

NCSM Journal

of Mathematics Education Leadership

SPRING 2023

VOL. 24, NO. 1



NCSM—Leadership in Mathematics Education

www.mathedleadership.org

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Critical Collegueship Development Amongst Elementary Instructional Leaders: A Comparative Analysis of Process and Outcomes

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Abstract

Mathematics coaches, as school-based instructional leaders, are well situated to promote instructional effectiveness and student learning. This ability is enhanced through ongoing professional learning opportunities that position them alongside other instructional leaders actively developing the skills, knowledge, and dispositions necessary for facilitating change. This study, conducted in an urban school setting, draws on social learning theories to examine the influence of professional learning processes on mathematics instructional leaders' critical collegueship development and collaborative inquiry engagement. Findings indicate increasing attention on establishing collaboration agreements, shared transformational learning goals, and consistent meeting structures promotes critical collegueship and team functioning in support of coaches' own professional learning and their facilitation of learning for the teachers whom they support.

Keywords: critical collegueship, mathematics instructional leaders, elementary school, teacher knowledge, social learning theory, transformational professional learning.

A social learning perspective defines knowledge development as both an intellectual and a social endeavor requiring active learner engagement as understanding is socially negotiated through interaction and experience (Akyol et al., 2009; Bandura, 1986). Transformational professional learning (PL), that which promotes the rethinking of current ways of knowing and doing and leads to changed practice in support of student academic achievement, goes well beyond the simple transfer of knowledge by centering social learning as productive professional dialogue around divergent, practice-based ideas (Mezirow, 1978; Steyn, 2017). Promoting this productive discourse requires opportunities for educators to take an inquiry stance to critically examine their practice in “ongoing, reflective, collaborative, and inclusive ways” (Voelkel, 2022, p. 346). This type of peer interaction supports transformative PL by encouraging ongoing knowledge and efficacy development. When skillfully facilitated, this critical dialogue enables individuals to openly exchange ideas, develop collective understanding, discuss their craft, self-reflect, and support implementation of new practices that support student achievement (Benoliel & Schechter, 2018; Donaldson & Karp, 2023; Vavasseur & MacGregor, 2008).

Literature Review

Existing research indicates transformational PL is promoted through social learning that includes: (a) job-embedded collaborative learning opportunities, (b) critical discourse centered on shared examination of the impact of personal and

collective practice on student learning outcomes, and (c) supportive facilitation by instructional coaches with strong content and pedagogical knowledge and the ability to lead sustained learning that is collaborative and grounded in reflective practice (Desimone & Pak, 2017; Myers et al., 2021). Each of these features is taken up in this section.

Job-Embedded Collaborative Learning

Transformational PL differs from traditional professional development workshops where educators are passive recipients of content determined by administrators in response to student performance data and associated perceptions of gaps in professional knowledge (Jensen et al., 2016; Wei et al., 2009). This traditional top-down, deficit focused approach to PL can diminish educators' perceptions of their individual and collective ability to influence student mathematics learning outcomes (Chetty et al., 2014; Goddard et al., 2000). As a result, educators often attribute students' failures to external factors, such as prior achievement or demographic characteristics, feeling they have limited power to influence student outcomes, thus decreasing their motivation to engage in change efforts (Abrami et al., 2011; Linder et al., 2013).

This sense of helplessness can be combatted by ongoing, job-embedded opportunities for collaborative PL that seek to deprivatize practice and build capacity from educators' strengths, as opposed to filling gaps or pointing to deficits (McCrary et al., 2012). This sustained, shared PL, supported by critical discourse around daily practice, also promotes positive perceptions of collective mathematics efficacy for teaching (C-MEFT), defined as an individual's beliefs about the collaborative ability of the group to achieve mathematics teaching and learning goals. This occurs as individuals raise moments of cognitive disequilibrium, reconsider existing ideas and practices, and develop a shared vision for how to collectively promote positive change (Benoliel & Schechter, 2018; Goddard et al., 2000). This positive impact is important as educators' C-MEFT perceptions have been found to better predict student achievement than other commonly identified factors such as students' socio-economic status or prior mathematics performance (Goddard et al., 2000; Hattie, 2012; Visible Learning, n.d.). Hattie (2012) proposes that positive perceptions of collective efficacy for teaching support transformative PL and student achievement by promoting educators' willingness to honestly analyze their collective impact on student learning. As educators openly engage in conversations with colleagues around critique of personal

practice they come to believe transforming their practice will promote students' academic success regardless of factors outside their scope of influence.

Critical Collegueship Development

When this collaborative, inquiry-oriented learning is structured to strengthen social connections and to promote a shared sense of vision and commitment, educators are more willing to critically analyze and take ownership for their personal impact on student achievement through open engagement in conversations around personal and shared practice (Curry & Killion, 2009; Hattie, 2012), or what has been termed critical collegueship (Lord, 1994; van Es, 2012). Critical collegueship promotes transformed learning and sustains change efforts because it moves PL discussions beyond the collegial sharing of experiences and perceptions to involve active probing of and elaboration on diverse ideas and perspectives (Donohoo & Katz, 2017; van Es, 2012). As a result, educators can work together to create a PL culture that values the deprivatization of practice, critical reflection around the relationship between teaching and student learning, and the development of a shared vision of the values and components necessary to promote high-quality mathematics teaching and learning (Nelson, 2008).

Critical collegueship development facilitates collective reflection and intellectual discourse around authentic, practice-based problems and amplifies this change effect (Lord, 1994; van Es, 2012) by drawing out divergent thinking around shared challenges and opportunities (Geijsel et al., 2003; Kintz, et al., 2015; van Es, 2012). The degree of critical collegueship evident in group interactions is determined by three discussion characteristics: (a) collaborative interactions (the extent to which discussion joins ideas and perspectives from multiple individuals); (b) participation and discourse norms (the extent to which discussion examines multiple, evidence supported perspectives and ideas); and (c) focus of activity and discussion (the extent to which discussion references specific instructional artifacts and practices; van Es, 2012; see Appendix A for more detailed descriptions and examples). Regular engagement in practice-based conversations characterized by critical collegueship strengthens cohesion resulting in a positive sense of collective efficacy for growth and change (Kintz, et al., 2015; Minckler, 2014; van Es, 2012) as individuals are able to see moments of cognitive disequilibrium as opportunities to bring new awareness and understanding to their practice (Anderson, 2008; Benoliel

& Schechter, 2018; Donaldson & Karp, 2023; Schechter & Ganon-Shilon, 2015).

