Grappling with "Bigger Questions" of Teaching

Engaging in Critical Reflection Through Participation in Cogenerative Dialogues

John Luciano Beltramo

Abstract

This investigation explores the critical reflection of two urban high school science teachers as they participate in cogenerative dialogues—weekly discussions with focus groups of students that are held outside of instructional hours and that center on identifying and addressing problem areas of classroom teaching and learning. The study finds that, over their semester-long participation in the dialogues, the teachers often grappled with what they termed the "big questions" of teaching—tensions centering on the extent of scaffolding versus the demands of rigor, district-mandated curriculum versus student-centered inquiry, and the competing purposes of collaborative student work. Addressing such tensions within cogenerative dialogues helped the teachers progress from technical and comparative considerations of instruction, to more critical forms of reflection.

John Luciano Beltramo is a lecturer and director of Excellence in Catholtic Education and Leadership in the School of Education and Counseling Psychology at Santa Clara University, Santa Clara, California.
Email address is: jbeltramo@scu.edu

Introduction

More than a decade ago, Loughran (2006) argued that teaching, with its complexities of policy and social dynamics, is an inherently problematic enterprise requiring continual development through reflection. Given the current educational context—one defined by a raft of federal and state reforms and high-stakes accountability systems—scholars argue that such reflection must go beyond the pragmatic, technical concerns of teaching and engage in critical reflection, or the consideration of sociopolitical factors contributing to instructional challenges (Selkrig & Keamy, 2015). Moreover, as classrooms become increasingly diverse, critical theorists such as Howard (2003) have called on teachers, especially those working with students from historically marginalized communities, to regularly undertake critical reflection as a means of developing equity-oriented pedagogy.

This push for pedagogical equity through critical reflection is especially felt in the area of science education. Despite calls for "science for all" (Bullough & Booth, 2013), numerous studies have underscored inequitable science learning opportunities for students of color attending urban secondary schools (e.g., Emdin, 2010; Lee, Robinson, & Sebastian, 2012; Parker, 2014). At the same time, science teachers are challenged with implementing new content standards (e.g., Common Core State Standards and Next Generation Science Standards) meant to "raise the bar" of rigor in learning. If science teachers are to provide quality instruction for all students while meeting greater curricular demands, I argue that it is imperative such teachers examine their practices through critical reflection so as to identify—amid trends of student diversity and structures of standards and accountability—spaces of agency for equitable instruction, or teaching that engages students in meaningful tasks and meets the needs of diverse learners.

Although the need for critical reflection among science teachers remains pressing, studies report challenges in promoting this form of teacher development, particularly in exposing teachers to diverse perspectives on their instructional approaches (Andersen & Matkins, 2011; Teo & Tan, 2011). This remains unsurprising, given that scholars have observed teacher development to be a "traditional" or "top-down" endeavor, where historically conservative entities like school districts largely constrain what gets learned or reflected on and whose framing or perspective is adopted in this reflection (Cook-Sather & Youens, 2007; Nieto, 2004). Thus, while critical reflection in teaching has been studied for decades (Schön, 1983; Whipp, 2003; Zeichner & Liston, 1996), scholars today (e.g., Liu, 2015) echo an enduring question: What kinds of tools or spaces can support teachers to become more critically reflective by examining their practices from new and challenging perspectives?

The present investigation seeks to address this question and add to the literature on critical reflection by exploring how teachers engaging in a recently developed student voice-centered pedagogical tool—cogenerative dialogues—might learn

about and reflect critically on classroom practices and contexts. Specifically, I report on the experiences of two high school science teachers who each met outside of instructional time with groups of their students to discuss ways in which class could better facilitate student learning. This study found that, for the participating teachers, cogenerative dialogues helped raise "bigger questions," which in turn fueled a reexamination of instruction in light of the conditions of learning and policies mediating it. These findings hold important implications for the field of teacher learning, particularly the role that student voice and critical reflection can take in supporting teacher growth.

Theoretical Framing and Empirical Investigations Into Teacher Reflection

Framing this study is a conceptualization of critical reflection as one of three levels of teacher reflection. At the first level of reflection, teachers consider the technical aspects of their instruction, such as the delivery of teaching strategies (Van Manen, 1977). Reflection at the second, or "comparative," level shifts focus by weighing those instructional decisions against evidence of student learning. At the third level lies critical reflection, where teachers consider each element of their practice in light of education policies, social dynamics, and/or issues of equity that mediate teaching.

Critical reflection is oriented toward the classroom-situated problems of teaching. Loughran (2006) characterized these problems-as-subjects of critical reflection as "the constant undercurrent of choices, decisions, competing concerns, dilemmas and tensions" (p. 30) that commonly arise in teaching. Because educational reforms and policies often frame the issues contended within classrooms (Van Manen, 1977), scholars argue that teachers taking a critically reflective stance need to constantly analyze and interrogate their problems (a) to identify and address discrepancies in power relations, as well as the competing values, assumptions, and ideologies, underlying them (Jay & Johnson, 2002; Nieto, 2004) and (b) to develop equity-oriented pedagogies that can afford all students robust opportunities for learning (Howard, 2003). Importantly, theorists propose that for reflection to reach a critical level, teachers must be exposed to new perspectives and frames that can help reveal previously unrecognized problems or tensions and challenge current approaches or understandings that guide instruction (Danielowich, 2007; Loughran, 2006). Complex tensions often fail to present a singularly perfect solution; however, critically reflecting on them can still help teachers to learn about the nuances of their craft, develop the principles of their identities, and seek liberation (for themselves and their students) through the construction of more equitable learning opportunities.

