

Using Problem (Re)framing and Teachers' Pedagogical Responsibility to Facilitate Teacher Learning Opportunities

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Abstract: Although for decades there has been a strong coalition of teachers working for social justice, we still know little about how teachers' learning to do this work can be supported. In this paper, I use interaction analysis to investigate a teachers' learning opportunities, finding that the teacher's learning opportunities were facilitated by coaching strategies including: (1) a co-inquiry approach, (2) deliberate and persistent problem (re)framing, (3) grounding interpretations in student sensemaking, and (4) building on the teacher's pedagogical responsibility. These findings contribute to theory of teachers' learning, suggesting some of the ways in which such learning can be supported in a video-based coaching model.

In mathematics, a movement to teach content in connection with sociopolitical contexts and applications has resonated with many teachers and researchers (Bartell, 2013; Frankenstein, 1983; Gutstein, 2007). However, authentically situating mathematics in real-world, sociopolitical contexts is a complex, demanding endeavor (Leonard et al., 2010) and we know little about how teachers' learning to do this work can be supported. Designing and investigating supports for teachers' learning to do this work is, then, an important research topic for the field (Bartell, 2013).

In this paper, I report an investigation of one teacher's learning to integrate mathematics and social justice, utilizing a video-based coaching model. Through interaction analysis (Jordan & Henderson, 1995) of a *critical case* (Flyvbjerg, 2006) of strategic importance to this challenge, I show how learning opportunities for the teacher arose in coaching conversations. Additionally, I share implications for design of learning environments for teachers, especially as it relates to supporting teachers' learning of justice-oriented pedagogies. Because of growing pressure for teachers to integrate content and social justice topics, a pressing challenge for the field is understanding how to support teachers' learning in this realm. This study begins to illuminate potential mechanisms of teachers' learning through coaching and provides important considerations for future design.

Study context

This study is situated in a four-year research-practice partnership, in which we developed a video-based coaching model. In this research, we partnered with a professional development organization, working with experienced mathematics teachers to support their development of ambitious and equitable pedagogies (Horn & Garner, 2022).

Conceptualizing teachers' learning through video-based coaching

To support teachers' learning in and from practice, we sought a novel form of coaching that would be built around teachers' own personal goals for their learning and that could respond to challenges that arise in teachers' ongoing instruction (Horn, 2020). To this end, we designed our model as "co-inquiry," where teachers and their coaches collaboratively investigate elements of teachers' practice, honoring the teachers' own learning goals and disrupting traditional hierarchies in coaching. In most cases, the focal teacher – whose classroom was filmed – was joined by a colleague (a "partner teacher") for collaborative engagement in the video-based coaching model; this partner teacher worked at the same school and was also part of the professional development organization.

In our model, teachers first identify a question for co-inquiry, then we film in-class instruction to capture phenomena of interest using a two-camera, multi-microphone recording system that captures both the teacher's point of view (Sherin et al., 2008) and a view of the entire classroom with simultaneous tracks of audio from student groups. After filming, members of the research team review the video, selecting clips to share with the teacher based on her inquiry question(s). We then debrief the lesson, using episodes of interest from the classroom video (Horn & Garner, 2022).

Theoretical perspective

To investigate teachers' learning opportunities, I take a situative perspective. This perspective offers useful analytic tools for studying teachers' learning (Greeno, 1998; Peressini et al., 2004), allowing a focus on teachers' contextualized negotiation of meaning (Nolen & Ward, 2008). Situative perspectives focus on "joint interactional accomplishments of individuals in relation to broader communities, processes, and structures" (Hand, 2010), such as how a teacher makes sense of deeply local problems of practice, while keeping broader systems such as the

school and sociopolitical climate that also have a bearing on this meaning-making in sight (Nasir & McKinney de Royston, 2013).

