NCSM Journal

of Mathematics Education Leadership

FALL/WINTER 2019 VOL. 20, NO. 2

NCSM–Leadership in Mathematics Education www.mathedleadership.org

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Equity-Focused Professional Development for Algebra I Teachers in Urban Districts

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Abstract

Student data show that there is a need to develop a more culturally responsive mathematics teaching force. As such, we developed a framework for equity-focused professional development (EFPD) for mathematics teachers through which we hope to improve student access to mathematical knowledge. In this paper we present our EFPD framework, program, and initial results related to culturally responsive mathematics teaching. Further, we describe our process for tracking teacher progress. In this context, we present struggles that we have faced in implementing this framework in an effort to contribute to ongoing discussions about the ways in which the educational system in general and the current political climate in education impact EFPD.

American students' average scale mathematics scores on the National Assessment of Educational Progress (NAEP) have consistently increased since 1990, yet the gaps in performance across ethnic groups persist (NAEP, National Center for Education Statistics 2017). This disparity in performance outcomes, in addition to the need to think about mathematics education more comprehensively (Gutiérrez & Dixon-Román, 2011), has highlighted the need for designing learning environments that address the educational needs of an increasingly diverse student population. Professional learning for mathematics teachers in the form of equity-focused professional development (EFPD) has the potential to address this problem.

In this work, EFPD for mathematics teachers is characterized as professional development that fosters culturally responsive teaching practices that "draw meaningfully on the cultures, languages, and experiences that students bring to classrooms to increase engagement and academic achievement for students" (Dutro, Kazemi, Balf & Lin, 2008, p. 271) in an effort to diminish the existing achievement gaps and counter the dominant deficit discourse surrounding underserved students in mathematics classrooms. As such, EFPD provides in-depth content support for teachers while explicitly addressing and centering race, class, and identity in the program. The shift towards culturally responsive mathematics teaching is foundational, and in-depth content knowledge supports teachers enacting more equitable teaching.

Culturally responsive mathematics practice (CRMT) (Bonner, 2014; Gay, 2000; Gonzalez 2009; Ladson-Billings, 1994), has roots in, " . . . a pedagogy of opposition [that is] committed to collective, not merely individual empowerment" (Ladson-Billings, 1995, p. 160). The literature base in culturally responsive teaching (CRT) provides a theoretical framework within which innovative practice can develop; however, systemic structures complicate the ability for teachers and teacher educators to enact culturally relevant practice in meaningful, holistic ways. In teacher education there are hallmarks of CRT that are important to teacher practice in general, not just in mathematics. As such, culturally responsive teachers operate from a

foundationally critically conscious framework that underlies practice. Culturally responsive teachers are committed to learning about and from students (Bonner, 2014; Villegas & Lucas, 2002) to capitalize on students' funds of knowledge (Moll et al., 1992) in the classroom. This requires teachers to focus on developing culturally connected ways of communicating with students so that transmission of knowledge, and therefore power, can be transferred in the classroom more seamlessly (Bonner, 2012). Through these practices teachers develop an asset-based view of students (Villegas & Lucas, 2002), implicitly and explicitly value the knowledge that students bring to the classroom, and help them to see how their knowledge base is valuable in operating in various settings (Gay, 2010).

Culturally responsive teachers build relationships with students by attending to the development of students' complex identities in and out of the classroom (Aguirre, Mayfield-Ingram, & Martin, 2013). This means disrupting deeply held beliefs about students that may have been ategorized as "low" or "at risk" and rejecting deficit language. Students from all backgrounds have shown resilience in a variety of settings (Martin, 2000) and are capable of brilliance in mathematics if given the opportunity (Turner & Celedon-Pattichis, 2011). As such, culturally responsive teachers utilize communication, knowledge, and relationships to disrupt the dominant narrative and create pathways and access for traditionally underserved students to thrive in mathematics and beyond. While much work on CRT has been done, there is little that speaks to professional development for in-service secondary mathematics teachers as a tool for developing culturally responsive practice.

Purpose of the Study

The purpose of this study was to determine if an ongoing professional development program that specifically focused on building mathematics content and equity-based practice was effective in developing more culturally responsive mathematics educators. The goal of that program was to improve the educational experiences of traditionally underserved students in mathematics classrooms. The study presented here explores the successes and struggles of this EFPD program and is meant to contribute to discussions in the literature around equity-focused professional development of mathematics educators. As such, this paper aims to present a comprehensive overview of our framework for EFPD and present findings related to ongoing struggles experienced within this framework that relate not only to this topic but also to larger conversations about the impact of professional development on teacher practice, particularly as it relates to underserved populations.