Traditional Teacher Reflection

Literature on science teacher learning has identified critical reflection as a particularly challenging area. A review of this literature surfaces a myriad of approaches and processes by which teachers can examine their pedagogy, including (but not limited to) action research (Lyon, 2011; Teo & Tan, 2011; Towndrow, 2007; Trauth-Nare & Buck, 2011), collaborative case studies (Yoon & Kim, 2010), structured mentorship (Barnett & Friedrichsen, 2015), interactive blogging (Andersen & Matkins, 2011), narrative inquiry (Hwang, 2011), professional development in disciplinary (or content-area) practices (Van Duzor, 2012), reflective writing workshops (Smith & Lindsay, 2016), and video clubs (LeBak & Tinsley, 2010). The vast majority of these studies follow a traditional approach to teacher learning and reflection (Wisby, 2011)—one where education professionals and/or other experts (e.g., university-based teacher educators, instructional coaches, fellow faculty members) guide teachers in reexamining their instructional practices through a particular exercise. Such a traditional approach can facilitate exploration of new strategies and techniques; however, because it centers more established and common perspectives and often involves individuals with less contextual knowledge of a classroom, it is less likely to bear opportunities for critical reflection.

Indeed, much of the literature on science teacher reflection supports this contention and reports on instances where teachers used a traditional approach to engage in technical reflective practices. For example, in a study by Andersen and Matkins (2011), preservice science teachers reflected on their experiences in practica settings through weekly interactive blogs; the authors found that many of these reflections were centered on the use of practical strategies and their evaluation from personal insights. A number of studies (e.g., Lyon, 2011; Teo & Tan, 2011; Towndrow, 2007; Yoon & Kim, 2010) reported instances where science teachers experienced a shift in their reflection, from more technical considerations to more comparative analyses, by examining instructional practices in light of student assessment data, usually standardized tests.

The reflective approaches of some studies, however, failed to move teachers into a more critical level of reflection. In research by Teo and Tan (2011), a university-based teacher educator conducted "critical interviews" with four in-service science teachers, who were asked about their students' racial/ethnic backgrounds and the perceived effectiveness of their instructional practices. In written reflections following each interview, though, the participating teachers did not consider issues of race, culture, or equity in their instruction. Still other studies (e.g., Barnett & Friedrichsen, 2015; Hwang, 2011) reported instances of "critical" self-analysis among participating teachers, yet their descriptions of such reflections centered solely on considerations of teaching strategies and student assessment and thereby aligned more closely with Van Manen's classifications of comparative practices. Thus the current literature on science teacher reflection offers few examples of and

little guidance for how teachers can engage in and develop professionally through critical reflection.

Student Voice in Teacher Reflection

The question is raised, then, as to how teachers can gain access to opportunities that foster *critical* reflection. From a situated learning viewpoint, scholars have argued for a move beyond a traditional approach to teacher reflection to a more "democratic" (Wisby, 2011) or "transformative" (Fielding, 2004) framework. Rather than limit participation solely to experts and practitioners, these scholars advocate opening the endeavor of teacher reflection and learning to outside or "peripheral" perspectives (Wenger, 1999), namely, those of students (Brookfield, 1995; Cook-Sather & Youens, 2007). Incorporating student voice into teacher development, they argue, can facilitate reflection that is more critical in nature by lending teachers "the capacity to see the familiar from a different angle" (Rudduck & McIntyre, 2007, p. 146). More specifically, by consulting students, especially those underserved by schooling systems, teachers are more likely to understand how and which school policies and structures disempower and marginalize students and constrain their learning (Arnot & Reay, 2007); to recognize "the *conditions of learning* in school—how regimes and relationships shape [students'] sense of status as individual learners and as members of the community and, consequently, affect their sense of commitment to learning in school" (Rudduck & Flutter, 2000, p. 76); and to challenge assumptions that the meaning teachers make of their practice and its results is shared by students (Schön, 1983). In essence, consulting students holds the potential to reveal to teachers new information that can spur the questioning required for critical reflection.

Currently few studies (e.g., LeBak & Tinsley, 2010) explore practical methods for embedding student voice into teacher reflection. The purpose of the present investigation is to examine one such space for teacher learning: cogenerative dialogues, which have gained recent attention in the field of science education. In cogenerative dialogues, a teacher meets with a representative group of her students on a regular (usually weekly) basis outside of instructional time to generate and deliberate ideas toward improved opportunities for student learning (Beltramo, 2017; Tobin, 2006). These conversations typically address questions like, How have activities and the classroom environment supported and/or impeded student learning? What classroom improvements could address such issues? (Emdin, 2016). Previous studies have examined cogenerative dialogues as spaces for teachers and students to discuss problems and propose solutions related to student disengagement and distraction during instruction (Beers, 2005) and a lack of shared social and cultural capital in the classroom (Emdin, 2007; LaVan, 2005). Research has yet to examine what learning opportunities cogenerative dialogues might offer teachers through critical reflection. Thus the present study addresses this gap in the literature—and sheds light onto a practical method of supporting teacher learning via student voice—by

exploring the potential of cogenerative dialogues to mediate experienced teachers' endeavors at critical reflection.

Specifically, this study addresses two questions: (a) Along Van Manen's typology of reflection, what kinds of reflection do teachers engage in through their participation in cogenerative dialogues? (b) How do teachers make sense of their individual reflective practices (and any changes therein) as they participate in cogenerative dialogues with their students? By exploring these questions, the study seeks to understand how frequent encounters with student voices can help mediate teacher learning via moments of critical reflection and perhaps help teachers grapple with the challenges of science teaching today.

Methods

Toward this end, I conducted a design-based study (Reinking & Bradley, 2008) of cogenerative dialogues. Employing purposive sampling, I recruited two teachers, Ellen and Lorena, who were graduate students at a university where I was a doctoral candidate. These participants met criteria (see Table 1): both worked in urban high schools serving diverse students and taught in the sciences, an area of teaching where critical reflection is of particular concern today (Gutiérrez & Calabrese Barton, 2015). This sample size facilitated a deep exploration of cogenerative dialogues while allowing for cross-site comparisons needed in design studies (Reinking & Bradley, 2008).

Similar to other design research into a process of teacher reflection (e.g., Towndrow, 2007), I collaborated with my participants for 5 months at their respective schools to establish and develop weekly cogenerative dialogues with small groups of their students. At both sites, students were recruited in the same manner: each teacher was asked to select one class period where they experienced particular challenges in supporting student learning. I then spoke with each of these class periods to describe the study and invite any interested students to participate in the cogenerative dialogues. Recruiting efforts resulted in the participation of 10 students from Ellen's site and 4 from Lorena's (see Table 2).

