

Experts' Experiences Using Cases

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Professional development that uses case studies feels radically different from traditional instruction. The dichotomy is especially true in a field like mathematics that prizes abstract thinking over examples. However cases, and especially video cases, provide a rich context for discussion and can provoke reflections about teaching that are hard to come by in other ways. Those with many years of working with novice math teachers find cases to be an indispensable tool, but also struggle with exactly how to use cases. In this essay we explore what they have learned about using case studies to provide professional development to novice college math instructors.

This essay is based on interviews with four professors from different mathematics departments. Each has regularly used cases to learn about teaching and to help others learn about teaching. Their experiences have included working with written case materials and with cases using other media like the video cases in this collection. Three clear messages arose in their interviews:

- (1) For most people studying advanced mathematics, teaching and learning from cases is very different from teaching and learning mathematics.
- (2) There is a shared cultural paradigm between case use and academic mathematics: storytelling. Mathematicians tell stories by way of analogy all the time; to help illuminate abstract, decontextualized, mathematical ideas. Similarly, in using cases we look for connections between the case story (that occurred in some other context) and our own personal teaching practices, perceptions, and approaches.
- (3) There is no such thing as a teaching theorem. There is no "best practice" in the sense that all people should seek to teach in way *X*. For each instructor, the best teaching for that person, in context, may differ from hour to hour. Teaching in a morning calculus class may need a particular approach appropriate to the people in the room and the context at the university; three hours later the same instructor teaching a different set of people in a different room in the same university may require different teaching practices.

There are some things the interviewees know from experience that the reader may need to know to have context for comments. One is that the vast majority of people who complete doctorates in mathematics will spend their career in a job where teaching responsibilities take up more of their time - and are expected to take more of their time - than their research. What they also know is that most doctoral programs in mathematics departments prepare graduate students as if the opposite were true (as if more time and energy were going to be spent on research than on teaching). For more on the disconnect, see Chen and Zimble (2002) and the trends in job duties reported by the American Mathematical Society (e.g., Kirkman, Maxwell, & Rose, 2007).

Each of the case facilitators reporting here has used cases in different ways. Jason has regularly used video of the graduate student mathematics teaching assistants (TAs) he works with - TAs choose a chunk of video from their own class meeting to share with other TAs and that is the story that is the foundation for discussion. For David, the focus has been on what he calls "hot button social issues" - high stakes things that many find uncomfortable to talk about, yet will have to deal with at some point in their teaching career, like harassment, racism, or students

dealing with mental illness. For Eric, the use of written stories, live teaching demonstrations, and video of other people's teaching, all have been resources in helping graduate students learn about teaching. Eric has worked extensively with graduate students in mathematics master's degree programs, many with the career goal of becoming a community college instructor as well as with students in doctoral mathematics programs who aim to be university professors. Natasha has used textual cases and video case materials in her work with mathematics and science (mostly physical science) graduate students and faculty; given the importance of labs for science instruction, discussions in her teaching seminars have often had a great diversity of participant perspectives and experience.

All agree that authentic cases offer multiple layers of information and detail. Cases offer the opportunity to engage participants with different backgrounds and experiences. Interspersed among interviewee observations are comments connected to the particular materials in this video case collection [in square brackets].

What is good about using cases to learn about teaching?

Eric: It's very hard to just *talk* about teaching. Video is this kind of neutral way of showing people really interesting things that happen in a classroom that you wouldn't believe happened if you didn't see them.

Jason: Seeing an authentic scenario can really draw out good discussion on teaching. Authenticity brings with it the complexities of what happens in a classroom. When you put a video case in front of people, they don't all see the same thing. People are going to see the kinds of things they see are "problems."
[The *Communication Gap* case provides an authentic view into how students think about the nature of proof and highlights the differences between how students and faculty perceive this mathematical idea. In a similar vein, the *What Were They Thinking?* case creates opportunities to consider differences between what instructors may assume students understand from their written work and what thinking was actually going on as students generated their answers.]

Natasha: It helps novices develop "professional vision." I'm thinking here about the phenomena that novices "see" different things than "experts." To me, part of the power of cases is that it allows people to realize that what they noticed in a situation might not be what someone else noticed and, just maybe, there is something about noticing that they can learn from hearing what other people noticed and why they felt that thing was worthy of noticing.
[To support the development of participants' abilities to notice aspects of instruction, the *Facilitating Group Work* case reduces the complexity of that task by featuring the visual and verbal components of the video separately.]

David: I find that cases are powerful ways to get TAs to begin to get anticipatory in their thinking. ... The main point that cases afford is they are richer than anything else you can present. If you simply talk about a subject area, what you lose is the detailed grain size of the

case. So the case, what it does, is it provides specificity for the discussion. Instead of talking *around* the subject, you're actually providing the opportunity to delve into the details.

