I put a 0 for a missing assignment, it tanks their average and grade. If I leave it as a blank, it computes their average without that assignment, which likely is an overpromise of their grade, sometimes sending the message that they're getting an A, even though they've only completed the opening surveys and introductory discussions. Right now, I set up a 4 point grading scale in Canvas, with 4=A, 3=B, 2=C, 1=D, 0=F. It's imperfect. For example, 3 shows up as 75%, but also as B, which is confusing to students who are used to 10 point percentage scales for grades. But if I put in a 0 for a missing assignment (with an

encouraging message sent about being able to still submit), it doesn't have the same strong downward pull that it would using a traditional percentage scale.
It is interesting to think about motivation in the face of a 0 and an "in progress" grade. I am competitive and for as long as I can remember, I have judged myself by outside standards and expectations. From that viewpoint, 0's have been motivating, nudges to keep me on the path of being "acceptable" or "more than acceptable." I have found many students are like me in this way, eager to avoid zeros and overly grateful for any opportunity to make up something they miss. For the last 7-15 years, I have been working to throw off the shackles of defining my own self-worth by other people's expectations. I can say that 0's are no longer motivating and they might be de-motivating for me. I feel like my job has become impossible. I am no longer able to create all the good that I can imagine. So in the privacy of my work, I earn 0's all the time. And I have to let them roll away, as simply ideas dropped to the cutting room floor. It creates a kind of grief, a belief that what I'm doing now is better than what I used to do…but that it doesn't check the boxes that define "good teacher." It's hard to not care, and I move back and forth between feeling good about the work I do and feeling very insecure about it. I imagine that that's what my students feel in a multitude of ways as they try to navigate the judgement of education and grades, even as they define their own path and goals. There is not necessarily a match between their own goals and the goals of individual assignments, classes, programs, and degrees.

Question 2: Did you enjoy group work as a student? Do you assign group work in your classes? Do you grade students on their work in groups? Do you anticipate making any changes based on what you've read?

I experienced very little group work as a student. I was very shy as a child, so I imagine being glad I didn't have to talk to other kids. Interacting with other children was difficult, except possibly one-on-one. It was hard to navigate playground dynamics. However, my favorite class ever, which re-affirmed my wavering belief in my mathematical path to a bachelor's degree, was jam-packed with groupwork. It was "Exploration and Proof" and the pedagogy of THINK-PAIR-SHARE was fun and riveting, metering out new information at a digestible pace (for me). In retrospect, I think it was just better teaching than I was used to. It was a type of groupwork, but it wasn't prolonged or graded; it was just for learning. In years past, when I assigned groupwork it was either because I thought the work was too hard to do alone or because I thought students would enjoy working with each other or because I didn't want to have to grade an entire class set of something. When Covid took us to virtual, I worked hard to create community and create groups. I don't think it was especially effective until this quarter, when I responded to last quarter's feedback and assigned people arbitrarily to groups up front rather than trying to match up people based on availability or shared interests. And I also assigned them a particular evening day and time during week 2 to meet and discuss. Not everybody did it, but based on my reading, I had decided that it wouldn't be counted as part of a student's grade and that anyone who asked, would be automatically allowed to "opt out," but that the default was an "opt in." And a person who opted out would have to create their own

short video to submit, since they wouldn't be part of the group video. So instead of answering questions for each other, they would just answer a posed question to me. There are still some who never launched into a group and who never responded to my nudges to submit their own videos. But I no longer care. I think that everyone who wants to work collaboratively and have that support has it. And separate from discussing with their group, they all asynchronously review 3 peers' labs and have time to improve their own based on that feedback before I "grade" it. This has helped with my workload and at this point I am VERY happy with the results. A big part of what has helped me get to this point was Joe Feldman's argument about grading group work. Just as he said, I have heard students complain up front that they didn't want to do the work for the whole team. None of my prior efforts to mitigate this phenomena has been so effective as simply not counting the group work as part of their grade, which simultaneously paved the way for people to opt out without any issues.