Description of the Program

The City Mathematics Collaborative[1] (CMC) is a program that provides long term (at least two years) professional development to mathematics teachers teaching in schools with high populations of traditionally underserved students. The program emerged due to state-wide needs in mathematics education and is federally funded. The program has served over 100 in-service Algebra I teachers who teach in one of several high-need urban districts, each of which serves traditionally underserved students from low socioeconomic neighborhoods. Teachers in these districts were recruited in teams (by district), and have been targeted for professional development based on district need (districts with high percentages of failing students are given priority), teacher content knowledge (number of advanced mathematics courses taken), years of service, or certification issues (alternatively certified or not certified in instructional area). Below is general information to give the reader a snapshot of the teachers involved in the project. These are averages over six years (three two-year iterations) of the project:

- Teachers have completed an average of nine hours in college level mathematics content courses.
- 20% of teachers have an undergraduate degree in mathematics content.
- 80% of teachers were alternatively certified.
- 10% of teachers were not certified in mathematics.
- Teachers have an average of seven years of experience (years of experience range from 1-25).
- Districts are among the lowest performing in the city in mathematics.

The CMC has two major components: a 45-hour summer course (three hours per day for three weeks) and 65 hours of professional development during the academic year (sessions are held roughly one Saturday per month). The summer course focuses largely on developing teachers'

[1] A pseudonym has been used

mathematics content knowledge but includes several other unique components. For example, master teachers from urban districts infuse the content-focused instruction with research-based, culturally responsive practices. Further, participants engage in an online component, eCommunity of practice, in which they are prompted to discuss issues of equity, reflect on topics from class, and work as a team to develop culturally responsive habits and action research plans that will help to investigate inequity and promote equity in their schools.

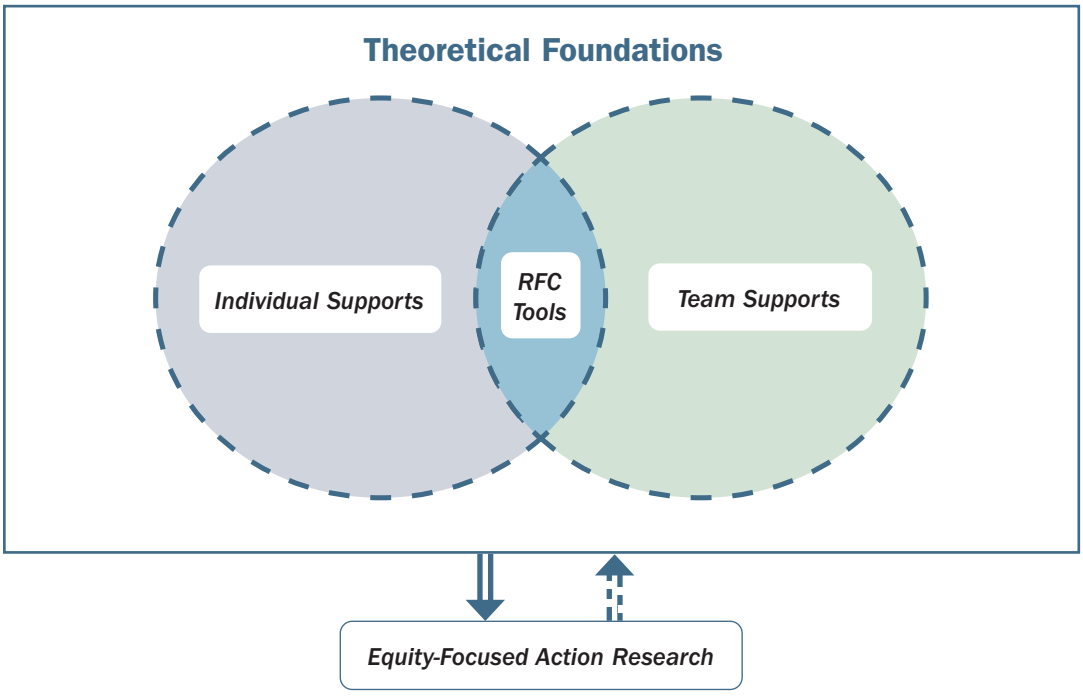
During the academic year, content of Saturday sessions is determined by specific district and teacher needs. For the cohort in this study, the most notable sessions centered on using technology in the teaching of Algebra I (calculators, GeoGebra, Wii gaming systems), and teacher planning and alignment. Further, teachers continued to engage in the eCommunity of practice and worked to build an ePortfolio throughout the academic year.