I have had previous experiences facilitating cogenerative dialogues, both as a

Table 1

Participant Demographics, Experience, and School Information

Participant pseudonym	*Race/ ethnicity*	*Experience in teaching (years)*	*Racial/ethnic makeup of school enrollment*	*Percentage qualifying for free/reduced-price lunch*
Ellen	Latinx	13	97% Latinx, 3% Black	97
Lorena	Latinx	11	99% Latinx, 1% Black	92

former teacher and as a current teacher educator. Thus, similar to previous studies on cogenerative dialogues (e.g., Tobin, 2006), I initially led most of the discussions among our dialogue members during our early meetings at each site. As the teachers and students became increasingly more comfortable with facilitating the conversations themselves, however, I scaled back my participation until I was a rare contributor, preferring instead to listen as discussions unfolded among other dialogue members.

To understand how the dialogues operated as catalysts for critical reflection and teacher learning, I collected ethnographic data via traditional methods of design research (Reinking & Bradley, 2008). I took detailed field notes on, videotaped, and transcribed each weekly cogenerative dialogue. Immediately following every dialogue, I separately debriefed with the teacher and students from each site, asking them for their impressions of the conversations and teaching ideas we had discussed. I audiorecorded and transcribed these debrief interviews, in addition to documenting them in field notes. To better understand the content of the dialogues and their possible impact on the participants' classrooms, each week I observed several hours of Ellen's and Lorena's instruction, which I recorded through video and detailed field notes. Additionally, at three points across the study, I formally interviewed the teachers about their reflective practices and any changes they noted therein. I audiorecorded and transcribed these formal interviews, which covered 1–2 hours each.

Data Analysis

Table 2
Student Participants at Each Site

Pseudonym	*Age (years)*	*Race/ethnicity*
	Ellen's Sophomore Anatomy	
Alejandro	15	Latinx
Angel	15	Latinx
Dylan	16	Latinx
José	15	Latinx
Lina	16	Latinx
Maria	15	Latinx
Melvin	15	Latinx
Nelson	15	Latinx
Patricia	16	Latinx
Vanessa	16	Latinx
	Lorena's Senior Anatomy	
Antonio	17	Latinx
Carlos	18	Latinx
Emmy	18	Latinx
Mateo	18	Latinx

In my analysis endeavors, I combed through the data to identify instantiations of reflection by Ellen and Lorena. Such instantiations included moments during cogenerative dialogues when the teachers reflected with students about their teaching and classroom environment; instances during our debriefs together when the teachers reflected on the content of the dialogues; and points during formal interviews when the teachers explicitly described the foci, process, and orientation of their individual reflective practices outside the cogenerative dialogues. These reflective moments were then coded over several cycles, using both inductive codes arising from the data and their contexts as well as deductive codes derived from theory on situated learning and teacher reflection.

To explore how the cogenerative dialogues may have shaped actual moments of reflection for Lorena and Ellen, I examined the field notes, videos, and transcripts of each dialogue, along with the debrief that followed it (see Table 3). Where an issue of teaching was mentioned, I tallied such a moment as "reflection" and then categorized it based on Van Manen's (1977) typology of reflection levels. I also attached to each reflective moment a descriptor based on its particular content and context. Codes derived from the literature and theory on teacher reflection were used to collapse like descriptors into broader categories (Miles & Huberman, 1994). I then returned to the data classified together and employed the constant comparative method (Strauss & Corbin, 1994) to develop a set of inductive codes that helped further refine each broadened category into more specific observations and assertions.

To examine Ellen's and Lorena's perceptions of the cogenerative dialogues' impact on their individual reflection, I used a similar approach to coding, but this time, I primarily explored the teachers' formal interviews and debriefs (see Table 3). Using descriptive coding (Saldaña, 2013), I analyzed each transcript to identify

Table 3

Examples of Codes by Research Question and Round of Analysis

Round	*First research question*	*Second research question*
1	Technical reflection, comparative reflection, critical reflection	Instructional reflection, curricular reflection, environmental reflection, policy reflection, reflection on individual student/s
2	Instructional tension, curricular tension, environmental tension, policy-related tension	Transformative/ democratic reflection, communal responsibility, student/peripheral perspectives, increased reflection, student learning needs, student backgrounds and families, and diversity among student perspectives

instances when Ellen or Lorena spoke about her reflective practices outside the cogenerative dialogues and then gave each instance a descriptor based on its interpreted focus and main idea. In subsequent rounds of analysis, I applied a set of concepts derived from the theoretical framework to begin organizing the descriptors into codes. Descriptors falling outside these concepts were then consolidated into categories based on inductive codes taken directly from teachers' words found in the data.[1]

Findings

These analyses led to two major findings: first that, while Lorena and Ellen tended to engage more often in technical and comparative reflection during their respective cogenerative dialogues, important moments of critical reflection did occur, particularly around several tensions involving competing social and/or political issues, and second, that the teachers perceived that their participation in cogenerative dialogues likely influenced the frequency and focus of their individual reflective practices. In the following pages, I expand on and illustrate these findings through representative quotes and excerpts culled from sources across the data corpus through the analysis efforts described earlier.

Technical and Comparative Reflection Situated Within the Cogenerative Dialogues

Similar to other studies of science teacher reflection (e.g., Andersen & Matkins, 2011), the majority of reflective instances found within the cogenerative dialogues and debriefs could be classified under Van Manen's (1977) typology as technical and/or comparative in nature (see Table 4).

Such moments of technical and comparative reflection occurred fairly evenly

Table 4
Reflective Moments by Levels at Each Site

Level of reflection	Reflective moments from Lorena's site, n (%)	Reflective moments from Ellen's site, n (%)
Technical (focusing on the techniques, procedures, strategies, etc., of teaching)	29 (40)	19 (21)
Comparative (examining the impact of teaching moves on student learning outcomes)	21 (29)	34 (38)
Critical (exploring the social, political, and equity factors and implications related to teaching)	23 (31)	36 (41)
Total	73 (100)	89 (100)

across the dialogues and tended to center on discussions of teacher strategies and/or learning activities, most often in relation to student engagement, as seen in other reflection research (e.g., LeBak & Tinsley, 2010). For example, Lorena and her student focus group discussed "test reviews" in their fifth dialogue. In the following transcript, Lorena and her students considered the structure of a review lesson in light of various student interests:

> LORENA: So, tomorrow we're gonna have to review for that test . . . and I'm not sure if we should maybe, like, what we should do—
>
> CARLOS: Miss, can we do like games or something to review for the test? 'Cause I pay more attention then . . .
>
> LORENA: OK, so I could do that, but I know some people like it better when I do a PowerPoint review. Which one do you think we should do?
>
> ANTONIO: Do both.
>
> EMMY: Yeah, I mean, they both help me study for a test. Couldn't we do both?