I'm reminded, after reading other's work of a couple of experiences in college. Math had been very solitary for me. I didn't understand differential equations at all and was afraid I was going to fail the first test. At the end of Friday's class, out of sheer desperation, I stood up and surveyed the room and realized there was only 1 other woman in that space. I approached her, told her my fears, asked how things were going for her, and then went over to Berkeley that weekend to work on homework with her. Unfairly, I scored better on that test than she did. But without her help, I would have failed. Sometime later, I formed a group with some others. I really disliked working with some of the men. In a class for which our grade was almost entirely based on homework which could be resubmitted multiple times, one guy took an incomplete and asked me if I could give him my homework binder so he could "double check" his work. I told him no. I had worked with him and a woman, Wendi for a couple of years and I knew he would just copy it and pass it off as his own. Another guy was more at my level, but seemed to feel like he was above me…so argumentative and certain he was right, even when he wasn't! He decided once that we had to go to the teacher to decide whose idea was right…and when the teacher explained it and it was in agreement with what I was saying, that man let on to the teacher like that's what he had been trying to convince me, even though it's what I had been saying all along. I pretty much despised him for that lack of humility and wouldn't give him the pleasure of my thinking any more after that.. Another guy (who I liked despite this) asked me to slip into his class one afternoon and take his test for him…he was sure the teacher wouldn't know the difference. I told him no. Among other reasons was that I had had that teacher and couldn't imagine that he wouldn't know the difference. In grad school, I studied a lot with 2 women, Myka and Ruth. It wasn't always enjoyable, but mostly it was. And it was necessary. And we all had a lot of respect for each other. And we all had a certain shared humility. I shared a teaching office with Myka and 3 men, Henri, Jim, and Rob. We were all smart and humble at the same time and it was a wonderful community. We helped each other out and talked about math with each other when we were stuck on something. There was also a guy named Jeff and a guy named David who would study with us on weekends in the conference room by our offices. My life got so much better when I found that tribe. I'm still in touch with Jim and Rob. I made Jim's wedding cake and got to go to Dave's wedding. I think it's the respectful working relationships and the community that people want…and a way to get away from the potential bullshit aspects!

Question 3:

2. Because the zero is never an accurate description of a student's knowledge, some teachers use a 1–5 scale instead of a 0–4 scale. Would this scale make the grade more accurate? More equitable? More motivational?

I see that 1-5 is just a 1 point shift of 0-4. So I guess it comes down to the meaning of the resulting percents/points. If 1 = F, 2=D, 3=C, 4=B, 5=A, then programing that into Canvas would make the scale A=100%, B=80%, C=60%, D=40%, F=20%. On the 0-4 scale, A=100%, B=75%, C=50%, D=25%, F=0%. I'll think about this some more. I only think 0 is a problem as an outlier, but maybe psychologically it's meaningful to shift and make 0 into a 1. Some would say it's problematic to treat categorical data as ratio data…for example, does a D signify that a person knows twice as much as someone earning an F? And does a B signify that someone knows twice as much as someone getting a D. I like a 4 point scale (1-5 or 0-4) better than I like percent scale, in which there are SOOOO many ways to demonstrate F and which leverages 0s as outliers (brutally punishing non-conformity). But I'm doing something equally wrong mathematically when I average an A and an F to a C. Ultimately, the more I dig into these ideas, the more I return to an idea I explored previously…not giving aggregate grades on an exam at all, but rather, tracking the acquisition of particular skills. I think the Learning Mastery Gradebook in Canvas allows us to use rubrics to track skill development throughout the class. But that's a whole new learning curve, with no guarantee that it would be better. I feel like we are seriously just jumping from learning proxy to learning proxy per the factory model. To be more real, we'd have to probably do what Jeff wants…very few students coached and guided over time. Because I don't hold out much hope for that before I retire, I keep grappling for an in-between alternative. For me, that is currently a combination of self-assessment, peer assessment, and my assessment. I guess I'm giving myself veto authority, but hoping students will get better at self-assessing. Most of my calculus students felt they deserved an A on a self-assessment, despite some of them falling far short in my estimation. Sigh…

Sarah's Responses

Question 1: For teachers: If you've assigned a 0, was it intended primarily to affect students mathematically or psychologically? Knowing that it is mathematically unsound as well as inaccurate, does that change your opinion of it? Would it change your opinion if you discovered that there is no evidence that receiving a zero motivates students, but in fact it often D motivates them?