Integrating opportunities for critical collegueship development into organizational structures by focusing them on building collaborative cultures and shared pedagogical approaches further enables development of positive C-MEFT perceptions by including opportunities for educators to engage in school/district-wide consensus building, thus fostering an atmosphere of shared concern, respect, and empowerment (Donohoo, 2017; Dufour, 2004). However, without strategic facilitation, educators may fall back on traditional norms of polite talk and isolationism as many educators doubt their ability to collaborate and have limited experience critically examining and explaining their instructional decisions and actions (Males et al., 2010; Nelson, 2008; Russo & Beyerbach, 2001).

Mathematics Coaches' Role and Development

Full time, school-based mathematics coaches (referred to throughout as 'coaches') are instructional leaders responsible for supporting classroom teachers' ongoing learning and instructional effectiveness (McGatha & Rigelman, 2017). Their close daily contact with teachers and students places them in a particularly powerful leadership position as change agents who can promote critical collegueship among classroom teachers as a source of personalized and collaborative professional learning that draws on individual and shared strengths and classroom contexts (AMTE et al., 2022; Campbell & Malkus, 2010; Coburn & Woulfin, 2012). Unfortunately, coaches may be limited in their ability to facilitate the work of identifying and addressing teaching and learning challenges alongside classroom teachers without ongoing opportunities to actively engage in PL with other instructional leaders (e.g., coaches and principals) to build the complex set of knowledge, skills, and dispositions coaching requires (AMTE et al., 2022; Desimone & Pak, 2017; Saderholm et al., 2016).

Federal, state, and district policies (Coburn & Woulfin, 2012) and professional organization position statements (AMTE et al., 2022) often call for the use of instructional coaches as part of teacher professional development. Many mathematics coaches are hired because they have been effective mathematics teachers but "become novices all over again...with a different set of challenges related to their role as a building or school district math leader" (Fennell et al., 2013, p. 173). Shifting from being an effective

classroom teacher to becoming an effective mathematics instructional leader requires ongoing professional learning that includes opportunities to engage in the same types of collaborative, transformational learning experiences they will be using with teachers (Desimone & Pak, 2017; Voelkel et al., 2021). Regular engagement in active, practice-based learning alongside other coaches enables ongoing development of pedagogical and leadership expertise and promotes professional relationships that support critical collegueship development and new models of thinking about what constitutes effective PL (Voelkel et al., 2021). Positioning coaches as active, collaborative learners also helps them to move beyond the evaluative, transmission style coaching they likely experienced as teachers as they gain appreciation of the power of structured opportunities for critical collegueship development through reflective inquiry around their own daily practice (Elfaragy et al., 2022; Hoffman et al., 2015; Lammert et al., 2020).

Using a convergent mixed-methods approach, this manuscript examines the relationship between the differential use of collaborative PL structures and processes and development of critical collegueship across four teams of elementary mathematics coaches from a single school district. The findings add to existing knowledge of how to effectively structure job-embedded learning for mathematics coaches in support of their instructional leadership capacity within transformative social learning communities.

Research Context and Methods

Libertyville (a pseudonym), the New England school district on which this study is focused, is an example of an urban district where the elementary mathematics coaches had limited opportunities to engage in critical conversations around daily practice with their peers or to take ownership of their own professional learning, as their monthly meeting agendas were set by district administrators and centered on transfer of information as opposed to examination of practice and development of shared knowledge and vision (Donaldson, 2018). The goal-based intervention (Newcomer et al., 2010) from the larger study on which this data is drawn, was designed to build upon the professional skills, knowledge, and relationships of the districts' elementary mathematics coaches and empower them to use a structured process to promote their own ongoing, job-embedded professional learning. Coaches were provided an opportunity to engage in structured collaborative inquiry into their own coaching practice to help

them see themselves as change agents capable of using critical collegueship to drive active development of a cohesive vision for mathematics instructional effectiveness and learning success throughout the school district (Donaldson, 2018; Donaldson, 2019-2020).

Participants

The 20 school-based, elementary mathematics coaches in the Libertyville Public School District, each of whom worked full time at one of the district elementary schools, all participated in the intervention. As members of their school's instructional leadership team, these educators served as what McGatha and Rigelman (2017) define as mathematics coaches because they provided instructional support to classroom teachers through grade level planning meetings and individual coaching sessions. They also served as a link between the district's mathematics leadership team and their school administrators, keeping school principals abreast of district level mathematics initiatives and overseeing mathematics assessment administration and data analysis. For the duration of the six-month study, each coach worked as a member of one of four collaborative inquiry teams (CITs; $n=4$ or $n=6$) determined by existing district established inter-school cohorts that were based on the geographic locations of the school buildings.

As can be seen in Table 1, most coaches were females ($n=16$) with each team having one male member and three or five female members. All teams had a mixture of individuals who worked as elementary classroom teachers prior to becoming coaches ($n=12$) and individuals who previously worked as middle school ($n=7$) or high school ($n=1$) mathematics teachers. Participants' coaching experience ranged from less than one year up to 17 years ($M=6.78$) and all but two of the coaches had worked in the district for most or all of their careers. With the exception of Team Y, all teams were comprised of individuals who

had worked as coaches in the district for over a year prior to engaging in this collaborative inquiry work. One member of Team Y was new to the district but had experience as both an elementary classroom teacher and mathematics coach in a different state. And another Team Y member was a first-year mathematics coach, but a long-term district employee having been an elementary classroom teacher for more than 20 years.