Throughout the academic year, data about the project were gathered from multiple sources, including interviews with participants (a minimum of every six months), classroom observations, the eCommunity of practice discussions and reflections (individual and group), and field notes from professional development sessions. Data were transcribed and deidentified before coding. A three-tiered coding scheme (open, axial, selective) and constant comparison (Glaser & Strauss, 1967) were utilized to unearth themes from the data. These themes gave us insight into the broad spectrum of data that we collected and helped us to identify patterns that emerged. We will report on this program and the ways in which various aspects and experiences impacted teacher practice and student learning as well as the components of the program that were not successful in impacting teacher practice.

Equity-Focused Professional Development Framework

Given the unique population of students served by our teachers, we explicitly focused our professional development sessions on issues of equity in mathematics including components that would contribute to a greater attention to these issues among teachers. Our initial framework is presented in Figure 1 and includes several foundational pieces: ready for classroom (RFC) tools (Gage, 1974), theoretical foundations, individual support (Fullan, 1991) and team building (Lieberman & Miller, 1991; Calderón, 1999) in the context of ongoing professional development and research. It is in the intersection of these foundational experiences that we hope to see meaningful outcomes such as equity-focused action research which may be useful in helping teachers to identify and challenge educational

FIGURE 1. *EFPD framework*



inequities that they see in practice (Cornell, 2012). Here we will provide details about the major aspects of our framework as a context for our research results so far and ongoing "struggles."

The EFPD framework is rooted in literature- and practice-based foundations on which we focus when developing professional development sessions and other experiences. In the short term, the goal in structuring the program around these areas is that together these foundations will serve as catalysts for more meaningful, deep, equitable practice among teachers. In the long term, the goal is for teachers to take these foundations forward together and facilitate change on their campuses and in their districts. It should be noted that although mathematics content knowledge is not its own category, it underlies all activities.

Theoretical foundations. All of the work that we did in facilitating professional development sessions and other supporting activities was rooted in theoretical foundations. Most readily, we centered discussions around culturally responsive teaching (Gay, 2000; Ladson-Billings, 1995), highlighting the following practices as central to this work:

- Learn about and honor cultural heritages, which affect students' ways of communicating, ways of learning, dispositions, and attitudes,
- Honor cultural heritages, which affect teachers' ways of teaching,
- Communicate consistently high expectations through challenging tasks, respect, and high level discourse that is culturally connected,
- Design instruction to promote student engagement and build bridges between lived and abstract mathematical concepts,
- Challenge the status quo, and provide opportunities for students to do the same.

As the facilitators and mentors operated from an equity perspective, these theoretical foundations were not only discussed, but also modeled and centered throughout the program. This was done in explicit ways, such as discussions around readings and classroom events, and in implicit ways, such as through targeted questioning that guided teachers to think about moves from an equity perspective. For example, during the first professional development session that we held, teachers read Wheatley's *Willing to be Disturbed* (2002, sessions 1 and 2) to set the stage for difficult discussions, teamwork, and individual growth. We also utilized Aguirre, Mayfield-Ingram, and Martin's (2013) guiding questions: "What mathematics, for whom? For what purposes?" (p. 5) to guide our discussion (sessions 1 and 2). These questions reinforced the central idea of constructing knowledge together about problems that have yet to be solved. Teachers also discussed McIntosh's (1989) White Privilege Inventory and the strengths and weaknesses of this type of tool (session 3). This facilitated discussions about race, privilege, and status, and the ways that these constructs affect students and schooling. Teachers also completed seminal readings such as chapters from Geneva Gay's (2010) *Culturally Responsive Teaching* (session 5), Sensoy & DiAngelo's (2012) *Is Everyone Really Equal?* (session 5), and Gloria Ladson Billings' (1994) *The Dreamkeepers* (sessions 5 and 6) during the project.

As we moved through the program, we kept these conversations and aforementioned bullet points as foundations for our work and continually referenced them as guides for best practice. Notably, this affected the ways in which teachers (and teacher educators) were more careful when using deficit language to describe learners. Ultimately, we saw these theoretical foundations facilitate paradigm shifts towards culturally responsive practice. We also held online discussions related to these ideas. For example, if a teacher taught a lesson and encountered an issue that called into question an issue of equity or access, he or she might post a thought question on our discussion board, and others could contribute or discuss as they were able. This allowed for more continuous dialogue in a safe space throughout the program.