It's been a while since I've had a heavily weighted assignment that couldn't be completed on the student's own timeline. I do give zeros this quarter for certain missed assignments, but the total weight is calculated to bring the student down to a C at the lowest if they "zero out" of all these assignments but complete the other coursework at their own pace.
My intention has been "psychological" in that I've wanted to encourage students to stay with the pace of the class rather than cramming to complete 12 weeks worth of assignments on the last days; and I've also tried to give the students a reasonable way to opt for a B or C grade if letting some pressure off in this class meets their needs.
Although I don't feel that my system is perfect or any kind of pedagogical model that I'd encourage for others, I guess I will disagree with the premise of the question. I'm sure that's what the research says. At the same time, in my particular scenario, I observe many students who are absolutely motivated to keep up with completing the assignments when that zero is their other option (and who are absolutely motivated to leave the assignments until the last minute otherwise).

Question 2: Did you enjoy group work as a student? Do you assign group work in your classes? Do you grade students on their work in groups? Do you anticipate making any changes based on what you've read?
I haven't gravitated to group work in a big way as a teacher - just minor in-class exercises. In my math major classes, I enjoyed group work, but as a younger student I had a big problem with it.

Question 3:

2. Because the zero is never an accurate description of a student's knowledge, some teachers use a 1–5 scale instead of a 0–4 scale. Would this scale make the grade more accurate? More equitable? More motivational?

I may be having an overly-literal moment, but in Chapter 7 I had a hard time with this idea that the grade describes the student's knowledge. I feel like, in the ideal case, the grade can only reflect the student's performance on the coursework. (Chapter 8 seems more closely aligned with this way of thinking.) It's great when that coursework performance is aligned with knowledge the student carries forward with them, but it seems far-fetched to think they're the same thing.

Pair 2: Phuong and Teresa

Phuong's Responses

Question 1: For teachers: If you've assigned a 0, was it intended primarily to affect students mathematically or psychologically? Knowing that it is mathematically unsound as well as inaccurate, does that change your opinion of it? Would it change your opinion if you discovered that there is no evidence that receiving a ero motivates students, but in fact it often D motivates them?

I don't assign a 0 if a student has submitted something, regardless of how incomplete or inaccurate the work is. It just feels depressing to give a student a 0 if they've at least tried and I want to recognize them for their effort even if I assign a failing grade. I don't think giving a 0 motivates students much but rather it creates a lot of anxiety for them and I can see how it demotivates them. I can see how they feel all hope is lost after receiving a 0 and then just check out. I've seen it with my students and I've seen how they can bounce back with a renewed sense to motivation once they find out they are given another chance.

I assign 0's to homework and other assignments near the end of the quarter to let students know the assignment was never submitted. Yes, that can be mathematically inaccurate, but it's the end of the quarter and I need to stop grading. I need to draw the line somewhere.

Question—If a student receives a 0 because they've not submitted an assignment but knows they can still submit it and have the grade changed, is it better for the instructor to put in a 0 or to leave the assignment as ungraded and without a score. Giving the 0 as a temporary place holder may not demotivate the student (as long as they know they can get the grade changed) and perhaps is better than leaving the assignment ungraded (which doesn't lower their overall score) and misleading the student to thinking they are acing the class when they're not submitting any work.

Question 2: Did you enjoy group work as a student? Do you assign group work in your classes? Do you grade students on their work in groups? Do you anticipate making any changes based on what you've read?

I hated group work as a student! It used to cut off my thinking process because someone else would solve or start the problem before me and they would run with the idea while I still wanted more time to process and think on my own. Group work sometimes lowered my level of

self-confidence and got in the way of my learning. It prevents me from thinking through a problem on my own and on my own timeline.

Because I hated group work and was well aware of how it affected my learning, I've not been a fan of it as a teacher and have not assigned any obligatory group work which means I do not grade students on group work. When we are doing class activities, I always encourage students to spend the initial 10-15 minutes thinking and working on their own, and then I have them get into groups to discuss afterwards but I don't force anyone to get into a group if they rather work on their own.

