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Affinity through Mathematical Activity: Cultivating Democratic Learning Communities

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In this article, the author demonstrates how a broader view of what shapes affinity is ideologically and practically linked to creating democratic learning communities. Specifically, the author explores how a teacher employed complex instruction (an equity pedagogy) with her ethnically and racially diverse students in the "lowest track" Algebra I course. Sociometric network analyses used to model peer relationships revealed an affinity among three students that could not be explained by shared attributes or history (e.g., race or gender). Through field note analyses, the author argues these students' affinity was forged through shared mathematical activity—what she terms a workship*. This workship reflected equitable relationships born of diverse youth learning to work together* by working together*. The author discusses implications of the workship for teachers and researchers, as well as the constraints that stratified mathematics programs can place on classroom-based efforts to advance equity.*

KEYWORDS: cooperative learning, democratic learning communities, equity, mathematics education, tracking

Structuring opportunities in which adolescents learn to treat all peers as mathematically capable can be a challenge; yet, it is central to cultivating democratic learning communities. Academic and social hierarchies often limit what is possible for adolescent relationships in school (Abraham, 1995; Cohen, Lotan, Scarloss, & Arellano, 1999; Eckert, 1989). Nonetheless, for educators, anticipating and encouraging diverse peer relationships is both ideologically and practically linked to the development of supportive learning environments. In this article, I examine how a broader view of what shapes adolescent affinity could be a promising pedagogical tool for cultivating democratic learning communities. Specifically, I explore how shared mathematical activity can shape a student's relationship to another, in contrast to the ways shared social attributes or history are currently understood to drive affinity among adolescents.

Prior research suggests that adolescent affinity stems from shared social attributes like race or gender (e.g., Miell & MacDonald, 2000; Tatum, 2003) or a shared social history like friendship (Azmitia & Montgomery, 1993; Strough, Berg, & Meegan, 2001; Strough, Swenson, & Cheng, 2001). In contrast, the focal

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group in this analysis emerged as a unique case of adolescent affinity in the "lowest" mathematics track of an ethnically and racially diverse and socioeconomically stratified, suburban/urban (i.e., urban sprawl) U.S. public school. Within this setting, three students developed an affinity for one another unlike what is typically predicted—they were a mixed-gender collective, ethnically and racially different, not previously friends, did not share social circles, and had no other classes together. I argue that these students' affinity was forged through shared mathematical activity—what I term a *workship*. Exploring how shared mathematical activity can shape students' relationships (in contrast to the way students' relationships to others shapes activity; see, e.g., Civil & Planas, 2004) is generative for two reasons: (a) it supports teachers in identifying and nurturing "unexpected" peer relationships in a diverse setting, and (b) it conceptualizes a closer link between peer collaboration and the creation of democratic learning communities.

There is, however, an important caveat to this narrative of possibility. The three students developed their affinity while simultaneously setting apart a fourth student, who was arguably the most academically vulnerable in the collaborative group. Therefore, this case of unforeseen affinity also speaks to the complicated and delicate nature of developing equitable relationships within a single group, let alone a classroom community.

Literature Review

In this case study, I conceptualize a generative relationship between pedagogy, students' mathematical activity, and the creation of democratic learning communities. I begin with a discussion of complex instruction (Cohen & Lotan, 1995; Cohen et al., 1999), a theory of pedagogy to advance equity that was used in this case study. I then describe two aspects of the pedagogy that are central to the analysis: (a) attending to students in relation to peers and mathematical activity, and (b) developing relational equity (Boaler, 2008) among learners.

Complex Instruction

Complex Instruction (CI) is a theory of pedagogy aimed at advancing equity that involves, in part, teachers addressing power relations among students (Cohen & Lotan, 2004; Featherstone et al., 2011). CI is typically used in collaborative settings in which students actively contribute to a mutual learning goal through shared effort (Teasley & Roschelle, 1993). Collaborative learning challenges the traditional conception of mathematical authority as concentrated in a teacher or textbook, and redistributes it among students and the teacher (Gresalfi & Cobb, 2006). Shifting from teacher to students heightens the role of peer relationships in advancing students' mathematical thinking (e.g., Barron, 2003; Engle, Langer-

Osuna, & McKinney de Royston, 2008; Kotsopolous, 2010; Sfard & Kieran, 2001) and in supporting students to develop identities as capable mathematics learners (e.g., Boaler & Greeno, 2000; Esmonde, 2009; Langer-Osuna, 2011).

Attending to Students in Relation to Peers and Activity

CI presupposes that differences in status among learners are consequential to learning. Status in CI refers to "an agreed-upon social ranking where everyone feels it is better to have high rank within the status order than a low rank" (Cohen, 1994, p. 27). Social ranking, or status, is "agreed upon" in two ways: (a) through local institutional arrangements (e.g., high status in a performing arts magnet school would be different than in a mathematics and science magnet school); and (b) through salient social and cultural attributes like race, ethnicity, or gender. CI urges teachers to disrupt status by altering the expectations of competence or ability within the local learning environment. Teachers do this by looking for instances where students of relatively low status perform well on some aspect of a task; the teacher then provides specific, positive, and public praise. This pedagogical move, called a *status treatment* (for more, see Cohen & Lotan, 1995), strategically elevates a student's contribution to cast the student as competent and important within the learning community. CI has been shown to impact student learning and the development of students' identities in diverse schools (see, e.g., Boaler & Staples, 2008; Cabana, Shreve, Woodbury, & Louie, 2014; Civil, 2014; Featherstone et al., 2011). Understandably, much of the research on CI focuses on the teacher and on interactions between the teacher and students. In the analysis reported here, however, I examine peer interactions often occurring beyond the reach of a CI teacher's pedagogical moves.

Although CI focuses on teachers' actions and their impact on how students are positioned within a learning community, my analysis also recognizes how *peers* act as resources for being seen as competent and important (Wortham, 2004a, 2004b, 2005). Similar to others, I attend to student talk and interactions to understand how students position in relation to peers and the discipline (Engle et al., 2008; Esmonde, 2009; Hand, 2012; Turner, Dominguez, Maldonado & Empson, 2012; Wood, 2013). This approach has, for example, demonstrated how students become marginalized in relation to peers or the classroom community despite having relevant and complex ideas to share (e.g., Kurth, Anderson &Palincsar, 2002; Gresalfi, Martin, Hand, & Greeno, 2009; Langer-Osuna, 2011; Moschkovich, 1999). Understanding students in relation to peers through changes in moment-to-moment interactions and activity differs significantly from research on adolescent affinity in collaborations, which identifies how social attributes like race or gender often *foretell* peer interactions. Within this literature, *homogeneity* in social attributes (friendships or same-sex grouping) is often demonstrated as a positive good; while on the other hand, heterogeneity of social attributes are ar-

gued as recruiting issues of status and influence that can mitigate positive outcomes (see, e.g., Miell & MacDonald, 2000; Strough et al., 2001; Webb, 1984, 1991; Wilkinson & Fung, 2002). The analysis here stands to complicate such conclusions by exploring the potentially significant role of affinity developing among highly diverse youth, within the greater project of creating democratic learning communities.