Problem-based learning

Our video-based coaching design was inspired by models of problem-based learning (PBL) for teachers (e.g., Horn, 2013), intentionally building learning experiences around real-life decision making (Horn, 2020). By centering active inquiry around authentic problems, we conjectured that PBL can support teachers' learning in ways that may more easily translate to complex, dynamic classroom life. PBL has most often been studied in K-12 classroom settings (e.g., Malmia et al., 2019), but Horn (2013) argues that teaching consists of copious problem-solving and that many rich learning opportunities occur when teachers engage in problem-solving around their work. Thus, using video, our model capitalizes on naturally-occurring problems in teachers' daily practice, using challenges that are identified by teachers themselves and that occur in their complex classroom ecologies.

Learning opportunities

To understand how teachers' learning can be supported through video-based coaching, I drew on Greeno and Gresalfi's (2008) characterization of learning opportunities as "*affordances* for changing participation and practice" (p. 172). These can include new ways of positioning teachers toward their practice (Horn, 2010); resources available in the activity system that might support different forms of understanding, participation, or practice (Greeno & Gresalfi, 2008; Horn, 2007); or patterns of interaction that afford or constrain different participatory identities (Greeno & Gresalfi, 2008; Holland et al., 1998).

Problem formulation and framing

To understand how learning opportunities arise in problem-based learning, I pay special attention to problem formulation. Problem formulation is a collaborative process that involves teachers' views about their work (Horn, 2013) and can occur through framing (Bannister, 2015; Goffman, 1974). *Framing* refers to the ways that problems, and possible solutions for them, are conceptualized (Horn, 2013). Frames can profoundly shape teachers' learning opportunities; they may orient teachers toward productive solutions or "render a problem insoluble and therefore encourage the abandonment of such a pursuit" (Horn, 2010, p. 230).

Rich representations of practice

Horn (2005, 2010, 2013) found that representations of practice were crucial resources in teachers' collaborative learning (see also Little, 2003). Because problems of practice often occur during the fast-moving work of teaching, "[s]tabilizing these moments to create a common object of inquiry (Bransford et al., 2000) requires means for representing it" (Horn, 2013, p. 134). In this vein, she refers to *rich representations of practice* in the form of video-records of classroom interaction (Horn, 2020) in which we captured the teacher's point of view as well as the whole class and four tracks of student audio. Horn argues that such rich representations of teaching practice can be key sensemaking resources for teachers.

Focal case: Bridgette

In this paper, I focus on one teacher's learning opportunities in one particular debrief from our video-based coaching model. I chose to zero in on this critical case (Flybjerg, 2006) because it highlights important affordances of video-based coaching for supporting teachers' learning, particularly as it relates to justice-oriented pedagogies such as social justice mathematics.

Bridgette and her colleague, Elaine (all names are pseudonyms), were accomplished high school mathematics teachers who had worked together for the majority of their careers. They had a close working relationship and seemed socially open with one another – they often expressed joy and frustration about how both their personal and professional lives were going. Both worked at Katherine Johnson High School, a large community school that hosted three smaller schools on campus. Bridgette and Elaine deliberately chose to work at this school because of deep commitments to supporting students whom the system has given up on and to social justice.

Although Bridgette was passionate about social justice, the lesson debrief analyzed in this paper reflects one of her first attempts to integrate mathematics and social justice in the classroom. On the day our team video-recorded Bridgette's classroom, she taught a lesson about the foundational concept of *functions*. Functions are a concept used to model the world and allow us to make predictions about phenomena. Aiming to show how functions can model sociopolitical realities, Bridgette used the criminal (in)justice system⁽¹⁾ to illustrate the concept. She drew on examples of sentencing for various crimes committed, providing scenarios describing legal infractions and their consequences. Most of the student discourse centered around a situation describing two

different rape charges that resulted in two starkly different sentences. Bridgette asked students to discuss whether the situations described were “predictable” and thus modeling a functional relationship.

Bridgette and Elaine were joined at this debrief by three members of the research team including the author. One member of the research team, Claire, had taken the lead in reviewing Bridgette’s video and served as the primary “coach” for this debrief, although the others also occasionally contributed to conversation.

Methods

This analysis was guided by the question, *How can video-based coaching support teachers’ learning to integrate mathematics and social justice?* To understand teachers’ learning opportunities, our team used ethnographic methods of data collection (Emerson et al., 2011) as participant observers (Spradley, 1980) throughout the 4-year study. This larger ethnographic corpus, including a video-elicited member check interview (Leander, 2004) serves to contextualize and allow triangulation (Denzin, 2009) against the in-depth interaction analysis of one video-recorded debrief.