No, I don't think I feel I need to change the way I do group work. I know some students really like group work and it definitely helps develop a sense of community so I will still continue to encourage but not require students to work in groups.

Question 3: Because the zero is never an accurate description of a student's knowledge, some teachers use a 1 - 5sclae instead of a 0 - 4 scale. Would this scale make the grade more accurate? More equitable? More motivational?

In the 0-4 scale, I would only use the 0 to indicate there was no submission. The 4 would mean "exceeds standards"=A and the 3 would be "standards met"=B. The 2 would mean "almost there"= C- which is not passing yet and the 1 would mean "standards not met yet". This scale seems easy to use for me.

The 1-5 scale would make grading more difficult for me. It would probably slow my grading down by adding another gradation that I don't think is necessary. We basically want to know whether standards have been met or not. So a 4 or 5 would mean passing and 1 or 2 would mean not passing like a D or F and what would the 3 mean? If the 3 means "almost there" and is equivalent to a C-, then having both a 1 or 2 for "standards not met" would perhaps be less equitable and less motivational for students because it seems like an extra level to climb. It also seems easier and more transparent for students to just know yes or no---have they met the standards or not? Do we need to differentiate at which level they've not met the standards? I suppose that begs the question---do we need both a D and F in our grading system?

Teresa's Responses

Question 1: For teachers: If you've assigned a 0, was it intended primarily to affect students mathematically or psychologically? Knowing that it is mathematically unsound as well as inaccurate, does that change your opinion of it? Would it change your opinion if you discovered that there is no evidence that receiving a zero motivates students, but in fact it often D motivates them?

In recent years, when I put a 0 in the gradebook for an assignment it is a signal to the student that they still need to submit the work, not a final score. This has been effective with using the Canvas gradebook. I will be sitting in my office on campus and put in zeros for all the missing Classwork #2 assignments for example, often, within minutes, students will come to my office to give me the assignment, submit the assignment online, come get help on the assignment or ask for another copy of the assignment so that they can complete it.

I am upfront about the role of the newly entered zero with my students at the start of class, because I have found that a zero grade often creates feelings of anxiety and panic for students when they think that is their final grade on the assignment, and that is the last type of feeling I want to create in my students. So, I tell them that when I enter the zeros, I don't want to give them that grade, but want them to submit the assignment as soon as possible.

What I need to improve is what I do with remaining zeros at the end of the quarter. What I currently do is at the end of the quarter, I go through my gradebook and if a zero is remaining for an assignment where the student has shown mastery of the objective in another way, I excuse the assignment for the student. For assignments where the student has not shown mastery of the topic in another way, I change it to a 50% so that the student's grade is not overly affected by the zero in the averaging process.

This last part is something that I have been experimenting with recently. It is very time consuming and I have been able to do it with the small clases that I have had recently, but if in the future I have full classes again, this will become unmanageable. I need to find a way to make this more animated if that happens, which doesn't seem possible. Also, I have not shared with the students that this is what I am doing, mostly because it is so new and my ability to do it depends on class size. So, more to think about and work on here.

Question 2: Did you enjoy group work as a student? Do you assign group work in your classes? Do you grade students on their work in groups? Do you anticipate making any changes based on what you've read?

I did not like group work as a student because I had and still do have to some extent rather intense social anxiety. This is one of the reasons I have been reluctant to force group work in my classes. Also, my brother has even worse social anxiety and would not be able to participate in a class that required group work. Where I would not be able to concentrate on the material being taught because I would be consumed by my thoughts about my interactions with others, he would not even be able to stay in the classroom.

Because of this, I have always made group work optional,I will give opportunities for students to work together and recommend that they work together, but if a student asks me if they can work alone, I always say yes. And I create a situation where students can ask to work alone without it being obvious to others.

I have had a set of group cards on my desk for years now, but have just not been able to use them because every time I consider it, I think of my brother and can't do it.

As for grading, the group work that I assign is mainly for practice, the score is a small factor in the students grade and is really graded for participation. Usually, students try the problems, get feedback, and make corrections all within the class period and all leave with full credit on the assignment.