Relational Equity

Boaler's (2008) introduction of relational equity brings together the pedagogical commitments of CI and the explanatory potential of studying affinity *in situ*. Boaler (2008) defines relational equity as students learning to communicate effectively with one another, demonstrating appreciation for others' perspectives, and engaging respectfully in mathematical practice together (p. 167). Though coined nearly a decade after CI was first introduced, the idea of relational equity grows from Boaler's 4-year study of a mathematics department using CI in an ethnically and culturally diverse urban high school. At that school, the mathematics department was de-tracked and the teachers adopted CI (Boaler, 2008; Boaler & Staples, 2008). Boaler and colleagues found mathematics students from different cultural groups, social classes, ability levels, and genders all achieved at high levels, while also demonstrating a deep appreciation for learning (Boaler, 2006a, 2008; Boaler & Staples, 2008). Boaler argues that relational equity serves an important goal of public education: the creation of an enlightened, connected, and committed citizenry. Under the rubric of relational equity, her work encourages teachers to create opportunities for students to "*act* equitably" (Boaler, 2008, p. 168, emphasis added). That is, equity is actualized through the way students speak and act toward one another and one another's mathematical contributions. This analysis leverages Boaler's conception of relational equity as a signal of democratic learning. My analysis, however, differs from Boaler's work in terms of the institutional context within which the teacher was attempting to advance equity. In this case study, the teacher was the only one to adopt CI within an "ability-based" tracked mathematics program (as will be discussed in the Methods section). My analysis therefore builds on previous research by considering the affordances (and limitations) of pedagogy in cultivating relational equity when there is little systematic institutional support for such efforts.

Methods

The methods, data sources, and analyses described in this section were engaged to answer: *How might a focus on students' talk, interactions, and mathematical activity extend what is currently understood about adolescent affinity as*

primarily based on shared social attributes or history? I conjectured that in answering this question, the results would offer new insights on the importance of relational equity and the cultivation of democratic mathematics learning communities.

Data Sources

Semi-structured interviews and sociometric network surveys. I conducted two semi-structured interviews with the teacher at the start and end of the school year to discuss the aims of her pedagogy and later, her reflections on them. Most of what I know from and about the teacher, however, is gleaned from frequent informal conversations over the year, where we discussed her lesson plan intentions, reflected on her teaching, shared thoughts about particular students or the department, and so on. I also conducted semi-structured interviews with the students at the start, mid-point, and end of the school year. The initial interview established a baseline of social relationships by asking who they knew, who were friends, and so on. It also established students' familiarity with collaborative learning in mathematics, their perceptions of mathematics and themselves as learners, and their career or college aspirations. The mid-year interview focused largely on roster-format sociometric network surveys. In the 1980s and 90s, sociometric network analysis gained considerable momentum in the social sciences because of its power to reveal relationships among social entities, and the implications of such relationships (Wasserman & Faust, 1994, p. 3). Sociometric network surveys were thus a particularly useful tool in this analysis because they could capture affinity among students in the class. At the end of the first and mid-year interviews, I gave students a list of their classmates and asked, for example: Whom would you identify as a friend? If given the opportunity to choose your own group for a project that would determine your grade, whom would you choose? Why did you choose those names? Coordinating network surveys with interviews allowed me to identify affinity among students in the class, while also capturing students' explanations of those affinities. The final interview elicited students' reflections on their performance during the year, and their experiences of group work.

Field notes. As part of the larger study, I observed 84 days of classroom instruction over 40 weeks during the school year. A typical observation cycle focused on a single group of students for the duration of their collaborations (10 days). This analysis draws from field notes taken over four days (approximately 4 hours) of the focal group. In handwritten field notes, I attended primarily to a group's interactions and talk, but also documented whole-class or teacher interactions as needed. I also recorded the results of summative assessments. After each observation, I elaborated on the handwritten field notes and converted them to

electronic field notes—that is, "research protocols" (Hatch, 2002)—before the next observation.

Other written artifacts. At the start of the school year, the teacher had students complete a biographical intake form, and required students to write a letter of introduction sharing what they thought was important for her to know as their teacher. Periodically, students also did quick writes and short surveys to reflect on their learning experiences. I collected these written artifacts, which are used to provide descriptive detail on the students in this analysis.

Setting and Participants

The setting and participants for the study followed from the purposive selection of the focal teacher. For the study, I sought recommendations from faculty at a private teacher education program with an explicit emphasis on pedagogies of equity, including CI. Ms. Baker,[1] a graduate of the program 8 years prior, was among the top nominees for the study. Ms. Baker was a middle-class, White woman who had completed her student teaching in the same mathematics department that Boaler and colleagues studied. After graduation, she began teaching and later became a trainer in the use of CI. When I met Ms. Baker, she had just accepted a position to teach the lowest track of Algebra I at a public high school. After meeting and expressing my research interests, she consented to the study of her Algebra I class for an academic year.

Redbird High School (RHS) was in an affluent suburb of Northern California. It embodied many of the social and economic tensions crossing over what once constituted the geopolitical line dividing "urban" and "suburban" schools in the United States. RHS was the most ethnically diverse high school in its district. The school population (approximately 1,900 students) was 35% Latin@, 30% White, 16% Asian, 14% Filipino/a, and 4% African American. Fifty percent of students at RHS qualified for free and reduced price meals, and 30% were designated English Language Learners. In the mid-1980s a high school in the predominantly ethnic minority and working class part of the city was closed due to enrollment declines. Students were then bussed to the predominantly middle and upper-middle class center of the city, and to RHS in particular.

Yearlong Algebra I courses at RHS were part of a newly created district-wide program targeting lower performing students. Yearlong courses were not the norm (semester-long courses were); structurally, yearlong courses could keep students from advancing to the highest level of mathematics offered. In contrast, all other departments were eliminating academic tracking at the time of the study. Ms. Baker's yearlong Algebra I class had 16 students from grades nine through twelve. All of her students were from the ethnic minority and working class part

[1] All proper names are pseudonyms.

of the city. On open-response written surveys, 11 students identified as female and five as male. All of the students reported this as their first experience using group work daily in mathematics.

The Focal Group

The four students discussed in this analysis are Vivian, Katrina, Lorenzo, and James (each are further described). This group's collaborations represent a unique and revelatory case for exploring collaborative learning, relational equity, and the cultivation of democratic community. First, their interactions led to one of the only instances all year of Ms. Baker rearranging groups just halfway through the typical 10-day cycle of collaboration. After class on the fifth day, I asked her why she disbanded the group and she explained that Katrina was being left out. Despite status treatments to support Katrina (as CI would direct), Ms. Baker's professional judgment was to reshuffle the groups instead. The second reason they were unique in the class was that despite their exceptionally brief (and only) collaboration in the first month of school, Vivian, Lorenzo, and James independently and *exclusively* identified each other as ideal collaborative partners on written surveys in mid-year interviews 5 months later.

Vivian. Vivian was half Filipina, one-quarter Hawaiian, and one quarter White, but identified primarily as Filipina in her introductory letter and interviews. Vivian was a sophomore in her first year at RHS and lived with her grandmother, sisters, and cousin. She was estranged from her mother, and her father was incarcerated. Vivian aspired to attend community college and then a large state university to pursue a career in law or middle school mathematics teaching. In whole-class discussions, Vivian regularly volunteered to do warm-up problems and was typically the first to reach the participation point limit for the week. Ms. Baker resisted calling on Vivian so others could speak, but would frequently call on her when no one else had the answer.