Individual and team supports. At the campus level, we provided teachers with implementation support at both the individual and team level. For example, a teacher mentor made regular visits to each participating campus. Each mentor was assigned to particular campuses for which they were primarily responsible. Some crossover was intentionally built in to encourage collaboration. Mentors traveled to assigned campuses and classrooms to provide specific feedback to participants in the course of teaching. This included observing, providing feedback on particular areas of interest to the teacher and/or project, co-teaching with participants, and providing emotional support. Project directors also visited each classroom at least one time per semester. In addition, peer observations and feedback were also encouraged, and we noted that these interactions occurred voluntarily, even when the mentor was not present.

To complement the individual support that teachers received, we provided team support at the campus and district levels. At the campus level, teacher mentors found common times where teachers could discuss specific lessons and action plans as well as ways in which they could support each other. These meetings operated in a fluid manner depending on schedules and new issues that may have come up. They often functioned as a support group to build community. When possible, campus administrators such as department chairs were invited to attend and contribute to these conversations. At the district level, teacher visits were facilitated between campuses. This allowed for discussions about vertical and horizontal alignment and helped teachers to see what was happening across the district.

Ready for classroom tools. In the course of recruiting teachers, we learned that participants desired tangible "tools of the trade" (Gage, 1974) that were physical manifestations of the theoretical ideas we were advancing. As such, we sought to provide professional development sessions that would provide these ready for classroom tools. To cue thinking (McTighe & Lyman, 1988) and facilitate discussion among the teachers, we had participants read short, key articles in preparation for a session and then engaged them in online discussions. These online discussions provided the bridge necessary to facilitate the development of praxis, that point where theoretical discussion meets practical application.

Many of our initial workshops focused on this area and addressed topics such as using an NSpire calculator to teach functions and using tools such as GeoGebra to facilitate problem-based learning. Further, participants spent much of the summer working with two master teachers who shared many ideas for projects and other instructional tools.

Equity-focused action research. The foundations of our framework are meant to serve as springboards to more meaningful experiences and actions in the classroom, particularly in terms of equitable practice. Our focus, therefore, is in accomplishing these outcomes as a result of providing the foundations. In looking at our foundations, for example, we have stated that teachers came to our program hungry for RFC tools. In our view, this was a great opportunity to provide teachers not only with these tools, but also with knowledge in theoretical foundations that would allow them to take RFC tools and adapt them for their particular population. Through this process, teachers were involved in innovating[2] to develop new tools and ideas about curriculum. Given the districts' focus on packaged curricula, we saw this as an area that needed particular attention. Further, we hoped that providing individual support and tools, such as calculators, computers, and literature, would help teachers to innovate in other ways such as using technology as a tool to promote equity.

In order to support this type of innovation beyond the project, we engaged teachers in action research projects to inform the most effective types of instruction for their particular population. These types of projects had both an individual and group component, and they allowed teachers to focus on areas that were of particular interest to them. For example, a teacher could choose to investigate whether a particular computer program (an RFC tool) supported a student's understanding of equivalent fractions. Alternately, a team of teachers could develop a community-based lesson and implement it across classes to determine if that type of lesson had an effect on student engagement and achievement.

The results of teachers' research studies were shared across the CMC project and beyond. As such, teachers learned to use a sustaining tool that allowed them to design classroom research projects to inform instruction and promote equity. Further, teachers began to advocate for themselves and each other using data collected in classrooms. For example, one group of five teachers from a particular campus found that providing access to a particular computer program for three minutes per day helped students to master basic skills, thus increasing achievement across the board. As a team, they disaggregated their data to show the administration that this was most beneficial to traditionally underserved students and advocated that this should be available to students across campus to promote a more equitable environment.

Outcomes and Discussion

The purpose of this study was to determine if an ongoing professional development program that specifically focused on building mathematics content and equity-based practice

[2] We define teacher innovation as the implementation, on any scale, of a new idea, activity, or teaching method in or out of the classroom.

was effective in developing more culturally responsive mathematics educators. Across all of our data several themes emerged that provide some insight into this type of work with this particular population.