If I was to have large assessment type assignments that students did in groups, I agree that the students should work together, but that each student's assignment should be graded separately. It is something for me to think about as I explore ways to assess students other than exams.

Question 3: Because the zero is never an accurate description of a student's knowledge, some teachers use a 1 - 5sclae instead of a 0 - 4 scale. Would this scale make the grade more accurate? More equitable? More motivational?

For quite some time I have been troubled by the problems of the 0 - 100 grading scale and I have been trying to work within it to make it more fair and descriptive of students' knowledge. For instance, when grading a math problem, I was taught to assign each step in the problem a certain number of points, however far the student got through the problem, that's how many points they get for that problem. Over the last few years, instead I have been giving points using a more global analysis of the student's demonstration of their understanding. So, if overall the student demonstrated a good developing understanding of the material assessed I would give them whatever number of points corresponded to about 85% or a B on that problem. The

students' interpretation of this grading was that I give "a lot" of partial credit compared to other instructors. It has led to the students having a more positive attitude about learning and schoolwork. They are more relaxed, happy and productive. They were also very grateful which made me a bit uncomfortable since I was only giving them what they deserved.

I don't think that I am ready to go to a 0 - 4 or 1 - 5 grade scale yet. I find that gradual change works best for me and the students. My next step is to make a general rubric for all assignments in the class that has five levels like a 0 - 4 or 1 - 5 scale, but for each of these I will give a number of points that correspond to a A - F grade in the 0 - 100 grading scale. This is one of my projects for the summer and I plan to use, modify and improve it all next year. Then I think I will be ready to switch to a 1 - 5 grade scale. I like the 1 - 5 better mostly because I want the zero to not be a grade, but a signal to the student to "get that assignment done and submitted". Using the zero as a grade is demoralizing and seems to produce a strong negative emotional reaction in the students.

Pair 3: Nicole and Jeff

Nicole's Responses

Question 1: For teachers: If you've assigned a 0, was it intended primarily to affect students mathematically or psychologically? Knowing that it is mathematically unsound as well as inaccurate, does that change your opinion of it? Would it change your opinion if you discovered that there is no evidence that receiving a zero motivates students, but in fact it often D motivates them?

Honestly for the first 8 years of my career I didn't think much about grading at all, beyond that it didn't like the grading process very much and tried to find ways to not spend too much time grading. Then in 2004 Rob Johnstone, then the Foothill Institutional Researcher, did a report and presentation that changed my view of grading. Rob had worked in industry before he came to Foothill College. So, he had a lot of good data analysis skills along with viewing data tracking in higher ed through fresh eyes. Rob was asked to use that fresh view to pick up on the assumption that we make as educators and do the analysis that verify or challenge those assumptions. Two things from that study shocked me. One, was students who are taking the most units do the best. We had been for years advising students to not take too many units because they would get overwhelmed, but his research showed that wasn't necessarily the case. Now I think we need to think more about this on a case by case basis. The second idea was about the grade data. I will never forget what Rob said. "I have good news, and bad news. The good news is that your grades are meaningful, the bad news is that they probably don't mean what you want them to mean. Students who took a prerequisite course a Foothill (say pre-algebra) had about an 85%

chance of passing the next class (Elementary Algebra) if they got an A in the prerequisite. They had about a 50% chance if they got a B and less than 20% chance if they got a C. And the data was similar for other prerequisites. Yikes, giving a C to a student was like dooming them to never get through their math sequence.

That grade study weighed heavily on my conscience. That led to the creation of Math My Way, which was designed to never give students a B or C grade, but instead ensure that students had at least B+ knowledge of all the different topic areas in prealgebra before they went on to Beginning Algebra. Lori did a study of Math My Way data when she was work on her Phd, and the data showed that while indeed fewer students completed Math My Way, more of those that completed were able to go on to pass a transfer level math class. So, in a way it worked. In that class, no zeros were given. Students completed homework and it was reviewed for completeness, correct use of notation and correct answers. Stamps were given to assignments (not grades) when they showed that all those criteria were met. And once a student completed all the assignments for a unit they could sign up and take a test. Tests were graded using points, but they were really had a pass/no-pass record in the gradebook. If a student didn't get a certain grade threshold, then they needed to retake the exam. So, looking back on it, it had a lot of good grading practices.