Katrina. Katrina was an African American sophomore in her second year at RHS, as identified in her introductory letter and interviews. She and Vivian identified each other as very close friends and like Vivian, lived with her grandmother. In class, Katrina used humor regularly. For example, I once observed Ms. Baker nearly lose her temper and Katrina, perhaps sensing the same, suggested she stroke her earlobes and chant "Woo-sa! Woo-sa!" This reference to a popular movie (*Bad Boys II*) diffused the tension with laughter. Katrina's classmates noted her use of humor and sarcasm as well. For example, Amina explained she liked working with Katrina because, "Katrina explains in a funnier way," while Selma said Katrina made others laugh (Mid-Year Interviews). Mathematics was Katrina's least favorite subject but she explained it was necessary to fulfill her goal of playing college basketball at Michigan State University (Initial Interview). During

the study, Katrina was ineligible to play basketball because of low grades in Algebra I and History.

Lorenzo. Lorenzo was Mexican and lived with his parents and brother, which he explained in his introductory letter and initial interview. Lorenzo was a freshman who aspired to attend a 4-year university to study engineering. He considered mathematics his favorite subject and was the highest achieving student both semesters. His peers generally described him as quiet, hardworking, and very smart; in a mid-year interview, a classmate called him a "quiet boss." I observed Lorenzo to be consistently on time, working on the warm-up problem when the bell rang, and ready to volunteer. In a year-end survey asking what it means to be good at mathematics, Lorenzo wrote: "To be good in math you have to show the best you got." At the end of the year, Ms. Baker nominated Lorenzo for the Outstanding Algebra Student Award, and he was the sole recipient across both tracks of Algebra (yearlong and semester).

James. James identified as a half Vietnamese, half White ninth-grade student in his introductory letter. He lived with his parents and four siblings. I did not gain permission to "formally" interview James but we often spoke before or after class about school, coursework, and friends. James wanted to design cars and pursue a "mechanical degree" at a junior college. In his letter of introduction, he explained regretting not paying closer attention in prior mathematics classes. He also explained that he had no problem asking questions but that because he is a "fun person," he is likely to talk a lot in his groups. In class, James regularly volunteered to do problems at the board and readily offered thoughts on solutions or methods during discussions.

The Researcher

I am a former high school mathematics teacher who now conducts research and teaches graduate students and pre-service secondary candidates at a public university. I am a woman of color and the daughter of immigrants: I recognize that my own commitment to democratizing educational opportunity informs much of my professional work. At some base level, I wanted to see Ms. Baker succeed in her aims. Through systematic reflexive practice, however, I worked vigilantly to tame my subjectivity (Peshkin, 1988). Qualitative validation strategies in the present analysis include researcher reflexivity, triangulation of multiple sources (interviews, observations, surveys, written artifacts), and prolonged engagement at the site (Creswell, 2007).

Data Analysis

In this section, I first explain the overall approach to data analysis that led me to identify this collaborative group as a revelatory case of adolescent affinity

within the classroom community. I then discuss the specific analyses of sociometric network surveys and field notes.

In general, I first identified three of the four students (Vivian, Lorenzo, and James) as potentially representing a revelatory case of adolescent affinity based on outcomes of mid-year sociometric network surveys. In those surveys, students identified and explained whom they saw as ideal collaborative partners. This led me to assess all data collected in relation to the three students from the start to the midpoint of the school year. These data included: (a) letters of introduction, (b) interview transcripts, and (c) field notes. The analyses I present draw primarily on field notes, which revealed the three students had worked together only once, and in collaboration with a fourth student (Katrina).

Sociometric network surveys. The premise behind sociometric surveys is that the relationships individuals have to one another can be determined and modeled as a network of ties (e.g., Buchanan, 2002; Cross, Parker & Cross, 2004). Once students completed the network surveys in their mid-year interviews, I developed a model of affinities (ties) within the community. The model I present in the Results section depicts whom students identified on surveys as ideal peer collaborators. The model shows how frequently someone was nominated (ordered highest to lowest vertically), which gives a sense of her or his positioning in the class, and which students nominated which—that is, a way to identify relationships in the class.

Field notes. The purpose in analyzing field notes was to explore why the three students emerged as such a unique collective in network survey outcomes. Most striking (aside from meeting only once for four days, five months prior) was that they had been working with a fourth student (Katrina) that none identified in the survey. I therefore focused my analytic efforts on what transpired among the students over those 4 days by using an analytic framework created to identify when students name, arrange, shift, and reformulate relationships among themselves during small group activity.

McDermott, Gospodinoff, and Aron's (1978) framework uses the term *contexts* to define moments when participants name, shift, or reformulate relationships to one another in a given activity. Based on a microanalysis of students during small group reading instruction, the framework was intended to attune ethnographic researchers to the way physical and verbal interactions prove significant to understanding shared activity. Since 1978, this framework continues to inform studies of classroom discourse and peer microinteractions (see, e.g., Cazden & Beck, 1988; Kendon, 1990), microethnographic studies of schools and microgenetic-historic studies of learning (see, e.g., Corsaro, 1985; Roth, 2014), and has even contributed to the development of other frameworks that describe peer influence in collaborative mathematics problem solving (see, e.g., Engle, Langer-Osuna & McKinney de Royston, 2014). And yet, I leveraged the original frame-

work here because of its four specific criteria for identifying the formulation and reformulation of relationships in a group (i.e., contexts). These criteria aptly allowed me to consider how specific moment-to-moment peer interactions mark the formulation or reformulation of adolescent relationships. Thus this framework provided the crucial logic linking *in situ* peer interactions during mathematical activity to the idea of developing affinity.

According to the framework, the formulation and reformulation of relationships (i.e., contexts) become apparent in four ways: (a) when participants name them; (b) by changes in participants' positioning, which represents a negotiation of relations; (c) when participants struggle to preserve relational order; and (c) when participants hold one another accountable to fit particular behaviors of the activity (McDermott et al., 1978, p. 274). Thus, analyzing field notes meant identifying and coding when student talk and behaviors reflected a particular criterion. With this more structured and systematic approach to analyzing field notes, I could explore the contexts emerging and later account for the mutual affinity Vivian, Lorenzo, and James reported in network surveys.

Analysis and Results

There are three parts to what is reported here. First, I present the results of sociometric network surveys administered during mid-year interviews. Second, I present a relatively brief narrative account of "what happened" over four days as an overview. Third, I present results of field note analyses that led to the primary outcome of this work: identifying a form of peer affinity grounded in shared mathematical activity rather than shared social attributes or history.

Identifying Affinity Through Network Surveys

In the mid-year interview, students were asked to complete a survey identifying preferable collaborative partners for a major project. Figure 1 depicts only those ties (as arrows) between students who mutually identified in response to the prompt. The numbers on the left in Figure 1 reflect how often peers identified a student as a preferable partner. For example, three students perceived Yasmin as a good partner while no one perceived Thomas or Kaitlynn as such. Of importance to this analysis, Vivian, Lorenzo, and James identified one another and *only* one another as preferred partners.

In general, as Figure 1 depicts, there were few mutual identifications of affinity within the community by mid-year: a dyad of Ofelia and Amina, and a triad of Vivian, Lorenzo, and James. Amina was Palestinian from Jordan and Ofelia was Mexican from Mexico. They shared social attributes (both identified as female, both were recent immigrants, and both were English Language Learners)

and history (they were friends and regularly worked together in science and mathematics). Thus, their relationship was a relatively known quantity in the study of adolescent affinity.