In this example, what began as a technical consideration by Lorena (i.e., Which instructional activity should be used for the test review?) quickly shifted into a moment of comparative reflection when students began to voice their own learning preferences in relation to two general strategies: direct instruction and in-class games (i.e., Which test review activity would most engage students and facilitate their learning?). This segment of dialogue also illustrates how moments of such reflection began with a problem (or multiple problems): Lorena's uncertainty about future instructional plans and various (and potentially competing) student suggestions for a review activity.

On many occasions, foci of technical and comparative reflection that surfaced in one dialogue reemerged in the debrief immediately following it and/or in the dialogue of a later week. For example, in our debrief held just after the dialogue above, Lorena and I discussed the students' proposals for the test review activity:

> AUTHOR: So, what did you think of the students' suggestions for tomorrow's review? Which ones are you going to do: the game, the PowerPoint, the—
>
> LORENA: I think Emmy's idea made the most sense. I guess I'll do, like, a Jeopardy game and then follow each answer up with a slide of notes. . . . It might keep everyone engaged, but it's just going to be long, maybe too long. We'll see.

In this debrief, Lorena shared her plans for incorporating the students' suggestions from the dialogue into her future instruction. In most circumstances, group discussions of technical or comparative matters such as this often led to a direct and actionable plan for solving the original problem.

In the foregoing example, Lorena did enact the plan discussed with the students and me: my field notes indicated that she led her anatomy class in a review activity that situated direct instruction (via PowerPoint lecture) within a team-based Jeop-

ardy game. During the next week's dialogue, captured in the following transcript, members once again raised the topic of test review:

CARLOS: Miss, I think we all did pretty good on the test—I mean, I did.

LORENA: Yeah, you did and you did (pointing to Emmy) and the class as a whole probably did a bit better on this test than the last one . . .

AUTHOR: So, would you consider doing that same review again, with the Jeopardy game and the PowerPoint together?

CARLOS: Yeah—

EMMY: Yeah, I would. It helped us out, I think.

LORENA: OK, maybe we'll do it again, if we have time in this unit.

This segment of dialogue illustrates a continuation of comparative reflection around effective practices of test review. In the preceding dialogue, members of the cogenerative dialogue discuss and evaluate Lorena's strategy for test review and its potential impact on student learning (as measured by test results).

Put together, these snippets of data demonstrate how participation in cogenerative dialogues with students (along with debriefs with me) facilitated the teachers' ongoing technical and comparative reflection, through a cycle or process: Dialogue members presented an instructional problem, where teaching "moves" were considered, usually in relation to student engagement and learning. Solutions were then discussed, and after the implementation of one or more, results were evaluated in subsequent meetings.

Critical Reflection Situated Within the Cogenerative Dialogues

At other times, however, members of the dialogues gave voice to problems that did not lend themselves to an immediate or simple instructional solution. In these cases, initial suggestions proposed during the meetings—suggestions that often represented examples of technical or comparative reflection—were judged by members to be insufficient in fully addressing the complexities of the original problem. Eventually, competing social forces within the classroom or school/district policies were identified as key contributors to the dilemma. It was at these points that Ellen and Lorena engaged in reflection that most fully demonstrated Van Manen's (1977) notion of critical reflection. That is, the cogenerative dialogues allowed for members to discuss further these sociopolitical factors, particularly those related to more equitable learning opportunities for students, and thus gain more clarity into their subsequent problems. At the same time, solutions that could completely eliminate emerging challenges remained elusive. Instead, the participants began to understand these dilemmas as the "bigger questions" of teaching—or enduring tensions of the profession (Loughran, 2006)—that lurked at some level beneath regular instructional decisions and could potentially spark critical reflection but

may never be completely resolved (Liu, 2015):

> ELLEN: I got a sense that we were asking bigger questions [in the dialogue today] because the students hit on a couple of things that I have been thinking about, especially in terms of rigor, challenging students. . . . I think we were all sensing it, so I really wanted to share with them these big questions. I know they were heavy, and loaded, and dense but those are the things we as teachers need to think more about.

Across both sites, these dilemmas tended to revolve around three common tensions: student needs for scaffolding versus school expectations of "rigor," policies of curriculum standardization versus student preferences for inquiry and relevant content, and competing purposes of collaborative work. At each instance in which a dialogue (and, at times, its subsequent debrief) addressed one of these tensions, what resulted was a progression from technical and/or comparative reflection to critical reflection (Danielowich, 2007; Zeichner & Liston, 1996). In what follows, I offer two *episodes* (Roth & Tobin, 2001), or data-rich narratives, that illustrate how each of the teachers engaged in critical reflection by arriving at and grappling with the tensions identified herein.

Ellen's critical reflection episode. As membership in cogenerative dialogues is ideally intended (Emdin, 2016), the students participating in Ellen's cogenerative dialogue comprised a representative cross section of abilities in social skills and academics. Some students, such as Angel and Dylan, described themselves in their formal interviews with me as individuals who had experienced traditional notions of success in academics but admitted personal challenges in developing the social skills necessary to building and sustaining relationships in school. Others, like Vanessa and Lina, identified as students who "struggled" in science classes. Lina described herself as a "shy" student who was often uncomfortable making new relationships and leaned on a small but close set of friendships in her class. Vanessa, on the other hand, felt confident in her ability to create and sustain social networks throughout the school. In the 10th week of the dialogues, these student members raised the topic of "group projects" in Ellen's class and expressed divergent perspectives on and experiences of such collaborative in-class learning activities:

> ANGEL: I want to bring up something about group projects. See, I like that you let us choose our groups, but I feel like mostly it's a choiceless choice. Because I know each time [we pick groups], me and Dylan are always waiting over on the side, saying, "Pick me, I'm here, we'll work with anybody."
>
> ELLEN: So, Angel brings up a really important issue. Should I start choosing your groups then so no one's feeling left out?
>
> VANESSA: I like that we get to choose our own groups, because when I work with my friends, they're the ones who explain stuff to me so that I understand it.
> LINA: Yeah, because they use vocabulary that I understand. They know I'm slow

> so they're patient and not rushing me. . . . So, I'm just more comfortable with my friends and I learn more [with them].