Intervention Design: Collaborative Inquiry Team Development Structures

Engaging Libertyville's elementary mathematics coaches in inter-school CITs supported their ongoing PL and provided opportunities to develop critical collegueship around self-identified goals aligned to the district's vision for mathematics instruction, professional growth, and student achievement. However, critical collegueship does not develop on its own, but instead requires clear articulation of individual accountability as well as established agreements for communication and collaboration (Cosner, 2009; Thompson & MacDonald, 2005). Although 18 of the 20 participants had worked as mathematics coaches in the district for at least one year prior to the start of the study, their work together in the past had been limited to scheduled time at their monthly elementary mathematics coaches' meetings where they worked to complete tasks assigned by district administrators. As a result, even though they knew each other, each coach worked in isolation at their individual school, not as a part of a cohesive or coordinated team focused on district-wide capacity building. Increasing opportunities to interact in structured, purposeful teams can support the development of collaborative relationships, a critical organizational resource for capacity building and change enactment (Cosner, 2009; Desimone & Pak, 2017; Smith et al., 2005). The researcher designed and facilitated the intervention to promote effective teamwork by (a) providing opportunities

Table 1: Participant Characteristics

Team	Gender	Coaching Experience (years)	Prior Teaching Experience
W	f=3; m=1	M=7.0 (min=3; max=17)	2 ES, 1 MS, 1 HS
X	f=5; m=1	M=5.2 (min<1; max=12)	4 ES, 2 MS
Y	f=5; m=1	M=8.7 (min=3; max=17)	4 ES, 2 MS
Z	f=3; m=1	M=6.3 (min=2; max=12)	2 ES, 2 MS

Note: f = female; m = male; ES = elementary school; MS = middle school; HS = high school

for collaborative engagement within coaches' schedule without direct supervision from the researcher or district administrators; (b) establishing structures and expectations for honest communication, collective decision making, and conflict resolution; and (c) supporting the identification and development of shared, data-based inquiry goals connected to their daily work. The researcher collaborated with district administrators to put the collaboration structures and processes in place (e.g., bi-monthly meeting time, an online space for asynchronous work, team charter templates, and action planning templates) and introduced them to the coaches but did not facilitate meetings or provide feedback around ongoing collaborative work.

Opportunities for Collaborative Engagement

Time for collaboration was built into the coaches' normal workday over a six-month period. Each CIT was expected to meet bi-monthly for 60 to 90 minutes, once in person as part of a full day mathematics coaches' meeting and once virtually at a time that worked within team members' schedules. Each CIT was also asked to use the district's G-Suite for Education platform and email to collaborate asynchronously between meetings through ongoing communication and the exchange of resources in support of their shared inquiry work.

Charter Development: Establishing Collaborative Norms and Expectations

Establishing clear agreements and expectations for collaboration, mutual support, and accountability, as well as establishing a specific and measurable work focus, supports successful development of interdependence (Cosner, 2009; DuFour, 2016). Therefore, the CITs began their shared inquiry work by using a template to create a team charter for collaborative norms and responsibilities and determining their collaborative inquiry focus (see Appendix B). Team charter development provided an opportunity for each CIT to establish specific collaboration agreements for in-person meetings, virtual meetings, asynchronous work, and communication. For instance, as each CIT completed their team charter templates, they talked through perceived personal strengths and challenges related to teamwork, potential teamwork barriers (e.g., lack of attendance or unequally distributed workloads), and collaboration agreements and roles to be used at subsequent meetings.

Action Plan: Establishing Measurable and Actionable Goals

After establishing initial guidelines and expectations for their collaborative work, CITs examined existing student achievement and shared instructional rounds data and identified a specific, shared, practice-based problem, which they saw as worthy of collaborative inquiry and as aligned to district professional development priorities for mathematics teaching and learning (e.g., standards-based instruction, supporting multilingual learners, or student-centered instruction). With their chosen foci in mind, each team used a template to develop a collaborative action plan that helped them break down their larger goal into *small-wins*, specific individual and collective action steps or sub-goals, and a timeline for the work (see Appendix C).

Research Design

This convergent mixed-methods study centers a comparative analysis (Bray et al., 2014) of quantitative and qualitative data drawn from the larger intervention study (Donaldson, 2018) to examine relationships between CIT functioning and outcomes. Quantitative data from attendance records, monthly survey data, online platform use records, and collaborative inquiry planning documents (e.g., the team charter and action planning templates) were used to examine the extent to which each CIT used different intervention structures and processes. Qualitative data from conversation analysis (Clayman & Gill, 2012) of verbatim meeting transcripts were used to explore how critical collegueship developed within each CIT. The two sets of data were then merged to gain greater insight into the following question: How did differences in the use of the collaborative inquiry process structures influence critical collegueship development and team functioning amongst this group of mathematics instructional leaders?

Data Collection and Analysis

Engagement in Collaborative Inquiry Teamwork

Individuals' active engagement in the collaborative inquiry process was a key indicator of intervention fidelity. Without authentic engagement, critical collegueship likely would not develop. Quantitative data related to the use of intervention structures were disaggregated by team and month and then merged with critical collegueship data from the analysis of meeting transcripts to examine how differing levels of engagement influenced critical collegueship development within each team.

Specifically, levels of CIT participation and engagement were examined through frequency tabulations of team meeting transcripts (the number of times each individual spoke at each meeting), meeting attendance records (the number of member absences), and asynchronous use of collaboration tools (the number of times each individual used the team's G-Suite for Education space or email to collaborate between meetings). The researcher also used descriptive statistics (mean, maximum, minimum) to analyze monthly feedback survey responses related to individual and team participation, attendance at team meetings, and tabulations of contributions to asynchronous interactions and synchronous meeting discussions to determine individual engagement (see Appendix D for the survey questions).