Grading in my other classes didn't change much and I definitely continued to use zeros for missing assignments. I guess I thought of it, and still kind of do as more of a psychological motivation. I leave the assignments open for students to complete up until that last day of classes, hoping that many students will take advantage of their motivation to pass, that seems to come late in the term, and complete those late assignments, and I found that there were always a few students who would do that and changed a non-passing grade to a passing grade at the end of the term.

I admit that even with reading what Feldman has to say about zero grades, I still can't bring myself to completely give up on them. I want students to have certain learning experiences, and I still feel like if they don't complete those assignments, that it's strange to give them some credit for them. I recognize the flaws in my thinking. One, that I shouldn't really feel that I am the driver of student learner, that I should allow my students to have more ownership over their own learning. Two, that the zeros don't actually motivate the students to do the work, although I am baffled by this, I cannot imagine being a student and just not completing an assignment. Three, that giving zeros mathematically skews grades.

Yup I have some growing to do. I wonder what I'll be when I finally grow-up?
Nicole, I know what you mean about giving credit for missing work. I was setting missing at 50% for a while and it felt undefendable. But mathematically, that is just a transformation of a 0-5 point scale (multiply by 10 and add 50). Jenne

Question 2: Did you enjoy group work as a student? Do you assign group work in your classes? Do you grade students on their work in groups? Do you anticipate making any changes based on what you've read?

I didn't enjoy assigned group work as a student, but for my upper division and graduate level math classes I always formed study groups to talk about and discuss assignments. Now, looking back on it, I guess I didn't like the assigned group work because it made me think about fairness in terms of the grade that would be given to the full group. But I did enjoy collaborating and thinking through problems with my fellow classmates as long as there was no grade attached.

I do assign group work in most of my classes. But asynchronous online quantitative reasoning is the first class were group work is given a grade. And all the other classes that I've taught group work was a way to run in class activities so that I had fewer students to check on when I walked around the room to see how students were doing.

I think one of the tricky things about group work is coming up with problems that are accessible to students but sufficiently complex that students can't divide up the work and do it separately. Fortunately, the Quantway materials have great problems in the collaboration assignments that are done by the student groups in my class. The first time I taught Quantway as an asynchronous online course, the groups failed to form. I had one pair of students who ended up working well together and I think that's because they typically join me together for office hours in the first weeks of the course and completed a few of the assignments online together with me. That gave me the idea of dedicating the first week of the course to working with students online to complete collaborations and help the students to develop habits for working together that would support group work for the rest of the quarter. This is worked pretty well and of the 7-10 groups that get set up each quarter, all but 1 or 2 of those groups function well as a group for the full term.

Because I hated graded group work as a student, I have been very hesitant to grade group work. But, the Quantway online curriculum materials are designed for these assignments to be given a grade. Additionally, I recognize that many of the students in the class would not form the habit of joining their groups if these assignments did not have grades associated with them. The students sign up for an asynchronous class and many are hesitant to sign-up for group times and beg to be allowed to work on their own on their own time instead of being put in a group. So, I feel that in order to get students to initially work in groups I need to have grades associated with these assignments. But I have decided to grade them as full credit for all the students who show up and participate in the group. Students can complete the assignment individually, but they only get 75% to 80% when they do this. This grading scheme seems to be designed well enough to get the students to join their groups in the first few weeks of the term. I believe that after the

habit was formed, most of the students would continue to work in group even if they didn't have points associated with the assignments, because they see how beneficial it can be to work in a group and discuss the concepts. This seems to be working well for the asynchronous environment, so I don't have any plans to change this grading practice when I transition from Math 180 to Math 80. But, if you have ideas for me I'd really like to hear them.

Question 3: What practice(s) do you use to challenge traditional approaches to math education? Why do you do this?

Three things come to mind Math My Way, Quantway and concept quizzes.