Through these exchanges in the dialogue, competing purposes of student collaboration became apparent: For students like Angel, group projects represented (missed) opportunities for social inclusion and the development of peer relationships; for others, such as Vanessa and Lina, working with peers offered a chance to learn from friends who already knew one another and could thereby teach each other content in relatable and accessible ways. Thus, in this cogenerative dialogue, a tension between social factors began to emerge, along with an attendant "bigger question": Do collaborative learning activities primarily function to help students feel included and develop peer relationships and social skills for students like Angel, or are they mostly meant to help students like Lina develop content knowledge through engagement with already-developed social networks?

In our debrief following this dialogue, Ellen weighed each of these competing purposes against an additional tension—administrative expectations for heterogeneous groupings based not on any social considerations but solely on previous achievement and learning:

> It pains me to hear Angel talk about how he feels when he gets left out. But I also can see it from Lina's perspective. . . . And then I get pressure from admin saying, "Why do you let your students choose your groups? Why aren't you doing heterogeneous grouping like we trained you?" Well, I mean, I can, but is that really going to help them? If a student does not feel comfortable, because they're embarrassed about being slower than others, or being socially more awkward around peers, then they're not going to feel comfortable enough to learn. The catch is, how do I make it so everyone is comfortable?

In the preceding dialogue, members posed technical suggestions to address this question. Melvin, for example, proposed that each student could select a friend he or she was comfortable working with, and then Ellen could combine pairs based on varying academic ability levels. In later weeks, Ellen experimented with new structures for collaborative activities such as Melvin's suggestion, but after each change in group arrangement, members reported similar problems—some students felt somewhat excluded, while others were still uncomfortable working with new partners. Ellen commented in one of our last debriefs together: "They're at this delicate age where what other people think of you matters. And it can be that trigger of whether you learn or not that day—just the group you're in. So, I keep that in mind as I teach . . . but I haven't figured it out."

Seen as a whole, this episode shows how participation in cogenerative dialogues can help raise a "bigger question" of teaching by uncovering social and policy-related tensions that underlie instructional decisions and provoke critical reflection. What began as technical and comparative considerations—Angel feeling left out in group work, Lina needing understanding peer collaboration—gave way

to deeper, social and even policy-based factors, such as the competing purposes of peer learning activities and school expectations for academically heterogeneous groupings. New structures for group work were proposed in the dialogues and ventured in the classroom but were ultimately deemed unsuccessful at eliminating the latent tension—the competing demands of collaborative activities to meet students' social, emotional, and academic needs. As Ellen alluded to earlier, the overarching problem remained, and yet at the same time, it created an opportunity for ongoing reflection in her teaching.

Lorena's critical reflection episode. Moments of critical reflection that arose in Lorena's case followed a similar pattern. For example, during the 12th dialogue at her site, Lorena began a conversation through an instance of technical reflection—discussing her plans to begin the next unit with a review of previous material:

> LORENA: So, next week we're going to start a unit on the respiratory system. And I was thinking that we'll probably need to start with a review of the circulatory, 'cause it's been a kind of a long time since we've had more, like, normal school schedule—
>
> MATEO: Hey, Miss, can we do what we did last time? Like, get into groups and research our own questions about systems stuff.
>
> CARLOS: Yeah, we need to be doing a lot more stuff like that—
>
> ANTONIO: I know, I was, like, really into my topic about—
>
> CARLOS: 'Cause when you do a PowerPoint thing, Miss, I don't mean to be rude, but I just [puts head on table in dramatic fashion]. I can't pay attention, especially now that we're almost graduated.
>
> LORENA: I know, and I like having you do your own inquiry. . . . But we're way behind the pacing plan, what I'm supposed to be doing with you. . . . You know how last month, we were only able to get through, like, half the benchmark test, which is fine because I know you learned a lot from your projects, but we also need to get through respiration if we're ever going to cover reproduction by the end of the year.
>
> CARLOS: What if we did, like, our own research, like, one more time before—
>
> LORENA: Maybe. We just gotta see how much we can get through in this week first.

Mateo, then, proposed an alternative commencement to the new unit—one based on a student-inquiry project. Earlier in the study, Lorena and her student members of the dialogue had collaboratively created a new structure for student inquiry, one in which pairs of students posed a set of authentic questions around an anatomical system, conducted online research to answer the questions, and presented their questions and answers to the class in an oral presentation. In the current dialogue, Mateo, Carlos, and Antonio each expressed his interest in continuing this learning activity within the next unit of study on the respiratory system, thus moving the

discussion from merely a technical issue (i.e., Which activity should begin the unit?) to a more comparative one (i.e., Which activity would best promote student engagement?).

A deeper problem began to emerge, however, as Lorena explained that she is responsible for following a district-wide "pacing plan," which maps the state standards for anatomy against the school calendar and is enforced through standardized benchmark tests administered at the end of each month (or unit conclusion). Lorena reported that the class's earlier efforts at inquiry, while valuable to the students, extended previous units beyond the time allotted by her pacing plan and precluded students from learning all the required content prior to the units' end-of-month standardized exams. At this point in the dialogue, Lorena's reflection began to focus on a particular tension between her students' desire for more relevant, inquiry-based learning activities and her district's pacing plans and testing schedule. This represented a shift from comparative to critical reflection, as Lorena grappled with tensions between equity (or providing students with deep, meaningful learning opportunities via inquiry) and policy (or mandated curriculum enforced by standardized assessments). Carlos then proposed (or, rather, started to propose) a technical compromise, which would have allowed for one instance of student inquiry somewhere in the last two units of the school year. Lorena, however, distanced herself from this suggestion, still anxious over her fidelity to the district's pacing plan. Our debrief following this dialogue centered on the tension that Lorena now confronted in her reflection:

> Our district curriculum specialist made these pacing plans. We're behind it now. First semester I was on it. In second semester, I was like, "OK, I want to get here. I want the kids to get here." But now I just want them to really learn, and so they need to be engaged. . . . How can I get them to get something out of this that's important for them? Do projects, right? But then I'm running out of time in the pacing [plan]—I'm behind. So yeah, pacing is an issue and sometimes I don't really care but . . . in every single meeting, they [administrators] ask me, "How is it going? Where are you on pacing?". . . So how do I balance that?