Sustained Support

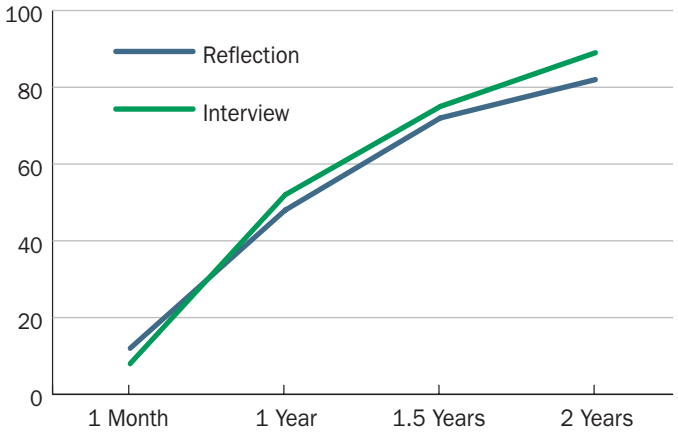
As detailed in Figure 2 and Table 1, we saw shifts in pedagogy and approaches to teaching over the two years that teachers were engaged in the program. It is important to note, however, that many of these shifts occurred very gradually, with the most notable movement towards CRT happening towards the end of the project. This pattern was most evident in interview and online reflection data collected from participants. On average, the number of participants who discussed some aspect of culturally responsive teaching in subsequent instances of interviews and reflections grew substantially. Figure 2 shows quantitatively (by count) the drastic increase in discussion of CRT tenets across the project. We believe these sharp increases were due to continued and in-depth discussion of these ideas in individual, team, and online settings. Our observation data showed similar trends, but the interview and reflection data were particularly relevant as these data came directly from the teachers themselves.

Sustained support also decreased deficit language used by teachers in the program. After one year in the program, teachers' use of deficit language in online reflections decreased by 78%. This was a major shift away from using the words "low", "at risk" or "below grade level" to describe students.

Innovation

Generally, teachers who were in the project for one year showed more willingness to innovate in culturally responsive ways in the classroom. This finding is supported by classroom observations. In interviews and surveys, teachers indicated that they were more concerned with "whether a student gets the concept, not just the answer" than they were at the beginning of the project. Further, teachers reported that although it was "scary to try new things, it is great to embrace what the kids know and roll with it." It is important to note that it took many months for us to see any changes in practice. This supports the notion that long term, sustained professional development, as opposed to day long sessions, are more likely to have an impact on classroom practice.

FIGURE 2. *Participant (on Average) Articulation of CRT across Years in Project*



In relation to the culturally responsive practices of participants, we found through classroom observations and interviews that 82% of participants (1) exhibited a greater awareness of the role of culture in the mathematics classroom, and (2) exhibited a greater ability to verbalize about culturally responsive mathematics teaching. These transitions are shown in Table 1. Interviews cited here were roughly 1.5 years apart. While this does not always imply action on the part of the teacher, it was apparent that willingness to discuss issues surrounding culture greatly increased over time. This made it possible for us to more readily discuss issues of equity in recent group sessions.

Sample responses for four participants are shown in Table 1. These findings were triangulated with observational and online discussion data. Participant C, for example, began the school year relying heavily on direct instruction. After looking at data on student achievement and purposeful attention to student engagement, this teacher has incorporated structured discussions around mathematical tasks into his class more readily. Though this teacher still heavily relies on teacher-centered approaches, our data show that he is now more engaged in online discussions with others about ways to innovate in his classroom and is more attentive to student engagement. Participant D emerged as a leader in the group and, eventually, in various communities in the city. For example, her mural projects which combine art and mathematics have been widely publicized, and she speaks of these as emancipatory practices for students. She has spoken at university and conference events about decolonization and racism in the education system.