Development and Use of Team Planning and Process Tools

As described earlier, each team was provided a charter template (Appendix B) and an action planning template (Appendix C) at the beginning of the intervention to support successful development of interdependence. These tools enabled teams to establish clear norms and expectations for collaboration and accountability, as well as establish a specific goal and plan for their work together and for tracking progress. The development and use of these two templates were examined through both the documents themselves and the discussion of the documents during team meetings. Analysis of the documents focused on the extent to which the templates had been completed. This included examining whether all sections of documents had been filled in as well as the quality of the information, for instance whether goals were specific and measurable (e.g. "By February 2018, we will see an increase in the percentage of students at the engagement level during mathematics instruction based on Schlechty's Levels of Classroom Engagement," Team X goal) versus broad and ill-defined ("More students will be engaged in math class"). Meeting transcripts were analyzed to determine the frequency of references to and use of these two templates. Team use of the planning and process tools (charter and action plan) was examined through meeting transcripts (how many times the documents were discussed and referenced) and the documents themselves (the degree of completion and revisions and additions made over the six month time period).

Development of Critical Collegueship

Development of critical collegueship was examined through analysis of meeting discussions. CIT discussions from both in-person and virtual meetings were audio recorded and then transcribed verbatim for analysis. All participant names were removed from the transcripts prior to analysis with each team member being assigned a label based on their team and the order in which individuals spoke at the first meeting. For instance, the first person who spoke from team X was identified throughout the study as X1. All recordings and transcripts were stored on the researchers' password protected device.

Using each meeting transcript as the unit of analysis, conversation analysis was employed to examine the naturally occurring discourse and consensual meaning making (Clayman & Gill, 2012) within the CITs' meeting discussions of practice-based work. Trustworthiness of this qualitative analysis was supported by grounding the hierarchical deductive coding process within a priori themes from extant literature and the inclusion of raw data within the manuscript (Creswell & Plano Clark, 2018; Nowell et al., 2017). As a first step to this deductive analytical noticing, each meeting transcript was analyzed using *a priori* codes based on van Es' (2012) three-stage rubric for community development in terms of three discussion elements:

- *collaborative interactions* (the degree to which discussions involved multiple individuals, the use of joint versus individual pronouns, and the joining of ideas and perspectives about mathematics teaching and learning);
- *discourse norms* (the degree to which discussions contained multiple ideas and perspectives about mathematics teaching and learning); and
- *focus of discussion* (the degree to which discussions referenced specific mathematics teaching and learning artifacts or incidents from classrooms).

Using the three-stage rubric, each element was coded (1) beginning if the exchange primarily involved exploration of single perspectives and general ideas by one or two members, (2) intermediate if the exchange involved limited sharing and probing of different perspectives and practice-based connections among some team members, or (3) high-functioning if the exchange involved active probing and elaboration of multiple, practice-based perspectives by all team members (see Appendix A for examples and further explanation).

The rubric was deemed reliable in a study of a professional learning community structured around the examination of classroom mathematics instruction videos. Van Es and colleagues (2012) had several individuals code a subset of transcripts, resulting in 85% inter-rater reliability. They also examined coded discussions for confirming and disconfirming evidence of the three elements from early versus later sessions of their intervention to further validate the coding rubric. Knowing that the rubric requires subjective judgments about the presence of defined criteria and that data reliability refers not to the reliability of the scale itself, but instead to consistency of scores obtained from that scale (Barry et al., 2014), the first round of in-person meeting transcripts for this study (one for each CIT) were analyzed independently by the researcher and by a second individual (a professor of mathematics education with a background in discussion analysis) and then the scoring was compared. There was 83% inter-rater reliability across the four meeting transcripts which is greater than the 70% threshold percent agreement statistic deemed acceptable in the social sciences (Stemler, 2011). Because there was an acceptable level of consensus, the researcher's scores were used for all subsequent meeting transcripts. At the conclusion of the study, this qualitative data was quantified using the three-point rubric (van Es, 2012) and then graphed to support insight into changes to critical collegueship functioning and development over time. Scores for exchanges within conversations were averaged across each full meeting transcript, resulting in whole (1, 2, 3) and half scores (1.5 and 2.5).

Seeking to better understand the nature and content of CIT discussions in terms of both participation and discourse norms and focus of activity and discussion, a second round of conversation analysis and coding of meeting transcripts was done using *a priori* codes developed by Ke and Xie (2009) for analysis of learning interactions in terms of the knowledge construction and regulation of team functioning and learning. In their model, exchanges involving knowledge construction represent a four stage progression: (K1) individualistic sharing of information and ideas, (K2) egocentric elaboration on ideas, (K3) comparing and synthesizing multiple perspectives, and (K4) planning future, school-based application of new ideas. Exchanges involving regulation of learning and team functioning consist of: (R1) teamwork planning and coordination, (R2) self-evaluation and regulation, and (R3) technical issue management (see Appendix D for definitions and illustrative examples). This second round

of conversation analysis data was then converged with both the critical collegueship development data and the quantitative data related to engagement and tools/structures usage data to provide understanding of the complex relationships between process and outcomes for the four different CITs.

Comparative Analysis: Team Processes and Outcomes

The following comparative analysis examines connections between individual and collective engagement in collaborative inquiry, goal achievement in terms of each CIT's development and use of both their team charter and action plan, and the development of critical collegueship within each team.

Charter Development and Team Engagement

Engagement

Active engagement in the collaborative inquiry process by all participants was a key indicator of implementation fidelity. Levels of engagement were defined by the following factors: number of meetings held, member attendance at meetings, number of times each member contributed ideas during meeting discussions, and asynchronous interactions within the G-Suite for Education space and email between meetings. High engagement was defined as (a) 100% of meetings being held, (b) no member missing more than one meeting, (c) all team members actively participating in all meeting discussions, and (d) all members contributing asynchronously online at least one time per month. Engagement was considered low if (a) more than one meeting was cancelled, (b) more than one individual from a team missed more than two meetings, (c) less than 90% of team members were actively involved in meeting discussions, and/or (d) more than one individual from any given team did not contribute asynchronously at least one time per month.

Overall, Team W had low engagement cancelling two of their five virtual meetings and one of their six in-person meetings. Additionally, only one team member was present at all team meetings, with two of the other members each missing one meeting, and the fourth member missing four meetings. When team members were in attendance, they all actively contributed to discussions. However, only one team member shared resources and communicated asynchronously online between meetings.