Lorena processed the dilemma for herself and landed on the "bigger question" unfolding within the tension: How can she balance the competing demands for authentic, inquiry-based learning with standardized content and scheduling? Like Ellen's episode, these excerpts from Lorena's cogenerative dialogue and subsequent debrief collectively highlight a process of reflection that shifts among the three levels and includes an instructional recommendation but, in failing to arrive at a definitive solution or answer, leaves the door open for Lorena to continue to grapple with the "bigger question" posed earlier.

Following Cogenerative Dialogues

These instances of technical, comparative, and critical reflection *within* the cogenerative dialogues and debriefs seem to have impacted Ellen's and Lorena's individual reflections *outside* these structures, in two particular ways. First, the teachers reported reflecting on their teaching more frequently and with greater accountability to their students. Lorena noted,

> I'm definitely thinking more about my teaching [since participating in the dialogues]. I mean, I have to, because every week I'm gonna get questions—good questions—from the students and so I need to better think about them ahead of time.

This quote illustrates how the recurviseness of the dialogues encouraged Lorena to reflect not only *with* the students but *for* her students—or so that she was prepared to engage in productive conversations in the next dialogue. Ellen echoed a similar sentiment during one of her debriefs:

> They [the dialogues] definitely make me think more about what I do as a teacher. . . . A lot of what the students bring up, I've thought about before. But a difference is, now I've got to have an answer for them [the students], or at least I have to explain my thinking to them when they bring up issues in the classroom.

Like Lorena, Ellen shared that the dialogues increase the frequency of her reflection. Additionally, she felt obligated to share at least part of this reflection with her students by giving them a rationale for her instructional decisions. By feeling accountable to students for this work, the act of reflection for both teachers transcended the notion of being merely an individual quest toward improvement and began to approach an action of communal responsibility (Wenger, 1999).

Second, each teacher noticed that her reflection outside of the dialogues became more student centered and thus began to approach transformative teacher development (Fielding, 2004; Wisby, 2011), where reflection on a teacher's practice necessarily includes students' experiences. For Ellen, working with students in cogenerative dialogues allowed her to begin viewing instructional issues more clearly from student perspectives:

> As crazy as this is going to sound, [dialoguing with the students] has put some voices in my head that accompany my reflection. Now when I think about some issue in class, I don't have to wonder what students think, I can already hear what they've said about it or might say about it.

For Ellen, such a student-centered perspective on her teaching was invaluable:

> What's helpful about these dialogues is that you get that immediate feedback from the people that you are there to serve, right? Your students . . . these are the kids that are with you day in and day out. They watch what you do. They watch what you don't do, which is most important. . . . And they give you different perspectives, right? And the way I see it, it's like they're my kaleidoscope. I'm looking

> [at my teaching] through one end, and by hearing from my students, I'm seeing different parts of it.

This quote highlights how Ellen began to privilege the stature of student voice; for Ellen, their daily view gave students a valued, intimate experience and knowledge of her teaching. Importantly, Ellen also explained that the student perspective gained through the dialogues was not monolithic but rather varied and textured based on the diversity of individual voices that emerged during the weekly conversations. In my concluding interview with Ellen, she revealed that her time in cogenerative dialogues allowed her to learn so much detail about her students' interests, learning needs, and curiosities that she could now "predict what Lina or Patricia or Melvin are going to say" about the future instructional plans as she created them.

Lorena also recognized that her reflection away from the dialogues had become more student centered, but in a slightly different sense. Lorena perceived that her understanding of teaching (and her growth as a teacher) expanded beyond her own understanding of the practice and now began to include the knowledge and experience of instruction that students brought to the cogenerative dialogues:

> In the dialogues, you're giving value to everybody who's involved in the process. . . . It's no longer like me the teacher is the person that holds all the knowledge, and knows everything. Because now I'm saying, "No, you know what? I don't. And you, as students, do have some knowledge that can actually help me become better at teaching." So now my own thinking is actually becoming more student centered.

Here Lorena explains how the cogenerative dialogues not only opened her reflection to students but also allowed her to recognize and consider the knowledge of teaching that students possess and could contribute to her reflective practices, both within and outside the cogenerative dialogues. In these ways, both Lorena and Ellen noted concrete changes in their individual reflection practices as a result of their participation in dialogues with students.

Discussion and Conclusion

The themes described herein suggest that cogenerative dialogues can raise the social, equity-oriented, and policy-related issues that frame classroom problems and fuel critical reflection, while also facilitating frequent, student-centered reflection outside the dialogues themselves.

These findings represent a substantive contribution to the current field of teacher education. To help teachers (re)orient themselves toward equitable instruction during today's policy climate of standardization and high-stakes accountability, scholars (e.g., Gutiérrez & Calabrese Barton, 2015; Selkrig & Keamy, 2015) have called for more opportunities for teachers to engage in critical reflection that can reveal and interrogate the sometimes hidden political and social implications of their classroom work. And yet the literature indicates that, particularly for science teachers,

such critical reflection is difficult to induce (e.g., Andersen & Matkins, 2011; Teo & Tan, 2011), likely because it requires a problematizing of one's teaching from new and unexplored perspectives. This study addresses the present gap in literature on critical reflection by highlighting a practice—cogenerative dialogues—that can help teachers raise and grapple with the "big questions" of their teaching: questions like, What kind of student learning is group work supposed to facilitate? How do teachers equitably balance the different and sometimes competing social needs of their students? How can teachers create engaging, responsive curriculum in times of standardization and high-stakes accountability? Such questions—while not easily answered or concluded—stimulate teacher thinking and advance teacher learning beyond strategies for and indicators of student learning, to contemplate the factors and rationales mediating their instructional and curricular decisions.