I use discourse and interaction analysis methods (Gee, 2014; Jordan & Henderson, 1995) to identify interactional, conversational, and design features that afford or constrain Bridgette’s learning opportunities. During and after data collection, I wrote reflective and analytic memos about salient moments and emergent questions and hunches that I had (Hatch, 2002). I followed Ochs’ (1979) transcription conventions, slightly modified (Table 1).

Table 1
Summary of Transcription Conventions Used in Data Excerpts

Convention	Description
text—	self-interruption
<i>italics</i>	speaker emphasis
(.)	brief pause (less than one second)
:	elongated syllable (each “:” represents one beat)
//text]	overlapping speech
?	rising intonation
...	some of the transcript omitted for brevity
((text))	gesture
=	latched speech

Data analysis

To analyze the learning opportunities afforded to Bridgette through video-based coaching, I followed Horn’s (2005) method of breaking the debrief transcript into *episodes of pedagogical reasoning* (EPRs). EPRs are “moments in teachers’ interaction in which they describe issues or raise questions about teaching practice that are accompanied by some elaboration of reasons, explanations, or justifications” (Horn, 2007, p. 46). EPRs “can be individual, single-turn utterances... or multiparty co-constructions over many turns of talk” (Horn, 2010, p. 237), depending on the boundaries of topical shifts in conversation. Importantly, this unit of analysis allowed me to identify learning opportunities within the interaction contexts in which they arise (Horn & Little, 2010).

After coding for learning opportunities, I looked for sensemaking resources in the coaching interactions that seemed to shape Bridgette’s learning opportunities about what it means to integrate mathematics and social justice in her instruction (Horn, 2013). Sensemaking resources that emerged during the coding process included *anecdotes of student thinking* provided by the rich representations of practice as well as ideas related to Bridgette’s *pedagogical responsibility* (Horn, 2020) such as *ethical stances*, *moral precepts*, and *teaching principles*. *Pedagogical responsibility* refers to “whom or what teachers feel beholden to, and often – although not always explicitly – underlies teachers’ pedagogical reasoning about their pedagogical actions” (Chen et al., 2020, p. 3). *Ethical stances* refer to teachers’ positions about what is right or worthwhile to do (Ricoeur, 1992). These can be outright declarations or implicit in teachers’ pedagogical reasoning. I defined *moral precepts* as guiding principles, often taken to be shared general rules about what is good. These were often contained in *teaching principles* – that is, propositions or claims about teaching (Horn, 2013). I then coded for coaching strategies, to understand how the coaches’ participation may have supported or constrained Bridgette’s learning opportunities.

Findings

Overall, the sensemaking resources that supported Bridgette’s learning opportunities included: (1) ethical stances, (2) moral precepts, and (3) anecdotes of student thinking that came from the rich representations of practice. Her

learning opportunities were facilitated by four key coaching strategies: (1) our co-inquiry approach, (2) deliberate and persistent problem (re)framing (Bannister, 2015; Horn, 2010), (3) grounding interpretations in student sensemaking, and (4) building on the teacher’s pedagogical responsibility. In the following section, I describe the arc of the debrief by summarizing the seven EPRs analyzed. Next, I present analysis of two focal EPRs that exemplify how learning opportunities arose for Bridgette. Through this analysis, I highlight how Bridgette’s learning opportunities were supported through sensemaking resources and the video-based coaching process.

The arc of the debrief

I closely analyzed seven EPRs which contributed substantially to Bridgette’s learning opportunities, but for the sake of space, I focus here on three. First, I present in broad strokes a summary of the seven focal EPRs to show the flow of the debrief conversation and to situate the focal EPRs in the larger context. Next, I present a fuller analysis of three focal EPRs.