In contrast to Amina and Ofelia, the expressed affinity between Vivian, Lorenzo, and James could not be explained through social attributes or shared history: They were two boys and a girl, they were ethnically and culturally different, they were never friends, they shared no other classes together, and they collaborated only once, 5 months earlier. As the research question reflects, the survey results led me to consider how talk, interactions, and activity among the students might extend what is typically predicted as the basis for adolescent affinity in schools.

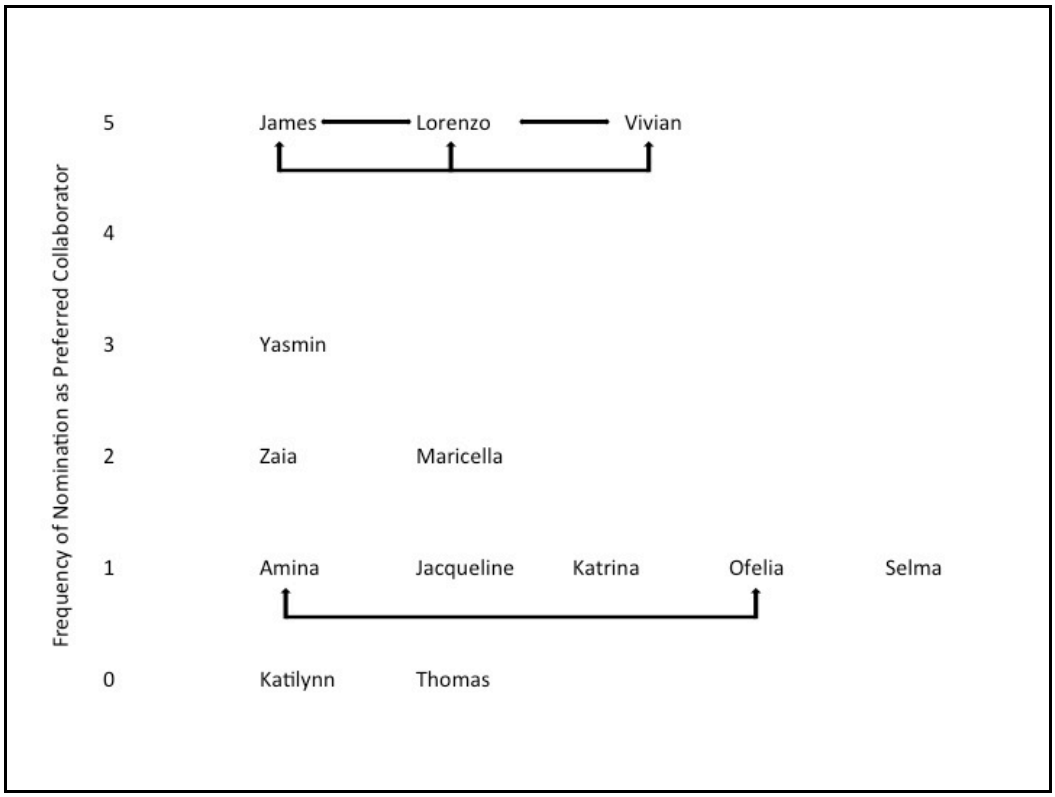

Figure 1. Mid-year network model of mutually identified ideal collaborators.

A Narrative Overview

On the first day, Ms. Baker introduced the class to algebra tiles and showed them how to build and represent expressions. She built an expression, which groups would rebuild before determining the symbolic equivalent. James and Lo-

renzo discussed how to manipulate the tiles. Vivian worked on problems independently and checked her answers with James and Lorenzo. Vivian also doodled, sang, and texted under the table with Katrina.

On the second day, the group worked with algebra tiles and mats to simplify expressions. This meant, for example, flipping and shifting tiles such that $-(x-2)$ would become $-x+2$. Ms. Baker circulated among groups. After watching Vivian work, she gave her a high five. Ms. Baker then noticed Katrina had not done her work and said to Vivian, "A good friend would keep another on track." As Ms. Baker left, Vivian checked on Katrina's progress but shortly thereafter, Katrina was off-task again. Vivian called to Katrina a few times to get her attention; when Ms. Baker returned to see little progress from Katrina, she told Vivian she was not being a true friend unless she helped Katrina focus. Ms. Baker assisted Katrina and then watched Vivian help Katrina with the next problem. Throughout the period, Katrina would get distracted again and Vivian would admonish her to stay focused. At the end of class, Vivian and Katrina were both giggling and shoving each other, when Vivian abruptly stopped and asked James for help. James and Vivian disagreed on their answer and James tried it again. James then asked Lorenzo about it as Vivian showed Lorenzo her work. James, looking over Lorenzo's shoulder, pointed to Vivian's paper and said: "You're not supposed to do that yet." Vivian replied, "Look, exponents first then multiple [*sic*] that." James thought for a moment and erased his work as class came to an end.

On the third day, Ms. Baker asked students to take turns building, simplifying, and representing increasingly difficult algebraic expressions as a group. Lorenzo built and solved the first expression. Vivian pushed her paper toward Katrina and showed her the answer. Lorenzo and James built the second expression in two different (and incorrect) ways. James and Lorenzo asked Vivian to check their work, and she agreed with James. Vivian then flipped and shifted the tiles as the boys looked on. Katrina continued working alone on her paper and never touched the tiles. When Vivian and James compared their written simplified expression with what they determined through manipulating the tiles, they found it did not match. Ms. Baker came over and looked at them in a slightly exasperated way. She took a breath and built the expression for them. Katrina declared she had that solution and Ms. Baker asked the others if they listened to Katrina. Vivian, Lorenzo, and James remained silent as Ms. Baker said, "What happened? What is happening here? I'm feeling bad energy here," and then left. Vivian continued to work with James and Lorenzo. When an assistant teacher came to check on the group's progress, James showed him that he was done. When the assistant asked if Katrina was done, James replied, "No, *you* have to help her out." Vivian looked up and said she was just helping Katrina a moment ago.

As class ended on the third day, Lorenzo, James, and Vivian were discussing a task. As James began reading his answer aloud, Vivian and Lorenzo chimed

in, in unison, to complete it. The three laughed and cheered in celebration. Vivian then turned and read her answer to Katrina. As Katrina wrote it down, Vivian looked up and noticed a male student passing by. "That guy is cute," she said to Katrina who looked up and stopped writing. Vivian reached out and took Katrina's paper to finish the problem as Katrina remarked, "You're causing me to get a bad education!"

On the fourth day, the students corrected homework and took an individual quiz on the week's material. The quiz results were: James, 98%; Lorenzo, 94%; Vivian, 89%; and Katrina, 87%. On the fifth day, Ms. Baker rearranged the groups, only halfway through the typical 10-day cycle.

Identifying Affinity through Talk, Activity, and Interaction

These results are organized by criteria that focus on participant's talk, actions, and interactions to identify the formulation and reformulation of relationships (i.e., contexts) in a group. The results extend conceptions of adolescent affinity as governed by shared social attributes or history to include affinity as forged through shared mathematical activity.