However, given the challenges that previous studies have reported in their various attempts to facilitate critical reflection among science teachers, the question is raised as to why participation in cogenerative dialogues helped the teachers of this study extend past technical and comparative pedagogical considerations to reach more critical levels of reflection. Findings suggest that engaging outside perspectives—that is, those of students—in dialogue about instructional practices opened several affordances to Ellen and Lorena that facilitated instances of their critical reflection. First, listening to student voices surfaced conditions of learning (Rudduck & Flutter, 2000) that were new or theretofore unseen. For example, through her cogenerative dialogue, Ellen gained greater appreciation for the complexities underlying a single instructional activity—group work—which was mediated by a constellation of competing factors, including students' learning needs, students' need for belonging and inclusion, and administrators' expectations for standardization of student grouping. Dialogue with her students helped Ellen understand how they could make meaning of her instruction in ways that were unexpected and different from her own (Schön, 1983) and, in so doing, presented pressing new tensions for her consideration. Second, for both teachers, including student voice into their reflective practices unearthed ways that policies of standardization had marginalized students and constrained equitable opportunities for their learning (Arnot & Reay, 2007). Student voices like those of Mateo and Carlos, for instance, helped Lorena recognize how her district's pacing plan limited the extent to which students could engage in inquiry, a practice not only preferred by her dialogue members but also one touted as an essential component of equity-oriented science teaching (Gutiérrez & Calabrese Barton, 2015). Third, instances of critical reflection that Ellen and Lorena encountered through their participation in cogenerative dialogues led them to challenging pedagogical questions that resisted clear, easy solutions (Loughran, 2006). Rather than being unproductive, the unresolved status of these "bigger" questions encouraged the teachers to continually think back to problems of teaching with student perspectives in mind, seek out more information and possible solutions, and experiment with new practices.

Taken together, these observations suggest that incorporating student voice

into regular reflective practices may support opportunities for critical reflection (beyond technical and comparative considerations) by helping teachers like Ellen and Lorena develop their *contextual knowledge*, or understandings of the numerous ground-level factors (and the multiple meanings made of those factors) mediating student learning in the classroom, and their *political awareness*, or recognition of the ways in which education policies (at the federal, state, district, or school level) impede and/or facilitate equitable opportunities for student learning. This brings up certain implications for current practices of teacher education.

Given today's education environment, in which science teachers are tasked with implementing major policies of standardization while teaching in increasingly diverse classrooms, a chorus of scholars (e.g., Beltramo, 2018; Emdin, 2016; Gutiérrez & Calabrese Barton, 2015; Selkrig & Keamy, 2015) have argued for vehicles of critical reflection that can help teachers recognize tensions arising within these conditions—tensions that may point to constraints in equity. The findings reported here suggest that, if the field's pursuit of critical reflection is sincere, then the current traditional approach to teacher development—which other studies of science teacher reflection have shown to be limited (e.g., Andersen & Matkins, 2011; Teo & Tan, 2011)—likely begs an expansion to include transformative, democratic participation of peripheral voices, particularly those of students, who may advance teachers' contextual knowledge and political awareness. If such an expansion of the current approach to teacher reflection occurs, however, then—as seen in this study and as echoed by scholars of student voice research (Cook-Sather, 2006; Fielding, 2004; Mitra, 2001)—school leaders and policy makers must be prepared for the critical questioning that accompanies such reflection: questions that ask, for example, whose interests take precedence in a classroom (e.g., those of policy makers or students). If our field truly desires critical reflection that can lead to equity and "science for all," then we must consider inviting not only student voices into this endeavor but also "big questions," along with the potential critiques and disruptions they may introduce into teachers' thinking and instructional practices.

Note

[1] I shared a detailed written summary of this analysis with Ellen and Lorena, who concurred with the findings and provided no suggestions for revisions.

References

Andersen, L., & Matkins, J. (2011). Web 2.0 tools and the reflections of preservice secondary science teachers. *Journal of Digital Learning in Teacher Education, 28*(1), 27–38.

Arnot, M., & Reay, D. (2007). A sociology of pedagogic voice: Power, inequality and pupil consultation. *Discourse: Studies in the Cultural Politics of Education, 28*, 311–325.

Barnett, E., & Friedrichsen, P. J. (2015). Educative mentoring: How a mentor supported a preservice biology teacher's pedagogical content knowledge development. *Journal of*

Science Teacher Education, 26, 647–668.

Beers, J. (2005). Becoming an urban science teacher: The first three years. In K. Tobin, R. Elmesky, & G. Seiler (Eds.), *Improving urban science education: New roles for teachers, students, and researchers* (pp. 131–146). Lantham, MD: Rowman & Littlefield.

Beltramo, J. L. (2017). Developing adaptive teaching practices through cogenerative dialogues. *Teaching and Teacher Education, 63C*, 326–337.

Beltramo, J. L. (2018). Reciprocity, responsiveness, and responsibility: Establishing mutual accountability between teachers and students through participation in cogenerative dialogues. *International Journal of Student Voice, 3*(1). Retrieved from https://ijsv.psu.edu/?article=developing-mutual-accountability-between-teachers-and-students-through-participation-in-cogenerative-dialogues

Brookfield, S. D. (1995). *Becoming a critically reflective teacher.* San Francisco, CA: Jossey-Bass.

Bullough, A., & Booth, J. (2013). Science for all. *Education in Science, 251*, 12–13.

Cook-Sather, A. (2006). Sound, presence, and power: "Student voice" in educational research and reform. *Curriculum Inquiry, 36*, 359–390.

Cook-Sather, A., & Youens, B. (2007). Repositioning students in initial teacher preparation. *Journal of Teacher Education, 58*(1), 62–75.

Danielowich, R. (2007). Negotiating the conflicts: Reexamining the structure and function of reflection in science teacher learning. *Science Education, 91*, 629–663.

Emdin, C. (2010). Affiliation and alienation: Hip-hop, rap, and urban science education. *Journal of Curriculum Studies, 42*(1), 1–25.