Team X members had high engagement throughout the study. The team held all meetings, and never had more than one of their six members absent from a meeting, with three team members each missing one meeting. All team members communicated and shared resources online between meetings and actively participated in team discussions.

Team Y also had relatively high engagement. Team Y held all of its meetings and all but one of its members actively participated in team discussions and collaborated asynchronously online between meetings. Three of its team members were present at all meetings, while the other three members each missed one or two meetings.

Team Z had relatively high engagement. They cancelled one virtual meeting and had one member absent for one other meeting. All team members actively participated in team discussions, however they had very little asynchronous interaction with each other between meetings with only one member adding a few resources to their shared G-Suite for Education space after their second meeting.

Charter Development and Use

After the researcher introduced the purpose and structure of team charters at the initial intervention meeting, CITs were given time to collaboratively complete the charter template (see Appendix B). Successful completion entailed (a) all members adding their names and contact information, (b) all members adding and verbally sharing their teamwork strengths and weaknesses, and (c) all members actively working to come to consensus around the eight teamwork functioning questions. Teams were then encouraged to reference and adjust their charters over the course of the intervention as needs and tensions arose. The number of times each team mentioned their charter in meeting discussions and the number of changes made to the document itself after the initial meeting were used to gauge the extent to which each team used their charter. Participants' self-assessment of adherence to the charter within the monthly feedback survey provided data around its perceived usefulness for team functioning.

Charter Completion. With the exception of Team Y, all teams successfully completed their charters during their initial meeting. Instead of collaboratively working on their charter during their first meeting, Team Y chose to spend most of its time defining team member roles (e.g., facilitator, note taker) and creating a rotating schedule for these

roles for the course of the intervention. Instead of discussing individuals' perceived strengths and challenges related to the work, they asked each person to fill in this information independently before the next meeting. They also stated they did not feel it was necessary to discuss potential teamwork process issues, such as acceptable or unacceptable excuses for missing a meeting or expectations regarding team interactions and accountability, with one member stating, "We're all adults and professionals and expect everyone will behave that way" (Y6).

Not engaging in collaborative discussion and disclosure at the initial meeting appears to have impeded their progress as they were unable to agree upon a focus and plan for their inquiry work at their next meeting. Team members left this second meeting expressing negative perceptions of their collaborative abilities, with one member approaching the researcher and the district supervisor at the end of the day stating:

I don't know how this is possibly going to work. No one is listening to each other and there are two people taking over the conversation who do not seem to respect each other's ideas. Every time I tried to talk I was interrupted. I was really excited to get to work with other coaches, but right now I'm feeling like I just want to work alone at my school (Y1).

Two underlying factors may explain these initial concerns: (a) Team Y did not collaboratively talk through potential process issues, setting clear expectations for collaboration, or sharing personal strengths and potential challenges at their first meeting and (b) Team Y had two members who were new coaches, including one who was new to the district. As a result, these two individuals had not worked with the other coaches before and had not been part of previous discussions of school improvement plans across the different schools. Both factors, not having talked through potential collaboration issues and having new team members, can negatively influence trust, or the belief that individuals will make good-faith efforts, honor commitments, and not take advantage of others (Cosner, 2009). Trust is a precondition for cooperative behavior, interdependence, and group effectiveness as it is vital for team members to balance individual and collective needs and ideas and to support collaborative and productive discourse (Anderson, 2008; Tschannen-Moran & Gareis, 2015), two essential characteristics of critical collegiality (van Es, 2012).

To help promote productive collaboration moving forward, the district mathematics supervisor met with team members individually prior to their third meeting, providing them each an opportunity to voice concerns and to reflect on the influence their own actions have on the development of a CIT. The district supervisor also actively facilitated their third meeting, with a goal of reviewing their team charter and developing specific collaboration agreements and structures to support their future teamwork. This additional focus on collaborative functioning appears to have positively influenced subsequent work (e.g., “We are starting to rely on each other more. Through texts and our [virtual meetings], we are starting to feel like a team,” Y4, Month 3 feedback survey) and are evidence of Anderson’s (2008) proposition that

...the biggest problem for any team is the assumption that you can put people together to work on a task, and they will automatically become a team and know how to work together... The trick is to put the effort into the process side of teaming (p. 468).

Charter Use and Perceptions of Adherence. Team W and Team Z did not reference their charters at any of their meetings or make any changes to them after initial development. However, monthly feedback indicated members of both Team W and Team Z consistently felt they were mostly adhering to their charters even though there was evidence, such as member absences, meeting cancellations, and tasks not being completed, that indicated otherwise. For instance, at their November in-person meeting, members of Team W had the following exchange:

W1: Right, so when we are together, I think we do a great job of collaborating, we just didn’t have time the other day to do our hangout [virtual meeting].

W2: Right, when we’re together we get lots done, but it’s just hard with all the other responsibilities we have. Like the other day, my principal needed me to do something else when we were supposed to be meeting, so that makes it really hard. And then we have to try to align our schedules again to make up that time.

W3: Yeah, we have so many people asking things of us, that it’s hard to get together.

W2: But as far as adhering to our charter, I personally don’t feel like any of us is letting the other people down.

This exchange indicates that even though they did not always meet the responsibilities laid out in their charter

and action plan, team members felt they were not letting each other down and placed the onus for their lack of regular meetings on external factors, including schedules and principal expectations.

Members of Team X and Team Y also indicated through monthly feedback surveys that they strongly agreed that they were adhering to their charters throughout the study, both at and between meetings. Team X and Team Y’s use of their charters in support of their collaborative work was also evident within their meeting transcripts, with exchanges involving teamwork coordination (R1: Ke & Xie, 2009) being evident in almost all of their meeting discussions. This teamwork coordination included establishing and referencing meeting agendas, coordinating meetings and school visits, clarifying team goals, and ensuring all team members agreed with next steps and expected deliverables. One example is this exchange from Team Y’s month three in-person meeting where they developed the agenda for their next meeting and coordinated the work individuals would do prior to that meeting:

Y3: Okay, So, I put that into the agenda. And we’re moving onto the December roles, so Y2 you’re the facilitator and Y5 you’re the resource manager. Should we create an agenda now for the Google hangout meeting?