When the group of instructors who initially worked in the Math My Way program went to conferences to talk about the program we were viewed as aliens. How could we run such a program? There have been many thoughts and practices around mastery-based learning in math curriculum, but the idea of working around the registration structures to allow the students the time to be able to master the course material without having to worry about failing the course if they didn't learn the material in the designated length of the term, made people's heads explode. But as I write this it makes me see that there really were some great things about that program. Embedded in the structure of that program was the belief that all the students were capable of doing B+ or better work given the time and support. It makes me want to explore how we might create a similar program for doing precalculus or even calculus. Some students might go faster than we currently have the paced and some might go slower, but it would be at a pace that works for them and allows them to do B+ or better work. The Carnegie unit really gets in the way here.

Quantway is a challenge to traditional approaches to math education, because it is math in context and it's messy. The math we need to get through everyday life could be seen as a collection of "simple" math topics. Most of it based on concepts that come from beginning algebra or lower-level classes. But, with the way math is taught at all levels, students rarely see the connection between what they learn in a math class and what they do with numbers in their everyday life. When I review the videos that are made when students complete the collaboration assignments, I sometimes hear groups discuss how Quantway has helped them to see that they know and use a lot of math in their everyday life. Many students who are older and have been out of school for a while mention that they hope that many math classes are being transformed in this way so that the students are learning skills they can use in their everyday life. While the math skills in this course are from "simple" math, the students really do learn to use those skills in complex situations and become savvy consumers of quantitative information.

When I teach more traditional math classes, I give a concept quiz at the beginning of almost every class. These concept quizzes as students to write about the concepts they are learning in the course. In a beginning algebra class this might be a question asking students to describe the relationship and differences between expressions and equations. In an intermediate algebra class this might be a question that asks students to discuss how radical notation and fractional exponents are related. In a precalculus class this might be a question that asks students to describe what it means for a function to be an increasing function. What I gather from student reactions to these quizzes is that this is an unusual task for them to be asked to do in a math class. In fact, one student once yelled at me, you keep asking us to write words, but his is a math class it's supposed to be all about numbers and variables. He dropped the class. I tried but could not convince him that understanding mathematics means being able to describe the concepts and structures using language. For many of my students, I believe that this practice opened a door for them. It helped them to see that mathematics is not a set of steps to be memorized, but instead is operations and concepts to be understood and connected, and using language helps them form that understanding and explore those connections.

Jeff's Responses

Question 1: For teachers: If you've assigned a 0, was it intended primarily to affect students mathematically or psychologically? Knowing that it is mathematically unsound as well as inaccurate, does that change your opinion of it? Would it change your opinion if you discovered that there is no evidence that receiving a zero motivates students, but in fact it often D motivates them?

I assigned zeros for work that was not submitted or that had

Question 2: Did you enjoy group work as a student? Do you assign group work in your classes? Do you grade students on their work in groups? Do you anticipate making any changes based on what you've read?

I enjoyed working with other students immensely while I was in college. However, in the many math classes I took in undergraduate and graduate school, I seldom had the chance to work with other students as a formal part of the class. In fact, I cannot think of a single class where we got credit for group work. However, I did spend a lot of out-of-class time teaching and learning with other students in my math classes. Some of the most meaningful learning I did in my classes came from tutoring other students and from solving problems with classmates. Those experiences were extremely rich and led to huge improvements in my understanding of material.

In terms of grading group work, I love the idea that students engage with each other in peer instruction and in group problem solving. As I've tried to create classrooms in which this type of learning happens, I have noticed a few things.

First, many students struggle to teach each other and speak about technical content with their peers. Part of this, I think, is that this is a learned skill that is not commonly taught in many college STEM classrooms. In fact, in a traditional grading environment that assumes grades are distributed on a bell curve, students compete against each other for grades. That system incentivizes students to approach their studies in an insular way: working with a small group of trusted friends and keeping other students out of the loop so as not to give outsiders an advantage in the grading system.

Second, students are socialized to believe that learning happens when they do what the teacher tells them todo. Group work depends on interactions between students in which the teacher is not the center of the conversation. For a large portion of my classes in which I've asked students to work together while simultaneously removing the rewards/punishment aspects of grades, many students seem to devalue conversations with their peers.