Table 1: Sample Interview Responses

Participant	Interview #1 (beginning of project)	Interview #3 (1.5 years into project)	Observations (o) discussions (d)
Participant A	"It is not really an issue in my class. In math I treat [all students] the same."	"I've learned to adapt, that every student has a different learning style and you've got to try to adapt and cater to that… as difficult as it might be, but it helps the student."	Small groups pulled to engage in problem solving (o) Teacher says "It was smart when you"…(o) "Our students bring so much knowledge to teh [sic] table, I never thought to use their culture (in instruction) before." (d)
Participant B	"I think it plays a part but I just try to be fair…make sure everyone gets the same chance. I don't focus on it."	"I see that every district is different and every classroom is different. And it's more of a multicultural and how to deal with everybody and how to deal with differences, than necessarily how to deal with one particular culture."	"When I use problem tasks the students can come at it from different angles and strategies. Sometimes they get frustrated but that's good" (d) Whole lesson is gradual release of responsibility; no student discourse (o, beginning of project) 5 minutes, introduce task [task listed], 20 minutes students working in groups with teacher questioning strategies…last 10 minutes students share strategies (o, end of project)
Participant C	"I make sure everybody gets the same opportunity to work hard."	"I realized we have the cultures of pretty much, you know, the whole inner city…which is rich now I see. And with that I get to talk to parents, I see how it is at home and can use that in my teaching."	
Participant D	"I hold them all to that [high] expectation. No excuses even if they are from that side [of the city]".	"[Now] I'm able to relate a little bit more. [For example] when we're talking about graphs and we're talking about intersections I ask them "what part of the city do you live on?" and they tell me and I use a name from that part of the city. So I'm using street names from that part of the city, and they're like "oh, that's what it means?" and they're like "Yea, that's an intersection". So,I kind of go to where they live, kind of their mentality, even when I talk to the parents.	Teacher discussing mural project with students (teacher and students will be painting a mural in the neighborhood called "Always Learning" that combines mathematics and art, o) Switches between Spanish and English when explaining concepts(o) "My struggles in the past are what makes me who I am and why I can relate. These kids don't see their value until you help them see their value."

Team Building

The EFPD of this program increased CRT on a team level through intentional focus. Overall, our data show that the main factors in galvanizing teams were providing ideas for innovation and creating a space where teachers can discuss, debate, and plan to implement such ideas in a structured, team-focused setting. Teams indicated that not only had they "never [before] really had the opportunity to sit down collectively as a group and talk about what we got out of [a session or lesson] and debrief about our classroom," but also that they "were able to discuss the ways that we would implement these tools in our classrooms immediately so that students can benefit." Participant reflections also provided data to this effect. Teachers from one team described disaggregating student data and noticing different trends that correlated with race, class, and/or gender. In explicitly focusing on these categories in their teams, teachers began to deconstruct their practice to determine what they could do to provide access to the students who, as was shown by data, had not been successful in classroom mathematics.

Professional Development "Gap"

While issues continually emerge in most PD projects, one area, which we have termed the "professional development gap," was determined to be particularly notable because of frequency and severity. For a variety of reasons, teachers in our project struggled to implement innovative practices in their classrooms for sustained periods of time. As such, we found what we are calling a "professional development gap" (PDG). DuFour (2005) coined the phrase "knowing-doing gap" (KDG) to refer to the disconnect that exists between teacher knowledge of best practice (in terms of student engagement and achievement) and actual classroom practice which may not align with what teachers know. Our PDG builds on this idea but does not assume that teachers inherently "know" best practices, since pedagogy and instructional techniques are often defined within a district politically.