[One type of "anticipatory" thinking involves considering how initial impressions can set the tone for the rest of the course. In the *First Day* case, a variety of approaches to introductions and first activities are presented and participants have opportunities to consider the implicit and explicit messages students might receive in each scenario. In *Inside the Group*, participants consider the influence that ambiguous speech (in particular, pronouns) may have on student communication during group problem solving. The case discussions create opportunities for participants to anticipate these issues and consider ways they might address them in their instruction.]

What are the challenges for the Facilitators and TAs (participants) in using cases?

Eric: Well, I can think of lots of challenges that come up in doing cases. One thing that happens a lot, I don't like it when people become overly critical of the teacher. Sometimes the conversation, if you're not careful, veers into this "Oh, I can't believe they said this...did that." So, when you get people saying "I can't believe..." then something's gone wrong. Anyone, any teacher, who steps up to be part of a case study is a kind of hero – and I said this *before* I was a part of a case study (chuckle) – and, and you should be trying to learn from their experience. That's a gift. And people should appreciate it.

[The *Evaluation Feedback* case invites participants to assume the perspective of a student and provide feedback to the instructors featured in the video. This invitation to critique the instructor on the video provides the context for the remainder of the discussions and participants sometimes find it challenging to keep their critiques constructive and grounded in the video evidence.]

David: Participants, including the facilitator, are put on the spot. They have to be willing to discuss their tactics. So often as a student you're - what do I want to call you - a *silent observer* in many math classes. Unfortunately, as a silent observer, you get to "absorb" and then process "off-line" – at home, whatever. When you're doing cases as a participant you're now being forced to process "on-line." You're seeing the situation, you're reacting to it, expressing your reactions to real people. You as a TA are sitting there and you're used to being the silent observer and now someone's in your face saying, no, you can't be what you are used to being. You have to be this participatory entity taking what has just been presented to you, you have to remember what pieces you just observed. Some of the ways to help mitigate that is to give participants a set of lenses with which to observe the video. Focusing questions. And a chance to re-watch.

[Each case in the collection has focusing questions and many include multiple re-viewings of video to look for evidence to support discussion.]

Jason: Instructors/TAs watching a case can see things but not be sure if they can use them. The challenge is when deciding how to try things out because of seeing the video. It helps, the talking about what they, in the video, could have improved, then seeing what happened.

Natasha: I suppose that up until now there have been so few cases available that we all probably just use them for whatever topics are available and do without for other topics. However, as more materials become available, facilitators who want instructors to consider topic *X* will have more opportunities to decide whether to use a case or not. I often use cases for the topics that we have cases for because I want to use cases. If there were cases for every topic I might want to address, I'm not really sure how I would decide which topics were optimally addressed via a case (for my particular TAs, in my context, etc.). I don't think the materials exist yet to create the dilemma, but with this video case project and the Boston College Case Studies Project (Friedberg et al., 2001), it may be coming soon: instructors in college mathematics teaching seminars will need to make decisions, based on what case-based activities afford the learner, about when such an approach is best for their students (TAs).

Advice for facilitators?

Eric: Pay attention to the negotiation of trust in the room. Sometimes I don't like it when it gets too personal, that's why I started trying to structure it as positive stuff. The other extreme is sometimes people don't, aren't critical of the teacher. A famous one is the TIMSS 95 stuff with an American geometry teacher who is very talky and simplistic and a Japanese teacher who has this glorious multi-media, scaffolded presentation. When I show that, I want people to notice that in the American classroom, the kinds of questions being asked are about arithmetic, and in the Japanese classroom nothing can be answered with just two words or a number, but it can in the American classroom. People seem to like the American classroom and (as facilitator) it's important for me to make space in conversation for noticing that there were only a few students who were answering. ... This is a main challenge that comes up, you have to steer the conversation. So if someone says "Oh, yeah, all the students were engaged" and you can say, "Okay, do other people feel that all the students were engaged?" You can ask very gentle questions just to sort of linger on the points you feel like need more exploration. "What is it you are seeing/hearing that supports that?" and "What, for you, is evidence of that? Do other people see the same things? Other things?"

There's another kind of subtle issue that comes up with conversations about teaching. A lot of people sort of gather there is a right answer. And they will try to give you the right answer... But that's not very authentic, not necessarily someone genuinely trying to wrestle with subtle teaching issues and change of practices. People won't generally know what to say, and will say things like "well I want students to look happy," "be engaged," "I want everyone to participate." But why? How do you know when you succeed?

Also, I think it's really important over the course of a semester to make the space for people to say things that they know aren't correct, pedagogically correct, like "you know what, sometimes you just want them to shut up..." or "I don't think some students can learn math" or "you know, I really think it's that these people are plain lazy" – I think it's really important for that to come up; if those things doesn't come up, in talking about cases, then that is something I would consider to be a sort of failure.