Because this was Bridgette’s first video-based coaching session ever, she was unsure what type of co-inquiry question to pose, so in the first EPR, she and the coaches spent some time discussing what she would like to see and think about. The coaches, Claire and Kyndal, began to formulate a problem by elaborating the complexity of the topic and highlighting different students’ interpretations of the term *predictable*. Claire grounded this problem in specific student quotes from the video and began to crystalize the initial problem: that students had varying understandings of the idea of predictability, and this was hampering their ability to draw strong conclusions about the mathematics and the task.

In EPR 2, Bridgette responded to the first clip viewed by sharing more about her sense of pedagogical responsibility, clarifying that part of her purpose in teaching this mathematical topic using the analog of the (in)justice system was that she wanted students “to be very aware of what’s happening” and to support them to “*think more*” even when they leave class. In this episode, Elaine asserted the moral precept that “[students] should have their own thoughts about [sociopolitical issues],” and Bridgette responded with an important ethical stance: *I should not foist my own commitments onto students*.

In EPR 3, the coaches responded by building upon the pedagogical responsibility that Bridgette had just expressed, highlighting some specific areas of student discomfort that might need to be addressed. They leveraged Bridgette’s expressed pedagogical responsibility to continue reframing the problem, highlighting the teaching principle that *wrapping up such discussions about social issues may be an important piece of this kind of lesson*, especially because students were left with problematic issues having been raised, but with no opportunity for resolution. They acknowledged Bridgette’s ethical stances but gently reframed her pedagogical responsibility. Instead of worrying about *telling* “students what to think” (Bridgette’s words), Claire asked, “what does it mean to have these types of conversations [in a way] that does feel safe and inclusive for students?” Claire did not dismiss the ethical stance that teachers should not brainwash students, but she layered on a new framing that another important part of teachers’ pedagogical responsibility is *fostering a safe and inclusive learning environment*. This reframing was critical; it both affirmed Bridgette’s concern about telling students what to think and opened a new way of thinking about her pedagogical responsibilities.

Claire’s problem reframing from EPR 3 sparked, in EPR 4, an extended turn by Bridgette in which she named multiple ethical stances and moral precepts that she saw as part of her pedagogical responsibility. First, she took the stance that *simply raising awareness that these issues exist is not enough*. However, in the next breath, she clarified that *raising awareness was important*, a key part of why she taught these topics in a mathematics class (“And like I want them to be aware of them because some of them are like, ‘Oh, I didn’t know about any of that’”; turn 384). She then further elaborated that *raising awareness is insufficient if students are not empowered or motivated to make change* but contrasted this with another ethical stance: *teachers should not foist their own commitments onto students* (“Then, I also don’t want to (.) like *brainwash* them [into] what I think”; turn 384). This turn culminated with two more clear ethical stances: *teachers should prepare students to challenge systems of oppression* and *teachers should prepare students to navigate their oppressive world*. As she concluded, Bridgette landed on the pedagogical dilemma of *how to support students to navigate an oppressive world* – a problem framing that arose directly from her expressed pedagogical responsibility.

Focal EPR (5): Coach introduces a new problem frame using rich representation of practice

In EPR 5, Claire again drew on the rich representations of practice – video clips of students’ sensemaking – to frame a new dilemma (Table 3).

Table 3

Transcript Excerpt from EPR 5

Line number	Speaker	Transcript
385	Claire:	I wonder too, you've mentioned using these contexts as a way into the math. Amena said something at the very beginning about the video. Sh— they— When you gave them time to process how they felt about the video, that group mostly talked about, like 'it's really scary,' 'it's really sad,' 'it's really depressing' and Amena said, 'Does this have to do with math?' And the other students were like, 'I don't know, does it?' And she's like, 'Well, if this is math, I don't want to do math because it's scary.'
386	Bridgette:	Mm::::: ((looks up, smiles tightly, then looks down placing hands on cup))
387	Kyndal:	Someone here said that too.
388	Claire:	So that makes me wonder a little bit about the connection.
399	Bridgette:	Yeah.
400	Claire:	And like what are— how are students thinking about the relationship between the context that you're using and the math? I don't have more to say than that.
401	Bridgette:	If this is math, this is scary.