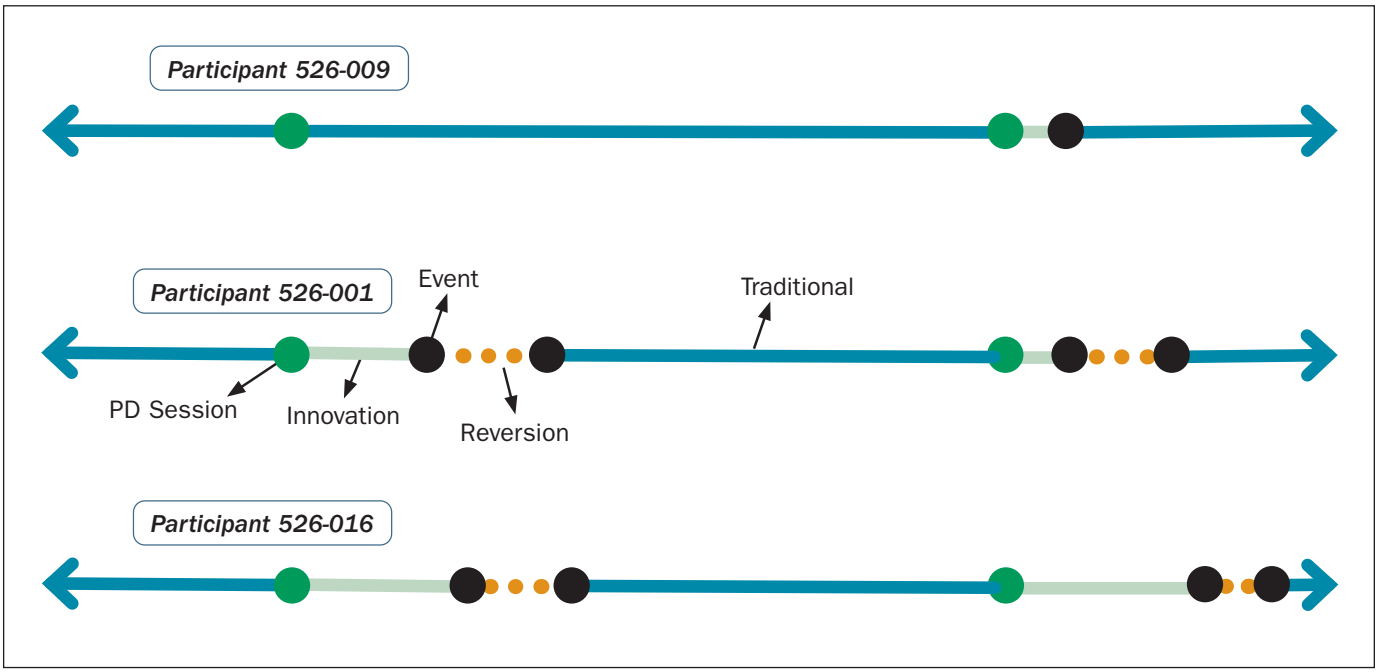
As our project indicates, we believe that teachers need ongoing, sustained professional development, especially in mathematics (Birman et al., 2007) that provides a space not only for teachers to gain new knowledge, but also to discuss, plan, and collaborate with other educators in ways that are constructive in terms of navigating the test-driven climate in many schools. Further, teachers need support at the classroom level to put these ideas into practice in the midst of scripted curricula and district mandates. The PDG, then, refers to the lapse that some teachers experience, largely due to school-related factors, back to traditional teaching methods that are not conducive to student achievement or engagement between professional development and support sessions.

When we noticed the trend that led us to the PDG, we began tracking individual teacher practice in terms of innovation, implementation of non-traditional practice (learned through the project or otherwise), and student engagement (as observed). Examples of these data points are shown below in Figure 2. As discussed earlier, teachers in this project were recruited because of gaps in background knowledge and low student achievement. Initial observations showed that 17 out of 18 (94%) of teachers employed largely traditional, "banking" style (Friere, 1970) teaching methods. As such, when tracking practices, we deemed "innovation" as any observed deviation from this traditional model for a sustained period of time (at least one lesson). "Reversion" (orange, dotted line) refers to largely traditional practice with hints of innovation. For example, a teacher in "reversion" may engage students in a problem-based task, but then walk them through the content step-by-step.

Results of this tracking from three participants are presented in the figures that follow. Though the three figures do not align in terms of time, we believe that there are many implications of these findings. In order to bring clarity to our model, we will briefly walk the reader through the first pieces of our findings related to participant 526-001. The timeline begins on the left-hand side of the model. Here, we first observed this participant employing largely teacher-led, lecture-based lessons. Specifically, the teacher would stand at the front of the classroom and use a projector to take notes, which students were expected to copy as she went. Students were rarely engaged, and engagement was usually related to behavior. For example, the teacher would notice a student sleeping and would call the student's name in the middle of the lesson in an effort to "correct the behavior" (as stated by teacher 526-001).

Where the first green dot occurs, the teacher attended a professional development session focusing on problem-based learning and computer applications for the project. During the debrief portion of that session, the teacher showed a strong interest in the topic and developed an idea for a problem that was relevant to her students. In the weeks that followed, we observed her implementing this

FIGURE 2. *Participant tracking sample data.*



idea through a two-day lesson, and she discussed the experience with others online. She indicated that she would be designing a similar lesson designed around the following week's content. During the second of these innovative lessons, the first precipitating event occurred. A student in her class began engaging in off-task behavior during the group work portions of the lesson. The teacher responded to the student but expressed some concern in terms of losing control of the class. At the end of that day, the teacher walked the students through the solution to the problem rather than letting them struggle with it for another day.

To the observers, this indicated reversion. At the beginning of day two of the lesson, the second precipitating event occurred. The teacher received the unit test written by the district coordinator that was to be given the next day. The teacher saw that the test consisted largely of non-contextual problems and became uncomfortable with her lesson plan for the day. She decided to build a review worksheet based off of the test and work through it with students in traditional fashion during class. This indicated a full reversion back to traditional instruction. In this, as in most cases, a systemic or "top-down" issue was the precipitating event that triggered the reversion. This speaks to the pull that teachers feel between trying new, potentially relevant, teaching methods with underserved students and preparing students for district and state mandated tests.