Y2: Sure, that would help me out a lot.

Y4: Great, Y1 [absent from the meeting] might want to change that lesson [a shared lesson they were going to all examine] though because I think she chose it because it was something that she was going to be teaching. So, that might need to change.

Y3: Another thing to consider connected to what we are doing is that we could do a consultancy for someone. So, like someone could bring a dilemma that they’re having around this [CIT] work and we could do the consultancy protocol around it where we ask them questions and they explain it. That might help us keep it connected to the classroom.

Y4: Sure. But will that really benefit all of us?

Y3: I think so. With a consultancy I think everyone takes away something because by talking about the dilemma there’s always something that you can connect to and talking through it will help you in your context too. I don’t know, we don’t have to do that.

Y4: Oh, no. I think it’s a good idea.

Y3: I'll link the protocol in here [on the agenda] so you can look at it.

Y2: Okay, so we have the consultancy. What else?

Y3: Are we taking out this lesson for now?

Y2: No, I don't think so. Y1 can teach it between now and then so we can talk about it.

Y4: Do you think I should try to teach that lesson too with my second grade?

Y2: I think anyone that wants to should try to teach it and then we can talk about it and compare what we did and how it went.

Y4: We could talk about how we changed it to make it more open-ended or how we included more student discourse.

Y2: There you go. That might be kind of cool. Everyone could try to do it, if they want to. So, for the consultancy can anyone just bring up a problem?

Y3: No, so one person would come prepared with a dilemma.

Y2: Okay, so who wants to bring a dilemma?

Y5: Do we want to wait and see who has a dilemma? It seems kind of silly to just make up a dilemma.

Y3: Sure, that makes sense.

Y2: Okay, did we make a decision? What are our goals?

Y4: So, we're all going to try teaching the lesson and add in more discourse and make it more open-ended.

Y5: Yeah, I told the teacher I'm going to let her do the teaching checklist on me and critique me.

Y6: Oh, that's a great idea.

Y2: Okay, and one of us is going to come with a dilemma. So, at our next meeting we'll have 20 minutes to talk about the lesson and 20 minutes for the consultancy which will leave us 20 minutes to plan forward and to just check in.

This type of attention to teamwork coordination appears to have supported team productivity as throughout the study monthly survey feedback indicated members of Team X and Team Y felt they were productive in all aspects of their CIT work and the teams consistently completed their monthly action plan goals.

Action Plan Development and Goal Achievement

At their second meeting, the researcher introduced teams to the action planning template (Appendix C) and then teams were provided time to determine a focus and long-term goal for their work and an initial plan for beginning their collaborative inquiry. Successful goals were expected to (a) align to a shared issue across team members' school improvement plans and (b) have the characteristics of a SMART goal, being specific, measurable, attainable, relevant, and timebound.

Action Plan Development

As discussed earlier, Team Y did not successfully develop a long-term goal or action plan at their second meeting. With their district supervisor's support, the team was able to successfully identify a goal and an initial action plan at their third meeting (see Table 2). Teams W, X, and Z established a long-term goal (see Table 2) at their initial meeting that met most of the SMART goal criteria and put forth ideas for initial tasks for team members to accomplish between meetings. In subsequent meetings all of the teams refined their goals, making them more specific and developing small-wins (sub-goals) and collective and individual action steps. Only Team X established a plan for making their goal measurable by defining specific success criteria.

Goal Completion

At the final meeting (month six of the intervention), all teams shared their goals, summarized the inquiry work they had completed, and identified next steps for their CIT work. Teams X, Y, and Z all reported having accomplished all or most of their small-wins and having established next steps to continue progress toward their long-term goals over the second half of the school year. Team X reported having accomplished its three small-wins: (a) developing a look-for tool to observe levels of student-to-student discourse in classrooms, (b) revising the tool after piloting it, and (c) using the revised tool to collect data and determining its value for engaging teachers in discussions around improving classroom practice. And Team Y reported having made some progress on its three small-wins: (a) guiding teachers in choosing high quality tasks to promote student discourse, (b) providing modeling and support for teacher use of strategies that support student reasoning and discussion, and (c) helping teachers to create a student-centered environment for mathematics learning. Although Team Z members reported having achieved most of their small-wins, these were not shared

Table 2: Areas of Focus and SMART Goals for Collaborative Inquiry Written on CIT Action Plans

	Initial Area of Focus	Long-Term Goal
Team W	Supporting teachers' ability to increase student-to-student discourse, authentic student engagement, and cognitive demand within a blended learning model [station rotation involving computer, small group, and independent practice].	By February 2018, based on weekly observation notes, we will see an increase in collaborative groups engaged in authentic mathematics conversations, during blended learning in the classrooms we support.
Team X	Supporting student-to-student engagement in problem solving contexts by helping teachers plan for productive struggle and perseverance.	By February 2018, we will see an increase in the percentage of students at the engagement level during mathematics class based on Schlechty's Levels of Classroom Engagement (www.schlechtycenter.org).
Team Y	Supporting teachers' incorporation of higher level DOK questioning and tasks into instruction.	By February 2018, we will see an increase of students communicating reasoning and responding to others around rigorous tasks in the classrooms we support.
Team Z	Using data and standards to purposely support mathematics instructional planning.	By February 2018, there will be an increase in opportunities for student engagement during the math block in the classrooms we support.

goals, but instead were unique sub-goals and actions steps each individual member was enacting at their respective schools, related to the team's shared long term goal. The team explained that although they valued the opportunity to regularly meet and "bounce ideas off of each other" (Z2, culminating session presentation), they had not come to consensus around shared action steps due to principal demands and school-based priorities. As a result, members were not working interdependently, a key criterion for working as a team (DuFour, 2016) and developing critical collegiality (van Es, 2012). This lack of interdependence is discussed below as part of the critical collegiality development analysis.