In turn 385, Claire built on one of Bridgette's articulated ethical stances, that *social justice topics should bridge students' interests and mathematics*; Claire contrasted this aim with students' reactions as heard in the video clips – they viewed the topic as scary and depressing. Bridgette's response in turn 386 was a drawn out “mm” and was accompanied by a shift in her posture: she looked up sharply, gave a tight smile, then looked down, resting her hands on her coffee cup. Her body language, tone, and utterances suggest that these student perspectives gave her pause. Her repeat of a student's phrase in turn 391, “If this is math, this is scary” also signals that she continued to engage this problem frame and seemed to be bothered by students' emotional response.

Focal EPR (6): Coach builds on teacher's pedagogical responsibility for new problem framing

In EPR 6, Kyndal built on the teacher's pedagogical responsibility and the problem frame offered by Claire in EPR 5 that students may have emotional responses to these topics. She offered an implicit moral precept that *education should not skirt topics simply because they are uncomfortable*, highlighting that as students discussed the case of the two rape convictions, they expressed highly problematic ideas about consent. She then reframed Bridgette's pedagogical responsibility, using language from her own ethical stance (Table 4).

Table 4

Transcript Excerpt from EPR 6

Line number	Speaker	Transcript
394	Kyndal:	I would be okay with brainwashing them about that.
395	Bridgette:	((laughs loudly))
396	Kyndal:	//If we're going to brainwash] them about something.
397	Claire:	//there are some things]
398	Bridgette:	Yeah.

Although she used Bridgette's language, Kyndal inverted the pedagogical responsibility as she reframed the problem; Bridgette had earlier expressed reluctance to foist her own commitments onto students, stating that she did *not* want to brainwash them. Kyndal instead asserted a new moral precept that *on some issues, students should be told what to think*. Again using anecdotes of student thinking, Kyndal framed a problem that *students' understanding about social issues was partial and problematic*. Both coaches used quotes they heard from students to vividly illustrate the complexity of the sociopolitical topics, and the partial understandings that students held about them.

Focal EPR (7): Coach builds on teacher's pedagogical responsibility for prognostic framing

In the final EPR analyzed here, the problem framing in EPR 6 was followed by an extended turn by Bridgette in which she reasoned in detail again about her pedagogical responsibility. In Bridgette's opening sentence, she revealed one part of her pedagogical responsibility; she seems to see her work as satisfactory if *conversations about social issues are happening* (“Okay I guess I'm okay then now that those conversations are happening”; turn 403). In her view, if she could support her students to have meaningful discourse about tricky social issues,

this was a step toward empowerment. She concluded “Okay, that’s what I want. I want them to be able to speak up and have conversations and be okay with that” (turn 403).

In the next turn, Claire gently extended Bridgette’s pedagogical responsibility, as though she was completing Bridgette’s sentence. She said:

I think in a way that also feels good for the people listening. I think this was Mariana, she was doing a lot of hedging when she was making inferences about the Stanford player probably being white and the Vanderbilt player probably— She kept saying, "I'm not racist but, I'm not racist but." I wonder in a situation like that, she's trying to be careful, she's also drawing on patterns and correlations that we know exist in the world. I wonder if a student like her, if she had a little more support around, how to communicate her idea— She clearly has no problem saying what she thinks but if she had a little more support around how to do that, I wonder if she would feel more comfortable and not do as much hedging and not have to worry that she's accidentally offending other people. (turn 404)

In her first utterance, Claire drew on a new moral precept to add to Bridgette’s pedagogical responsibility — the idea that *students should not feel too uncomfortable in the classroom*. In the next breath, she illustrated the need for this element of pedagogical responsibility, directly quoting a student to show that more support in having conversations around race and social injustices might be needed. By reframing the problem as one of student discomfort, she set the stage for a new prognostic frame: that *scaffolding students to have conversations about sensitive topics might be an important part of social justice mathematics pedagogy*.