We discovered that in delving more deeply into the issue of these precipitating events, we were able to more readily deconstruct teacher experiences in the program. Teacher innovation, for example, was mediated by professional development. Though not all teachers innovated after each session, when they did innovate, it was always precipitated by a professional development session. Likewise, when teachers began to revert back to traditional methods (i.e. the "reversion" stage), this reversion was mediated by some event, as was the final reversion back to traditional methods. Though these were varied, events were almost exclusively systematic and often political. One example is given above with the issues surrounding tests being written at the district level without teacher input. Other examples of events that led to reversion include:

- Two teachers had to shift focus due to an upcoming benchmark.
- One teacher was in a school that adopted a new curriculum and was "not given much room to stray" from the scripted lessons.
- One teacher stated, "I was going to try more [problem solving] but my principal really wants us to focus on [the state test] right now [in January].
- Four teachers indicated that "whatever strategies, or materials, or resources, [we get], we need to utilize them according to what the school wants. And sometimes

it's very difficult to incorporate them in the classroom, the strategies that I'm getting [from the PD]".

While these findings are especially relevant to the PDG, it seems that these precipitating events speak to the current political climate in which teachers are working. These struggles, then, are systemic and must be approached in systemic ways.

Timing of Innovations

Another interesting point for discussion stems from our findings related to the timing and content of the professional development sessions and how these relate to teacher innovations in the classroom. Particular sessions seemed to lead to more and longer periods of innovation, and this could have been due to a variety of factors. For example, one particularly successful session in terms of observed innovations occurred in December. According to interview data, part of this success was due to teacher interest in and relevance of the topic. However, we must consider the effects of the more flexible time of year and the gaps in mandated curricula that seem to occur around the holidays and after end-of-course testing is completed.

This particular topic is important to include in discussions among mathematics teacher educators as these types of data may give us clues as to how to best pique teacher interests, align with mandated curricula, and time professional development sessions for greatest impact. The fact that so many decisions at the school level are based on testing and other political structures, coupled with the fact that mathematics teachers in high-need schools need support in navigating these structures, makes these discussions imperative.

Implications and Further Discussion

Our data support that sustained professional development with an explicit focus on culturally responsive practice and equity can have an impact on teacher practice. With ongoing support and tools for practice such as action research, teachers in this study were more likely to sustain culturally responsive practice. These findings are based on a specific professional development program for secondary mathematics teachers, but they also have implications for all professional development programs. In developing and implementing these programs, it is imperative that mathematics teacher educators are aware of and report out about the complications that affect outcomes of professional development. Mathematics teacher educators should intentionally design these programs to engage teachers in challenging discussions about CRT, equity, and connections to practice.

This work adds to the literature base in that it provides data gleaned from professional development, rather than pre-service teacher education, specifically with secondary mathematics teachers. At this level, it is often not clear how to translate research and theory to practice, but our data show that there is real potential in doing this type of work in a long-term PD format. CRT does not always have to be embedded in mathematics tasks; rather, teacher practice in relation to deficit thinking, ways of communicating with students, and developing critical consciousness can be affected in ways that transform classrooms and student learning.

Phenomena such as the professional development gap should be discussed in mathematics education outlets so that we can collaboratively build successful programs while having ongoing discussions about issues that may arise. Through engagement in pragmatic conversations about programmatic nuances, we can more readily understand the scope of success and struggles in teacher education programs. These are important, timely, and systemic issues that, through investigation and discussion, can provide important information about how to develop a more culturally responsive teaching force.

It is through these professional, pragmatic discussions that we can (1) identify roadblocks and possible complicating factors that add to the complexity of our work, including political and curricular factors, (2) begin to identify and test possible solutions to these "roadblocks", and (3) implement sustained, professionally-based strategies that will allow for the greatest amount of teacher and student success. This will allow for an ongoing, productive discussion about the vast and expanding literature base on professional development and how it might apply in various settings and within various political contexts.

This project ultimately empowered teachers to question traditional mathematics practice and consider the questions posed by Aguirre, Mayfield-Ingram, and Martin (2013): "What mathematics? For whom? For what purpose?" (p. 5). Teachers were challenged to enact culturally responsive practice in a politically challenging context and to remember that they too are learners with assets that are vital to the success of their students. ✪

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