Team W reported that due to external factors (member illness and principal requests) it had not completed any of its small-wins, but that progress had been made on two goals not identified in their action plan: (a) developing a bank of high-quality tasks for teacher use and (b) creating and using classroom instruction videos to promote discussions among grade level teaching teams. The team also shared they had spent a lot of time calibrating their definition and vision of student-to-student discourse, work they felt would enable them to determine the data needed to identify how to best support high quality mathematics discussions in classrooms at their individual schools moving forward. Team W members also stated that "building

rapport and collaboration between our cohort members was the most beneficial aspect of our cohort work" (as written on their presentation slide at the culminating CIT meeting).

Overall, there were differences among the four CITs in terms of member engagement in and use of the intervention processes and structures. Three of the teams (Teams X, Y, and Z) had high or relatively high engagement overall with most members present at all meetings and actively collaborating both during and between meetings. All four teams collaboratively completed their team charters, with Team Y needing some structured support as described above. However, even though all four teams regularly reported within their monthly feedback surveys that they had adhered to their charters, only Team X and Team Y actively used their charter throughout their work together to coordinate their work and to hold each other accountable. And finally, although all four teams created a shared long term goal that was time bound, specific, and relevant to both their daily work and district priorities for mathematics teaching and learning there were some differences. Only Team X determined success criteria to make their goal measurable and they were the only team to have achieved their sub-goals by the end of the six-month intervention. And Team Z was unique in that the members established a shared long-term goal, but each individual

developed their own, unique small-wins and action plans as opposed to having a shared plan for collaborative inquiry. In the next section consideration will be given to the relationship between these differences and the development of critical collegueship across the four CITs.

Critical Collegueship Development

This section will first summarize the development of critical collegueship within the four CITs across the six-month period. This will be followed by discussion of illustrative examples of discussion excerpts connected to three themes that emerged as key differences within the discussions of teams that progressed to high-functioning levels of critical collegueship and those who did not.

Summary of Change Over Time

As described earlier, critical collegueship within professional learning contexts is defined as the promotion of cognitive disequilibrium through the critical analysis of existing instructional practices and beliefs (Lord, 1994; van Es, 2012). Quantification of the qualitative conversation analysis using van Es' (2012) three-stage rubric indicated that critical collegueship across the three characteristics of collaborative interactions, participation and discourse norms, and focus of activity and discussion did not develop in a linear manner for any of the teams. However, except for Team Z, there was an upward trend, with all three characteristics (interaction, discussion, and focus) ending at a higher level of development for teams W, X, and Y (see Figure 1). This development of critical collegueship indicates discussions from teams W, X, and Y progressed, to different extents, toward active analysis of diverse perspectives and the development of shared understanding.

As was discussed earlier, Team W did not meet regularly, cancelling all but their first virtual meeting and canceling one in-person meeting because only one team member was in attendance. Despite having low engagement in the collaborative inquiry process, conversation analysis using the Van Es (2012) rubric indicates that critical collegueship did still develop in Team W with elements of their final in-person meeting representing an intermediate stage of team development for all three aspects of critical collegueship (Figure 1).

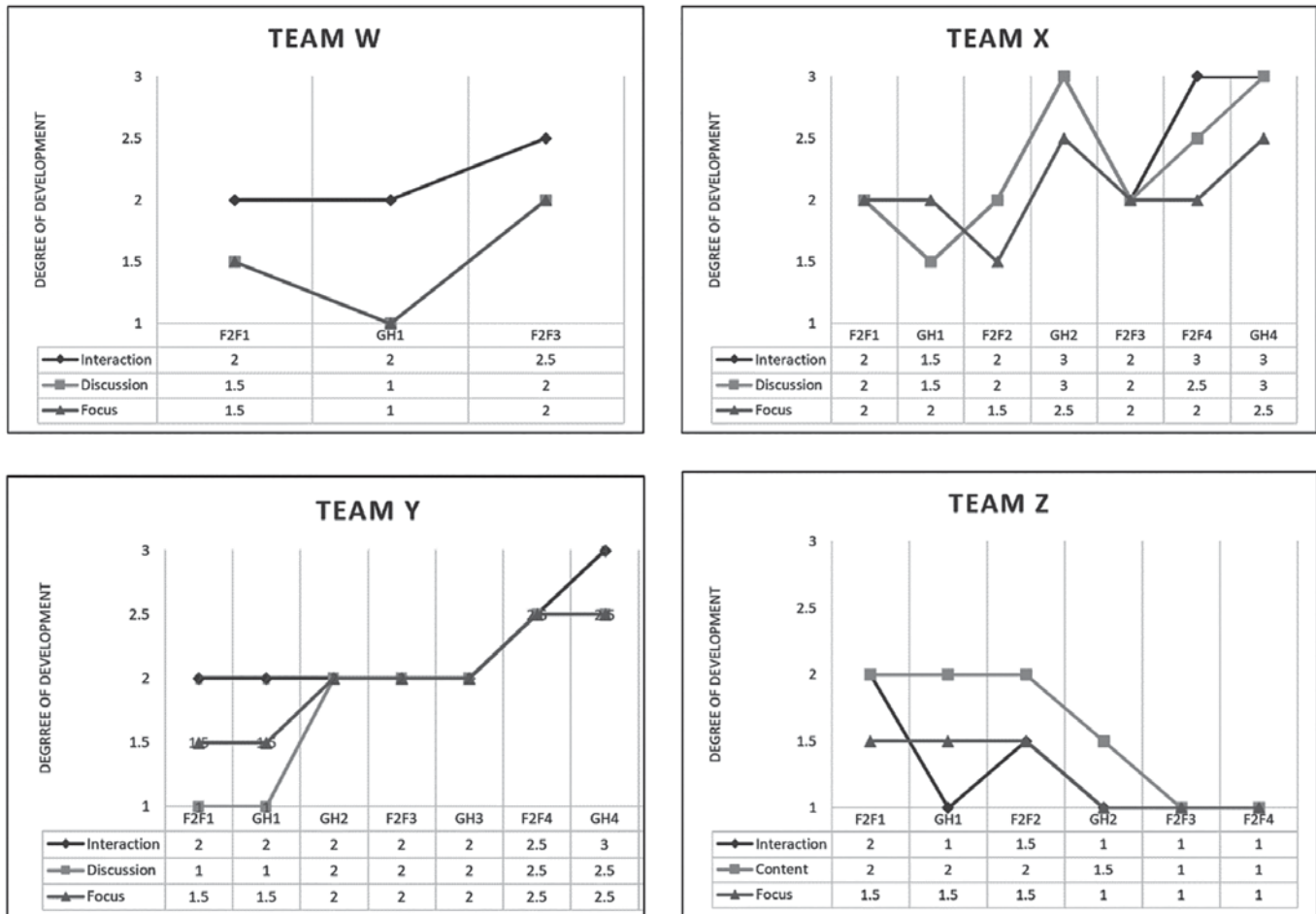
Team X showed critical collegueship development across all three characteristics, progressing from an intermediate to a high-functioning stage of development, with all team