Emdin, C. (2007). Exploring the contexts of urban science classrooms: Part 1. Investigating corporate and communal practice. *Cultural Studies of Science Education, 2*, 319–350.

Emdin, C. (2016). *For White folks who teach in the hood . . . and the rest of y'all too: Reality pedagogy and urban education*. Boston, MA: Beacon Press.

Fielding, M. (2004). Transformative approaches to student voice: Theoretical underpinnings, recalcitrant realities. *British Educational Research Journal, 30*, 295–311.

Gutiérrez, K., & Calabrese Barton, A. (2015). The possibilities and limits of the structure–agency dialectic in advancing science for all. *Journal of Research in Science Teaching, 52*, 574–583.

Howard, T. C. (2003). Culturally relevant pedagogy: Ingredients for critical teacher reflection. *Theory Into Practice, 42*, 195–202.

Hwang, S. (2011). Narrative inquiry for science education: Teachers' repertoire-making in the case of environmental curriculum. *International Journal of Science Education, 33*, 797–816.

Jay, J. K., & Johnson, K. L. (2002). Capturing complexity: A typology of reflective practice for teacher education. *Teaching and Teacher Education, 18*(1), 73–85.

LaVan, S. K. (2005). Cogenerating culturally and socially adaptive practices. In W. Roth & K. Tobin (Eds.), *Teaching together, learning together* (pp. 79–96). New York, NY: Peter Lang.

Lebak, K., & Tinsley, R. (2010). Can inquiry and reflection be contagious? Science teachers, students, and action research. *Journal of Science Teacher Education, 21*, 953–970.

Lee, V. E., Robinson, S. R., & Sebastian, J. (2012). The quality of instruction in urban high schools: Comparing mathematics and science to English and social studies classes in Chicago. *High School Journal, 95*(3), 14–48.

Liu, K. (2015). Critical reflection as a framework for transformative learning in teacher

education. *Educational Review, 67*, 135–157.

Loughran, J. J. (2006). *Developing a practice of teacher education: Understanding teaching and learning about teaching*. New York, NY: Routledge.

Lyon, E. G. (2011). Beliefs, practices, and reflection: Exploring a science teacher's classroom assessment through the assessment triangle model. *Journal of Science Teacher Education, 22*, 417–435.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). Thousand Oaks, CA: Sage.

Mitra, D. (2001). Opening the floodgates: Giving students a voice in school reform. *Forum, 43*(2), 91–94.

Nieto, S. (2004). Critical multicultural education and students' perspectives. In G. Ladson-Bilings & D. Gillborn (Eds.), *The RoutledgeFalmer reader in multicultural education* (pp. 179–196). New York, NY: RoutledgeFalmer.

Parker, C. (2014). Multiple influences: Latinas, middle school science, and school. *Cultural Studies of Science Education, 9*, 317–334.

Reinking, D., & Bradley, B. A. (2008). *Formative and design experiments: Approaches to language and literacy research*. New York, NY: Teachers College Press.

Roth, W. M., & Tobin, K. (2001). The implications of coteaching/cogenerative dialogue for teacher evaluation: Learning from multiple perspectives of everyday practice. *Journal of Personnel Evaluation in Education, 15*(1), 7–29.

Rudduck, J., & Flutter, J. (2000). Pupil participation and pupil perspective: "Carving a new order of experience." *Cambridge Journal of Education, 30*(1), 75–89.

Rudduck, J., & McIntyre, D. (2007). *Improving learning through consulting pupils*. New York, NY: Routledge.

Saldaña, J. (2013). *The coding manual for qualitative researchers* (2nd ed.). Los Angeles, CA: Sage.

Schön, D. A. (1983). *The reflective practitioner: How professionals think in action.* New York, NY: Basic Books.

Selkrig, M., & Keamy, K. (2015). Promoting a willingness to wonder: Moving from congenial to collegial conversations that encourage deep and critical reflection for teacher educators. *Teachers and Teaching, 21*, 421–436.

Smith, K., & Lindsay, S. (2016). Building future directions for teacher learning in science education. *Research in Science Education, 46*, 243–261.

Strauss, A., & Corbin, J. (1994). Grounded theory methodology: An overview. In N. Denzin & Y. Lincoln (Eds.), *Handbook of qualitative research* (pp. 273–285). Thousand Oaks, CA: Sage.

Teo, T. W., & Tan, A. L. (2011). Realities of curriculum and teaching: Revelations from Singapore teachers' meta-reflections. *U.S.–China Education Review, 5*, 601–612.

Tobin, K. (2006). Learning to teach through coteaching and cogenerative dialogue. *Teaching Education, 17*, 133–142.

Towndrow, P. A. (2007). Critical reflective practice as a pivot in transforming science education: A report of teacher–research collaborative interactions in response to assessment reforms. *International Journal of Science Education, 30*, 903–922.

Trauth-Nare, A., & Buck, G. (2011). Using reflective practice to incorporate formative assessment in a middle school science classroom: A participatory action research study. *Educational Action Research, 19*, 379–398.

Van Duzor, A. G. (2012). Evidence that teacher interactions with pedagogical contexts

facilitate chemistry-content learning in K–8 professional development. *Journal of Science Teacher Education, 23*, 481–502.

Van Manen, M. (1977). Linking ways of knowing with ways of being practical. *Curriculum Inquiry, 6*, 205–228.

Wenger, E. (1999). *Communities of practice: Learning, meaning, and identity*. New York, NY: Cambridge University Press.

Whipp, J. L. (2003). Scaffolding critical reflection in online discussions helping prospective teachers think deeply about field experiences in urban schools. *Journal of Teacher Education, 54*, 321–333.

Wisby, E. (2011). Student voice and new models of teacher professionalism. In G. Czerniawski & W. Kidd (Eds.), *The student voice handbook: Bridging the academic/practitioner divide* (pp. 31–44). Howard House, UK: Emerald Group.

Yoon, H. G., & Kim, M. (2010). Collaborative reflection through dilemma cases of science practical work during practicum. *International Journal of Science Education, 32*, 283–301.

Zeichner, K., & Liston, D. (1996). *Reflective thinking: An introduction.* Mahwah, NJ: Erlbaum.