Criteria 1: Contexts become apparent when named. The contexts of friendship and a separate relationship of mathematical activity were named at different times during the group's collaborations. For example, on the second day, Ms. Baker's use of friendship as the rationale for Vivian to keep Katrina on track *named* friendship as a salient context. On the third day, when Ms. Baker realized the others had been ignoring Katrina's mathematical work, Ms. Baker used the phrase "bad energy," which recognized the triad as formulating a context apart from Katrina. On that same day, when James told the teaching assistant to help Katrina, James implicitly named two formulations within the group: *Katrina* and *we share our mathematical work*. Notably, Vivian responds by saying they were just helping Katrina, as though re-naming James' formulations as: *we share our mathematical work* and *I help Katrina*. At the end of that day, Katrina told her friend Vivian she was causing her to get a "bad education." In so doing, Katrina was naming friendship as a salient context within the group (just as Ms. Baker had on the first day), as a context apart from one that affords a "good education" (perhaps because it is not grounded in mathematical activity), and as a context that only she and Vivian share.

These examples collectively point to participants naming two different contexts in the group: friendship and one characterized by mathematical work. Moreover, these moments of naming contexts simultaneously marked talk and interactions isolating Katrina from the others. In that sense, as the triad formulated a relationship based on mathematical activity, they were also formulating a relationship to Katrina that cast her as a problem.

Criteria 2: Contexts become apparent through changes in participant positioning. Over the course of 4 days, Vivian physically and verbally formulated a relationship with James and Lorenzo around mathematical activity. The first indication of Vivian's changing position toward Lorenzo and James came at the end of the second day when she was interacting with Katrina and abruptly stopped to ask James a mathematical question. That moment signaled a physical and verbal change in her position (i.e., she leaned in, addressed him directly, and eventually engaged Lorenzo in the task). From then on, she increasingly turned to Lorenzo and James to manipulate tiles, compare answers, debate disagreements and finally, on the fourth day, to shout happily in unison with them upon completing a task. The cascading effect of moments of repositioning toward Lorenzo and James indicated a relationship formulating in mathematical activity.

In contrast to Vivian's changing position toward Lorenzo and James, she changed very little in relation to Katrina. Vivian began by working alone and behaving off-task with Katrina on the first day, shoving and being silly with her on the second, and nudging her on the third to notice a "cute guy." Although she also passed, read, and eventually wrote answers for Katrina, Vivian could not formulate a relationship that bridged her activities with Katrina and those with Lorenzo and James. That is, she could not bring together behaviors of friendship with behaviors of mathematical work. This is also evident by virtue of Vivian being most often blamed for Katrina's mathematical isolation—first by the teacher ("a good friend would keep another on track") and later by Katrina herself ("you're causing me to get a bad education"). In such instances, Vivian's position on the border between contexts was treated as the cause of Katrina's isolation. In actuality, a *lack of change in positioning* by Lorenzo and James could have been identified as similarly causing Katrina's isolation.

The relationship James and Lorenzo formulated and maintained apart from Katrina was afforded (if not sanctioned) repeatedly over the 4 days. On the first day, for example, when Ms. Baker implored Vivian to help Katrina, she did not commensurately compel James and Lorenzo to help. Though Ms. Baker named friendship as a salient context in the group with her words, she may have also been inadvertently creating a same-sex context for Vivian and Katrina that allowed James and Lorenzo to abdicate their responsibility to help. There were other opportunities for Lorenzo and James to position and formulate a context that would incorporate Katrina in mathematical activity. For example, when Katrina had the correct solution and they did not (third day), they could have subsequently engaged Katrina in the task by speaking to her or leaning in her direction—that is, by changing their position. Additionally, when the teaching assistant checked in on the group, James reported Katrina needed help but made no effort to help, thereby maintaining Katrina's position of isolation in a context apart from activity. Thus despite opportunities for Lorenzo and James to formulate or reformulate

a relationship that incorporated Katrina in mathematical activity, the opportunities were largely unrecognized, unnamed, or ignored.

Criteria 3: Contexts become apparent in significant moments that maintain relational order. There were at least four significant moments that maintained relational order. Because some of these examples were discussed previously, this discussion is brief. First, when Ms. Baker named Vivian and Katrina's friendship, it communicated a relational order where friendship supersedes group membership as what compels helping others. Second, it was a significant moment when Katrina determined the correct solution because it challenged the relational order of being isolated from the context of mathematical work. Whereas the triad could have cheered and folded Katrina into their discussions and activities, they instead reconciled to the same relational order. Third, when James told the teaching assistant to help Katrina, he maintained a relational order by which he was not responsible for helping her. Fourth and finally, it was a significant moment when Vivian directed Katrina's attention to the "cute guy" while reading answers to her because it starkly contrasted with what happened moments previous: Lorenzo, Vivian, and James cheering for themselves in completing a task. The relational order embedded in such a contrast nearly speaks for itself: James, Lorenzo, and Vivian shared a relationship that celebrated mathematical activity, while Katrina and Vivian shared a relationships that was minimally mathematical and more focused on their shared social attribute (gender and [assumed] sexuality) and history of friendship.

Criteria 4: Contexts become apparent when participants hold others accountable to activity. Vivian made most apparent how accountability to behaviors of activity constituted two separate contexts in the group. Vivian started by holding Katrina accountable to work, telling her to "shut up" when she got off-task. Vivian said this with humor and a smile, as one might see among friends. Vivian's attempts to hold Katrina accountable on the first day gave way to formulating a different relationship in the group. Vivian became increasingly accountable to James and Lorenzo (and they to her) through questioning, comparing answers, and supporting each other's understandings—all of which are grounded in shared mathematical activity. As Vivian became accountable to James and Lorenzo, she stopped holding Katrina accountable for producing anything mathematical and instead, by passing answers to her, held her accountable only to the behaviors of mathematical work (i.e., filling in answers). This lack of accountability between Vivian and Katrina foreclosed any chance of reformulating their friendship into a relationship of shared mathematical activity. When Katrina chastised Vivian for her "bad education" on the third day, she showed how she implicitly held Vivian accountable for what she could accomplish in the group. Katrina did not, however, hold James, Lorenzo, or herself explicitly accountable; she still perceived friendship as demanding accountability in a way that group membership did not.

Summary. In Figure 2, I offer an illustration of the criteria-based analysis just presented. Depicted visually, the two contexts first become apparent as parallel dyads, with one student intermittently engaging in both. Then, the student becomes increasingly central to the other context while minimally engaging in the first. Finally, a triadic relationship results with a student set largely apart.

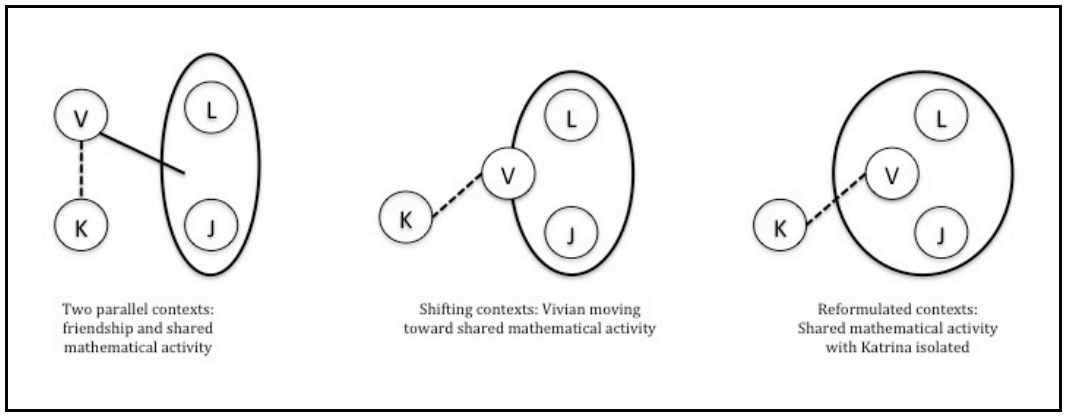

Figure 2. Depiction of two salient relationship formulations (contexts) operating in a group; network surveys suggested the final triadic partnership was seen as ideal.