I think part of the issue is that it takes a lot of thought and work to define great in-class group tasks. I'm working on a model for authentic modeling activities for Math 2B that would engage students in applied modeling over many weeks of the quarter. But I think another part is that students are not used to thinking about learning as happening in conversations with peers, at least not the type that counts towards performing well in the class. I am aware of the results from the Emerging Scholars Program and all that

came out of that model for instruction which focused on peer-to-peer interactions on rich problem solving tasks. The idea of motivating students to work hard on a shared goal is exciting but how to do that in a way that each student reaches for their best is a very challenging question.

A related question I think a lot about is: in the absence of grades, how can I help students tap into other sources of motivation to learn inside my classes? How can I help students develop strong learning communities without relying on punishments and rewards to coerce group learning out of students?

Grades rely on extrinsic motivation. The major motivational premise within the grading system is the desire to have students comply with my requests to earn the rewards of high grades and to motivate students to do work they might otherwise not by using the fear of punishment. It is true that I might get my students to work together by grading group assignments. However, I often wonder what needs to happen to get students to do work by tapping into their intrinsic motivations and providing authentically interesting tasks for students to work on. This problem of creating

Question 3: What practice(s) do you use to challenge traditional approaches to math education? Why do you do this?

One of the practices I challenge is the use of in-class lectures to present information. Instead, I use a flipped learning model for the delivery of course content.

My short answer to the question of why I do this is that I have lots of evidence that lecture-based instruction is bad for learning. I saw this was true in every one of my classes during the 10 years of college that I survived. As a young instructor, I witnessed so much harm that I caused many of my students when I used traditional lectures to deliver content. I also am aware of research-based evidence that demonstrates lectures to be harmful for learning. For example, check out the paper Active learning increases student performance in science, engineering, and mathematics by Scott Freeman and company. That paper reviews 225 academic studies on examination scores and failure rates that compare student performance under traditional lecturing versus in courses that use active learning (of which flipped learning is one example). The authors show that students who engage in active learning do better on exams than students who are in classes that feature traditional lectures. Moreover, students in traditional lecture courses are 1.5 times more likely to fail than students in classes that feature active learning. My favorite quote from that paper is:

> "The results (in this paper) raise questions about the continued use of traditional lecturing as a control in research studies, and support active learning as the preferred, empirically validated teaching practice in regular classrooms."

Translation: Using lectures to inspire learning is like using cigarettes to promote physical health. Just like we have scientific evidence that cigarettes cause cancer, we also have scientific evidence that demonstrates that lectures are harmful for learning.

For a longer answer to the question of why I don't use the lecture-based model, let's explore how I define my role as a teacher. My current draft of an antiracist, research-based definition for teaching is as follows:

> *Teaching* is the act of facilitating, inspiring, encouraging, supporting, and empowering learning. In other words, a teacher is someone who stimulates learning (we'll explore a formal definition of learning and models for learning in later work we do in this class). Because teaching happens within a social context, the work of a teacher is about creating an environment that helps students learn and liberates students from larger structures of oppression that might block, impede, or constrain their learning.

This is closely related to one of my favorite quotes:

> "Learning results from what the student does and thinks and only from what the student does and thinks. The teacher can advance learning only by influencing what the student does to learn."–Herbert A. Simon

In my teaching practice, I work hard to make design decisions based on deep research on how learning works and to create the types of environments that are conducive to putting you in control of your learning journey. My task is to empower you to create your own learning experiences that are customized to your unique identity, interests, and lived experiences. Central to this task, I believe, are your visions and dreams for your world. My hope is that the experience we create together will accelerate your ability to make meaningful progress on the problems you care most about.

One of the challenges we face is to help you learn how to track, monitor, and reflect on your own learning. These tasks are quite difficult and involve a lot of mental energy. If I'm serious about teaching (as defined above), the lecture-based model for instruction gets in my way. When I abandon that model and use flipped/active learning techniques to support you in this class, I re-center you as the most important person in your learning journey. Together, we create structures to put you in the driver's seat to track your own learning and assess your progress throughout this class.