[Eric mentions the kinds of questions being asked in a TIMSS 95 video that he uses as a case. To pursue issues around the nature of questions and the roles they play in instruction, consider the *Questions* essay. Eric also mentions the challenge of generating discussions that are productively critical. Sometimes, if a video shows a teacher or instructional activities that are

familiar to participants, it can be challenging to help them disentangle the positive dispositions they may have because of that familiarity from the learning opportunities the instruction *actually* provides. These issues can arise with the *Facilitating Group Work* case where one instructor's practice is apt to be something participants have seen/experienced, while the other may be novel to them. Eric also mentions the "right answer" and the *Grades* case provides a window into instructors' varied thinking about the meaning of grades and issues around grading equity. In the video, some instructors' statements seem to reflect their (implicit) assumption that there is shared understanding and acceptance of their views about these issues. This can generate discussion about whether a "right answer" exists around issues of grading and raise awareness about assumptions instructors make about how universal their particular views are.]

Jason: There's one time that I remember when I was observing a TA seminar where they read a case story without any preliminary discussion or directing of attention. I remember that the TAs focused on one little aspect, they all had their opinions on what was being discussed. People said what they thought, what they viewed as the right perspective, there was no basis for argument, it was all opinion based. The conversation was really dead. ... The facilitator interjected to say, "well, I've seen it this way..." but the conversation was already over. Having a focus, questions or instructions about what to pay attention to, that's important, and so is revisiting those.

One of the challenges of facilitating cases is getting out of the rut that some of us have been in the past, the challenge of needing to run the cases different than we would a traditional math class. That's one of the challenges for someone trying to pick up the cases and use them. ... I teach a lot of non-traditional math classes where we do discovery to bring up discussion. One of the contrasts in using cases for TAs is they don't have a common base - their experiences are what they draw upon and their experiences are not a common, shared, thing. This can be good. But, depending on the personalities, someone who has more experience can kind of take over. So the facilitator needs to pair up people and let smaller groups talk, then share with the larger group.

Natasha: I'm frequently reminded of how deep and detailed TAs can go with case materials. I think because I already know what "the issues" are that the case is designed to raise, it seems like a relatively straightforward task to come up with a list of issues or to answer the various discussion questions. So I catch myself thinking, "I should cut off the discussion, I don't want them to get bored or to start talking about other stuff." And then I listen in for a minute, and I realize that they are still engaged with the discussion and are still grappling with the issues that the case has provoked. I think I forget just how much time and effort it takes to do the type of analysis and problem solving that teaching entails, especially for novices and folks who do not have much opportunity to talk about teaching.

[Two video cases, *What Were They Thinking?* and *Leading Whole Class Discussion*, provide participants with opportunities to consider some mathematical ideas in a deeper way than they might have before. In both situations, the ideas are ones that participants may have a pretty good understanding of (as measured by the usual means) but when pressed, they have to consider issues and questions that they may not have appreciated before.]

David: Some of the ways to help mitigate the fact that a TA is being asked to act in-the-moment, think “on line” is to give them a set of lenses in which to observe the video. One of the things I’ll do with students in watching a video, I’ll give them different lenses, because there is so much to attend to they almost become overwhelmed by it. They start questioning everything. When you do that, there’s so much to attend to, you can’t attend to anything. You have to give some structure. When I’ve done cases, that is more helpful than anything else. As a TA, I realize doing cases is totally outside their comfort zone. I still believe it’s *the* most powerful way to get them to proactively think about classroom situations than any other tool that’s in our arsenal right now.

[In two of the video cases, the activities provide participants with explicit lenses through which they should view the instruction. In the *Facilitating Group Work* case, information provided is restricted to audio-only and then video-only. This makes it more feasible for participants to concentrate on specific things without having to consider the interactions in all of their complexity at once. Similarly, in *Inside the Group* participants’ attention is directed towards specific moments on the video and then to the very specific use of “it” and potentially ambiguous references in the students’ discussion.]

Conclusion

One of the challenges in learning to use cases is that as advanced mathematical thinkers we have experience in a tradition where there is a high value placed on narrative that is informational: lecture. In the traditional storytelling of mathematics texts and lecture-based instruction, the student is listener and does not interrupt the flow of information to ask questions (unless willing to be considered rude). Effective case use relies on a different paradigm. The learner - in this case the person who is offered an opportunity to learn more about teaching - is expected to interrogate the information while also connecting it to (and distinguishing it from) personal experience. While there is still the aspect of information-presentation (e.g., watching a few minutes of video), it is done in short bursts that are interrupted – on purpose – with opportunities to predict, reflect, question, and then (with video or text) *revisit* the information. Case learners are expected to make sense in-the-moment, question in-the-moment, revisit in-the-moment. While this can be done on one’s own, it is greatly supported through discussion with others.

For more information on the Boston College Case Studies Project, see Friedberg and colleagues’ (2001) *Teaching mathematics in colleges and universities: Case studies for today’s classroom*. More on “noticing” when watching a mathematics class is available in Miriam Sherin’s work (see, for example, Sherin, Jacobs, & Philipp, 2011; Sherin & van Es, 2009). A detailed written case story spanning the first two years of graduate school in mathematics can be found in Hauk, Chamberlin, et al. (2009) and in the essay based on that work, *Journal of a Math TA*, in this very collection of video case and essay materials.

References

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