In Figure 2, a solid line inscribes Lorenzo (L) and James (J), denoting the mathematical focus they share throughout. A dashed line connects Vivian (V) and Katrina (K), denoting friendship, which is how they primarily engage throughout. Katrina remained at the periphery of mathematical work and was therefore never inscribed in a solid line. Vivian, in contrast, reached toward the other partnership when mathematically challenged (solid line), reformulated her position, and finally joined in the shared activities of Lorenzo and James.

Discussion

The outcome of this analysis is the identification and naming of the *workship* as an affinity forged through shared mathematical activity. The workship rhetorically and literally identifies how shared *work* forges new possibilities for peer relation*ships* within a diverse learning community. The idea of workships comes in response to what teachers (and researchers) often treat as foreseeable or predictable adolescent affinities for collaboration (e.g., "Girls are most comfortable with girls in math…" and "Those two are friends..."). I contend that peer relationships forged during mathematical activity are as consequential to issues of equity as affinities we predict prior to mathematical activity. That is, I am identifying how shared mathematical activity shapes a student's relationship to another and

not how relating to one another shapes a student's relationship to mathematics. Therefore the appeal of workships within the greater project of cultivating democratic learning communities is that they represent generative relationships born of diverse youth learning to work together *by working together*. To be clear, whereas the contrast with friendship in this group made the workship even more apparent, such a contrast was coincidental and not necessary for recognizing or naming the workship in this analysis.

Workships and Relational Equity

If the workship is to be considered a promising pedagogical tool for cultivating democratic learning communities, its relationship to relational equity must be interrogated. Workships envision unlikely partnerships forged through shared mathematical activity, while relational equity assures those partnerships emerge as sites of appreciation, communication, and respect. In this case, the workship embodied relational equity: we saw communication, appreciation, and respect for mathematical thinking among Lorenzo, Vivian, and James. That could not be said, however, of the group as a whole. By formulating relationships apart (James and Lorenzo versus Katrina; James, Lorenzo and Vivian versus Katrina), the group as a whole reflected limited communication, appreciation, or respect for one another, let alone shared mathematical activity: Katrina never touched the tiles, she never asked nor was she asked a mathematical question, and she never offered nor received help from Lorenzo and James. In fact, when Ms. Baker identified Katrina as the only one with the correct solution on the third day, the respect and support for learning together was so skewed that silence prevailed instead of a newly created context of shared mathematical activity among them all.

One way to account for the workship is that these were simply high-performing mathematics students seeking each other out. There is some evidence to support this view: Lorenzo, James, and Vivian achieved the highest grades at mid-year (99.2%, 95.5%, and 94.9%, respectively), though two other students also earned A's. In contrast, Katrina's mid-year mathematics grade was 74.4%. When Vivian was asked in her mid-year interview why she chose James and Lorenzo, Vivian explained Lorenzo was someone who got good test scores and was a fast thinker. She similarly thought of James as smart and added, "He's pretty up there with me on how we think." Lorenzo explained he chose Vivian and James because: "We were getting kind of [the] same answer every time we're together and we're doing work…we were getting our work done. Every—everything was perfect" (Mid-Year Interview). Though James' guardians did not consent to him being interviewing, James wrote "would help me with the problems" on his survey to explain his choice of Vivian and Lorenzo. There is nothing in the conceptualization of a workship that would preclude perceptions of "ability" as partially driving affinity. That said, how students develop perceptions of one another's

ability is important. To be consistent with the vision of engendering relational equity, "ability" must be conceived of broadly. This broader vision occurs when, for example, teachers use open-ended tasks to elicit and reward a range of abilities (e.g., Lotan, 2003), employ CI status treatments to help assign competence (Cohen & Lotan, 1995; Webb, 2009), or, more generally, organize opportunities for multidimensional learning (Boaler, 2006b). Certainly teachers like Ms. Baker can organize opportunities for students to create and cultivate unlikely alliances through collaboration, but how students rise to those opportunities and with what consequences deserves more attention. In the context of this study, it means asking: How do we make sense of the workship in terms of Katrina's eventual isolation?

Katrina's Isolation

In culturally or racially heterogeneous settings, we know access to learning opportunities can vary for students where some are more influential than others (e.g., Engle et al., 2008) or are positioned as having more or less authority and ability (e.g., Sengupta-Irving, Redman, & Enyedy, 2013; Gresalfi, Martin, Hand, & Greeno, 2009; Langer-Osuna, 2011). Often, those students who become marginalized are also those who come from non-dominant racial, cultural, linguistic, or gender groups (Kurth, Anderson, & Palincsar, 2002). Katrina was different from the others in multiple ways that positioned her from the start as most vulnerable. She had the lowest grade of the four students, was on academic probation, and was the only one to identify mathematics as her least favorite subject. Katrina was also the only African American female student in the class—an otherwise underrepresented and marginalized community in STEM (science, technology, engineering, and mathematics) education more generally (Katehi, Pearson & Feder, 2009; Ong, Wright, Espinosa, & Orfield, 2011). Ultimately, to make causal claims about Katrina's isolation is beyond the scope of this analysis. What can be argued is that her quiz score did not suggest she was mathematically "less able" than her peers. Her understanding that mathematics was a gatekeeper to realizing her dreams of becoming a college athlete certainly counter any notion she lacked investment in her performance. Moreover, her behaviors in the group do not suggest that she could not conceptually or practically participate in the mathematical activities or discussions of the workship. Indeed, at one point Katrina was the only one to get the correct solution, and yet she was never able to establish a prominent position in shared mathematical activity thereafter. Most important, Katrina's isolation highlights how a definition of equity that is outcome-oriented (i.e., 87% on her quiz) fails to appreciate what relational equity captures. An outcomes approach to equity obscures how Katrina was rarely respected, treated, or supported as a mathematically capable peer. In her mid-year interview, Katrina confided that she saw herself as a good group partner because she understood what was going

on most of the time, but that she also knew her peers did not see her that way. In her sociometric network survey, Katrina identified only one student as an ideal partner: Lorenzo. She explained, "Because he doesn't really mess around and stuff," suggesting she was oriented toward work even if never incorporated into the workship.