Discussion

The way Bridgette grappled with her pedagogical responsibility in this debrief is not uncommon when teachers begin the work of integrating mathematics and social justice. Bartell (2013) found that teachers centered their goals for social justice mathematics “on student awareness more than on specific understanding of and action toward confronting injustice. In doing so, teachers perhaps avoided grappling with sociopolitical issues in the complex ways that their lesson warranted” (p. 145). In Bridgette’s case, video-based coaching provided opportunities for her to confront such avoidance, giving her time and space to process some of what may be beneficial or harmful about this lesson and to workshop ideas for the future.

The sensemaking resources that contributed to learning opportunities for Bridgette included anecdotes of student thinking (provided by the rich representations of practice), as well as ethical stances and moral precepts found in Bridgette’s articulated pedagogical responsibility (Horn, 2020). Her learning opportunities were facilitated by coaching strategies including: (1) a co-inquiry approach, (2) deliberate and persistent problem (re)framing, (3) grounding interpretations in student sensemaking, and (4) building on the teacher’s pedagogical responsibility. Because teaching mathematics for social justice is such a complex endeavor, the co-inquiry approach was well-suited to supporting learning opportunities, enabling the coaches to capitalize on the challenges Bridgette faced in her specific context and allowing problems of practice relevant to her work to drive discussion. By persistently reframing problems, the coaches repeatedly pressed on Bridgette’s sensemaking and surfaced numerous problems of practice within the one-hour debrief, highlighting multiple angles of her pedagogy that may have been invisible without this problem reframing. Finally, by building on the teacher’s pedagogical responsibility throughout, the coaches kept problems of practice close to issues of importance to her, and helped highlight areas of potential disconnect between her sense of pedagogical responsibility and her pedagogical actions, supporting robust pedagogical reasoning; these are conditions Horn (2020) describes as ripe for developing pedagogical judgment.

Because of the short duration of this debrief, it is difficult to make claims about Bridgette’s learning, thus I focused primarily on the *opportunities* afforded by this video-based coaching model, bolstered by the in-depth grappling with these problems of practice that she and the coaches did during the debrief. In this debrief, analysis showed that Bridgette had learning opportunities about multiple dimensions of her social justice pedagogy, including the complexity and partiality of students’ understanding, what it means to support students in conversations that feel safe and inclusive, what the purposes of teaching mathematics and social justice topics should be, how to prepare students for navigating an oppressive world, how to scaffold students to have conversations about sensitive topics, and more. However, I conducted a video-elicited interview with Bridgette two and a half years after this debrief, during which she confirmed several ideas that she has developed as a result of this debrief conversation, including *what it means to support students in conversations that feel safe and inclusive and addressing the complexity and partiality of students’ understanding*.

Conclusion

Although mathematics teachers hear increasing calls to integrate mathematics and social justice and to learn social justice pedagogies, there remains little support available to them (Bartell, 2013). Those who want to begin such efforts are often on their own to find or develop curricula, and have few mechanisms for feedback or reflection to improve such practice, even though social justice pedagogies are far from straightforward (Kokka, 2017). Because the video-based coaching design relies on teachers' own inquiry questions and rich video-records of classroom interactions for discussion, it positions "participants to think about themselves, their circumstances, and their future actions in ways that are deeply contextualized" (Gutiérrez & Jurow, 2016, p. 4).

This analysis shows some of the ways in which video-based coaching may be a promising tool for supporting teachers' learning to integrate mathematics and social justice—in part by offering teachers a glimpse into students' sensemaking, emotional reactions, and other elements of their experiences of this kind of mathematics. These insights, which were not otherwise available to Bridgette, supported her pedagogical sensemaking about her own students, their experiences in mathematics, and her practice. This model may be fruitful for supporting teachers' learning of other justice-oriented pedagogies. After an extensive database search and literature review (Marshall & Buenrostro, 2021), I concluded that this is the first study to investigate this potential. Self (2016) cautions that "culturally responsive teachers must become vigilant to the possibilities that exist, both positive and negative, for the approach they have chosen" (p. 67). The video-based coaching process afforded opportunities for Bridgette to become vigilant to such possibilities.

Endnotes

- (1) The system commonly referred to as the criminal "justice" system is, in fact, wildly unjust. Therefore, I follow Golembeski and Fullilove (2005) in calling it the criminal (in)justice system.

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