By the standards of adolescent affinity, one might argue that Katrina's friendship with Vivian could have signaled greater possibilities of shared mathematical activity than were seen. Indeed, Vivian was unable to broker her friendship with Katrina and the formulation of a workship within the group. Common to both contexts, Vivian was in many ways best positioned to bring about relational equity within the group. As the center image in Figure 2 would suggest, Vivian had opportunities to bridge between the friendship she shared with Katrina and the workship she created with Lorenzo and James, but instead moved from one toward the other. For Vivian, similar to James and Lorenzo, Katrina was seen as a "problem" in the group even when that "problem" had the solution. Wortham (2004a) similarly examines how teachers and students reformulate the identity of a student named Tyisha from "good student" to "outcast," where, by drawing multiple resources, her identity as an outcast thickens (Holland & Lave, 2001) over time. This analysis cannot speak to the thickening of Katrina's identity as an outcast (what might occur over time in a specific local context) but does indicate, as Wortham (2004a) explains, how particular events can signal her positioning as a problem or outcast at a given time (p. 166). Thus, unlike most studies of CI, this analysis attempts to explore how students may take up the aims of CI (relational equity, for example) as part of their interactions with others. After all, having three high-performing students declare an exclusive affinity for one another ran directly counter to Ms. Baker's goals of equitable learning. And yet, I consider the workship a potential pedagogical tool of democratic learning communities because making peer collaboration a generative experience, making mathematical learning in a diverse community a generative experience, means recognizing that some of this work is beyond the direct management of teachers. Or at a minimum, it takes recognizing the significant challenge for one high school teacher to pedagogically counter traditional "smart student" hierarchies established in many years of prior schooling.

The Limits of Pedagogy in Stratified Settings

Under the rubric CI, the responsibility to fold Katrina into the others' activities lies primarily with the teacher and not with the students. Ms. Baker's attempts at status treatments, asking if anyone listened to Katrina for example, largely failed. She also inadvertently set up some of the prevailing dynamics, particularly between Vivian and Katrina. Calling on friendship as what keeps people on track rather than, for example, the task itself or a commitment to the group overall, al-

lowed James and Lorenzo to largely abdicate any responsibility in attending to Katrina. This discursive move at the start—gendered and affinity-oriented—arguably set in motion the contexts as formulating apart rather than together. Thus, she saw little pedagogical recourse for the dynamics prevailing in the group.

As I identify the shortcomings of Ms. Baker's pedagogical moves, I must also acknowledge how she used a pedagogy of equity within a highly stratified school environment. CI was not uniformly adopted in the mathematics program, and the messages of competition and hierarchy were embedded in how the students understood their current placement (i.e., lowest track of mathematics) and their future placement. By examining CI within a school setting that is institutionally different (though not necessarily demographically different) to that of Boaler and colleagues (Boaler, 2006a, 2008; Boaler & Staples, 2008) we begin to see the affordance and limitations of pedagogy in advancing relational equity when the institution may be organized to undermine such efforts.

Conclusion

This case study was set in the lowest track of a racially and ethnically diverse and economically stratified suburban/urban high school. The teacher's pedagogical aims included cultivating a democratic learning community in which students expressed relational equity—respect, appreciation, and communication through mathematical activity. At mid-year, a network survey administered during individual student interviews showed how shared social attributes or history, which are often used as a basis for predicting adolescent affinity, could not fully account for who students identified as ideal collaborative partners. Through analyses of field notes, I explored why three students, whose triadic preferred partnership emerged as distinct from all others in the network, developed an affinity through mathematical activity—what I termed a workship. Moreover, this workship reflected relational equity, a link that allows us to imagine a closer relationship between collaborative learning and the greater social project of cultivating democratic learning communities among diverse people.

For educators, anticipating and encouraging diverse peer relationships is both ideologically and practically linked to the development of supportive learning communities. Workships remind us that democracies are built on the notion that everyone can contribute and that everyone should be valued, with or without shared social attributes. The tension presented in this case is that the democratic appeal of workships, of cultivating diversity in how and why adolescents value one another, can emerge in such a way that fails to incorporate everyone in the collective. That is, achieving relational equity uniformly in a group, let alone a classroom community, is a significant challenge even for motivated and experi-

enced teachers like Ms. Baker. When considered in light of the institutional setting, we can see constraints on a teacher's pedagogical efforts to develop democratic learning communities. Nonetheless, educators must endeavor to support students in seeing the value of unlikely peer collaborators, of creating alliances for learning that challenge the logic of social and academic hierarchies in their schools and communities, because doing so is among the greatest tools in our arsenal for assuring the longevity of democratic opportunity.

For researchers, this analysis offers a new vantage point for exploring adolescent affinity and mathematics learning, where the conditions for affinity are set in motion pedagogically, and the actualization of affinity may be expressed through shared activity. In terms of research on CI, the emphasis on students' actions and talk over the mediating power of the teacher shifts the analytic home toward *in situ* peer interactions as demonstrating the extent to which the goals of a pedagogy are realized. This work presses for better ways of conceptualizing a relationship between collaborative learning and democracy; for going beyond pedagogy to consider the educative value of student interactions in marking what is possible (or not) in the creation of learning environments that disrupt hierarchy, advance mathematical learning, and express relational equity throughout.

References

Abraham, J. (Ed.). (1995). *Divide and school: Gender and class dynamics in comprehensive education*. Bristol, PA: The Falmer Press.

Azmitia, M., & Montgomery, R. (1993). Friendship, transactive dialogues, and the development of scientific reasoning. *Social Development, 2*(3), 202–221.

Barron, B. (2003). When smart groups fail. *The Journal of the Learning Sciences, 12*(3), 307–359.

Boaler, J. (2006a). 'Opening our ideas': How a detracked mathematics approach promoted respect, responsibility, and high achievement. *Theory Into Practice, 45*(1), 1–11.

Boaler, J. (2006b). Urban success: A multidimensional mathematics approach with equitable outcomes. *Phi Delta Kappan, 87*(5), 364–369.

Boaler, J. (2008). Promoting 'relational equity' and high mathematics achievement through an innovative mixed-ability approach. *British Educational Research Journal, 34*(2), 167–194.

Boaler, J., & Greeno, J. G. (2000). Identity, agency, and knowing in mathematical worlds. In J. Boaler (Ed.), *Multiple perspectives on mathematics teaching and learning* (pp. 45–82). Stamford, CT: Ablex.

Boaler, J., & Staples, M. (2008). Creating mathematical futures through an equitable teaching approach: The case of Railside School. *Teachers College Record, 110*(3), 608–645.

Buchanan, M. (2002). *Nexus: Small worlds and the groundbreaking theory of networks*. New York, NY: Norton & Company.

Cabana, C., Shreve, B., Woodbury, E., & Louie, N. (Eds.). (2014). *Mathematics for equity: A framework for successful practice*. New York, NY: Teachers College Press.

Cazden, C. B., & Beck, S. W. (1988). *Classroom discourse*. New York, NY: Teachers College Press.

Civil, M. (2014). Guest editorial: Musings around participation in the mathematics classroom. *The Mathematics Educator, 23*(2), 3–22.

Civil, M., & Planas, N. (2004). Participation in the mathematics classroom: Does every student have a voice?. *For the Learning of Mathematics*, *24*(1), 7–12.

Cohen, E. (1994). *Designing group work: Strategies for heterogeneous classrooms*. New York, NY: Teachers College Press.

Cohen, E., & Lotan, R. (1995). Producing equal-status interaction in the heterogeneous classroom. *American Educational Research Journal, 32*(1), 99–120.

Cohen, E. G., & Lotan, R. A. (2004). Equity in heterogeneous classrooms. In J. A. Banks, & C. A. M. Banks (Eds.), *Handbook of research on multicultural education* (2nd ed.). (pp. 736–750) San Francisco, CA: Jossey-Bass.

Cohen, E. G., Lotan, R. A., Scarloss, B. A., & Arellano, A. R. (1999). Complex instruction: Equity in cooperative learning classrooms. *Theory Into Practice, 38*(2), 80–86.

Corsaro, W. A. (1985). *Friendship and peer culture in the early years*. Norwood, NJ: Ablex.

Creswell, J. W. (2007). *Qualitative inquiry and research design: Choosing among five approaches* (2nd ed.). Thousand Oaks, CA: Sage.

Cross, L., Parker, A., & Cross, R. (2004). *The hidden power of social networks: Understanding how work really gets done in organizations*. Boston, MA: Harvard Business School Publishing Corp.

Eckert, P. (1989). *Jocks and burnouts: Social categories and identity in the high school*. New York, NY: Teachers College Press.

Engle, R. A., Langer-Osuna, J., & McKinney de Royston, M. (2008). Toward a model of differential influence in discussions: Negotiating quality, authority, and access within a heated classroom argument. In B. C. Love, K. McRae, & V. M. Sloutsky (Eds.), *Proceedings of the 30th annual conference of the Cognitive Science Society* (pp. 2010–2015). Austin, TX: Cognitive Science Society.

Engle, R. A., Langer-Osuna, J. M., & McKinney de Royston, M. (2014). Toward a model of influence in persuasive discussions: Negotiating quality, authority, privilege, and access within a student-led argument. *Journal of the Learning Sciences*, *23*(2), 245–268.

Esmonde, I. (2009). Ideas and identities: Supporting equity in cooperative mathematics learning. *Review of Educational Research, 79*(2), 1008–1043.

Featherstone, H., Crespo, S., Jilk, L., Oslund, J., Parks, A., & Wood, M. (2011). *Smarter together! Collaboration and equity in elementary math classrooms.* Reston, VA: National Council of Teachers of Mathematics.

Gresalfi, M. S., & Cobb, P. (2006). Cultivating students' discipline-specific dispositions as critical for pedagogy and equity. *Pedagogies, 1*(1), 49–58.

Gresalfi, M., Martin, T., Hand, V., & Greeno, J. (2009). Constructing competence: An analysis of student participation in the activity systems of mathematics classrooms. *Educational Studies in Mathematics, 70*(1), 49–70.

Hand, V. (2012). Seeing culture and power in mathematical learning: Toward a model of equitable instruction. *Educational Studies in Mathematics, 80*(1-2), 233–247.

Hatch, J. A. (2002). *Doing qualitative research in education settings.* Albany, NY: State University of New York Press.

Holland, D., & Lave, J. (Eds.) (2001). *History in person: Enduring struggles, contentious practice, intimate identities*. Santa Fe, NM: School of American Research Press.

Katehi, L., Pearson, G., and Feder, M. (2009). *Engineering in K-12 Education: Understanding the status and improving the prospects*. Washington, DC: The National Academies Press.

Kendon, A. (1990). *Conducting interaction: Patterns of behavior in focused encounters*. Cambridge, United Kingdom: Cambridge University Press.

Kotsopolous, D. (2010). When collaborative is not collaborative: Supporting student learning through self-surveillance. *International Journal of Educational Research, 49*(4-5), 129–140

Kurth, L. A., Anderson, C. W., & Palincsar, A. S. (2002). The case of Carla: Dilemmas of helping all students to understand science. *Science Education, 86*(3), 287–313.

Langer-Osuna, J. M. (2011). How Brianna became bossy and Kofi came out smart: Understanding the trajectories of identity and engagement for two group leaders in a project-based mathematics classroom. *Canadian Journal of Science, Mathematics and Technology Education, 11*(3), 207–225.

Lotan, R. A. (2003). Group-worthy tasks. *Educational Leadership, 60*(6), 72–75.

McDermott, R., Gospodinoff, K., & Aron, J. (1978). Criteria for an ethnographically adequate description of concerted activities and their contexts. *Semiotica, 24*(3-4), 245–276.

Miell, D., & MacDonald, R. (2000). Children's creative collaborations: The importance of friendship when working together on a musical composition. *Social Development, 9*(3), 348–369.

Moschkovich, J. (1999). Supporting the participation of English language learners in mathematical discussions. *For the Learning of Mathematics*, 19(1), 11–19.

Ong, M., Wright, C., Espinosa, L. L., & Orfield, G. (2011). Inside the double bind: A synthesis of empirical research on undergraduate and graduate women of color in science, technology, engineering, and mathematics. *Harvard Educational Review*, *81*(2), 172–209.

Peshkin, A. (1988). In search of subjectivity—One's own. *Educational Researcher, 17*(7), 17–21.

Roth, W. M. (2014). Learning in the discovery sciences: The history of a "radical" conceptual change, or the scientific revolution that was not. *Journal of the Learning Sciences, 23*(2), 177–215.

Sengupta-Irving, T., Redman, E., & Enyedy, N. (2013). Re-storying practice: Using stories about students to advance mathematics education reform. *Teaching and Teacher Education, 31*, 1–12.

Sfard, A., & Kieran, C. (2001). Cognition as communication: Rethinking learning-by-talking through multi-faceted analysis of students' mathematical interactions. *Mind, Culture and Activity, 8*(1), 42–76.

Strough, J., Berg, C., & Meegan, S. (2001). Friendship and gender differences in task and social interpretations of peer collaborative problem solving. *Social Development, 10*(1), 1–22.

Strough, J., Swenson, L. & Cheng, S. (2001). Friendship, gender, and preadolescents' representations of peer collaboration. *Merrill-Palmer Quarterly, 47*(4), 475–499.

Tatum, B. D. (2003). *Why are all the Black kids sitting together in the cafeteria?: And other conversations about race*. New York, NY: Basic Books.

Teasley, S. D., & Roschelle, J. (1993). Constructing a joint problem space: The computer as a tool for sharing knowledge. In S. P. Lajoie & S. J. Derry (Eds.), *Computers as cognitive tools* (pp. 229–258). Mahwah, NJ: Erlbaum.

Turner, E., Dominguez, H., Maldonado, L., & Empson, S. (2013). English learners' participation in mathematical discussion: Shifting positionings and dynamic identities. *Journal for Research in Mathematics Education, 44*(1), 199–234.

Wasserman, S., & Faust, K. (1994). *Social network analysis: Methods and applications*. Cambridge, United Kingdom: Cambridge University Press.

Webb, N. M. (1984). Sex differences in interaction and achievement in cooperative small groups. *Journal of Educational Psychology, 76*(1), 33–44.

Webb, N. M. (1991). Task-related verbal interaction and mathematics learning in small groups. *Research in Mathematics Education*, *22*(5), 366–389.

Webb, N. M. (2009). The teacher's role in promoting collaborative dialogue in the classroom. *British Journal of Educational Psychology, 79*(1), 1–28.

Wilkinson, I. A., & Fung, I. Y. (2002). Small-group composition and peer effects. *International Journal of Educational Research, 37*(5), 425–447.

Wood, M. B. (2013). Mathematical micro-identities: Moment-to-moment positioning and learning in a fourth-grade classroom. *Journal for Research in Mathematics Education, 44*(5), 775–808.

Wortham, S. E. (2004a). From good student to outcast: The emergence of a classroom identity. *Ethos, 32*(2), 164–187.

Wortham, S. E. (2004b). The interdependence of social identification and learning. *American Educational Research Journal, 41*(3), 715–750.

Wortham, S. E. (2005). Socialization beyond the speech event. *Journal of Linguistic Anthropology, 15*(1), 95–112.