members engaging in interactions that built upon and connected multiple, context specific incidents and ideas (Figure 1). Discussion content also included multiple interactions Ke and Xie (2009) would label allocentric elaboration (K3), with individuals synthesizing, probing, and challenging the ideas of others in pursuit of deeper, shared understanding and broadened perspective (see Appendix D for coding descriptions). The team's monthly survey feedback consistently indicated positive perceptions of collaborative capacity and interdependence (e.g., "It is great to work on a team with different members who move forward to the lead or step back based on the needs of the group" X1, Month 1, monthly feedback survey comment) that are consistent with characteristics of high-functioning critical collegueship as well as positive collective efficacy perceptions (Goddard et al., 2000; van Es, 2012).

Team Y also showed critical collegueship development across all three discussion characteristics, progressing from a beginning to an intermediate stage in both participation and discourse norms and focus of activity and discussion and from an intermediate to a high-functioning stage in collaborative interactions (van Es, 2012; Figure 1). This indicates team discussions progressed from focusing on individual interests and general ideas to including active analysis of diverse perspectives and the development of shared understanding (van Es, 2012).

Team Z was the one team that did not develop critical collegueship according to analysis of meeting transcripts (see Figure 1). The discussion at team Z's initial in-person meeting was the strongest in terms of critical collegueship discussion characteristics, with both collaborative interactions and participation and discourse norms being at an intermediate stage on the three-stage rubric (van Es, 2012), and with all members contributing to the conversation and using their own experiences to build upon each other's ideas, exchanges Ke and Xie (2009) would label egocentric elaboration (K2). The focus of their initial discussion was between a beginning and an intermediate stage in that it centered on the team's goal but was not grounded in specific mathematics teaching and learning events in district schools. Subsequent meetings, both in-person and virtual, lacked both a focus on the team's goal of using data-based planning to increase student engagement and equitable involvement by all team members. One team member (Z4) rarely spoke during meetings (accounting for only 8.3% of tabulated discussion contributions across all meetings). The other three members

FIGURE 1.
Longitudinal Critical Collegueship Development by Team



Note. F2F connotes an in-person meeting. GH connotes a virtual meeting. Scores are only listed for meetings that were held and successfully recorded. Beginning = 1; Intermediate = 2; High-functioning = 3. Scores for both discussion and focus for Team W overlap for all meetings as represented in the lower line. See Appendix A for definitions and examples of the coding of each element.

contributed relatively equally to discussions (Z1=22.6%, Z3=32.2%, Z2=37.3%), but primarily talked collegially about technologies being used at their respective schools and other district initiatives in which they were involved. Overall, almost half of their discussion time, across all meetings, involved personal information and idea sharing (K1; Ke & Xie, 2009) with minimal probing or connecting of ideas, indicating a lack of critical collegueship development. Team Z completed the study at the beginning stage for all three indicators of critical collegueship development, lower than where they started (see Figure 1).

Collegueship versus Congeniality

As described earlier, the characteristics of critical collegueship that promote transformational PL include

shared sense making centered on daily practice, productive disequilibrium and collaborative self-reflection as problem solving tools, and a desire to unveil diverse perspectives in the critical analysis process (Donaldson & Karp, 2023; Lund, 2020; Males et al., 2010; van Es, 2012). This differs from congenial interactions that are more typical in U.S. education settings where a culture of politeness and a lack of collegial trust often leads to courteous exchanges and individuals feeling a need to protect versus critically examine their practice (Males et al., 2010; Marshall et al., 2004). Three themes related to this difference between critical collegueship and congeniality arose within the conversation analysis of the four teams in terms of how team members: (a) responded when practice related issues were raised, (b) addressed concerns related to external barriers

to CIT work, and (c) talked about the value of their time together.

Sharing and Grappling with Issues. Although Team W members were actively involved in discussion, when they met, almost half of their exchanges involved what Ke and Xie (2009) label information sharing (K1), an indicator of beginning stages of critical collegueship, with team members sharing individual work, as opposed to allocentric elaboration (K3), or discourse around diverse perspectives that involves the elaboration, probing, and pressing of ideas and experiences which van Es (2012) proposes are behaviors indicative of high-functioning critical collegueship and supportive of transformative PL.

The absence of high-functioning critical collegueship was evident in the following exchange from their third in-person meeting where an issue was raised and acknowledged (e.g., “That’s so maddening.”), but not grappled with by team members (e.g., “I don’t know how you make that happen.”):

W4: So, you know it’s the same old discussion. Some of us coaches are placed in rooms with undesirable teachers.

W3: Right, I have these teachers who have these big binders and they’re like this is what I taught last year at this time and so this is what I’m going to teach at this time this year.

W4: That’s so maddening.

W3: Right. And I have so many teachers with no flexibility. And they’re supposed to be working in a team because we have the dual language program where students have one teacher for math half the week teaching in English and the other teacher for the other half of the week teaching in Spanish. And the two teachers will not collaborate... my question to you is how did you break through with your teachers? ... I can’t even get them to be talking about standards instead of strategies. There’s just no common ground.

W4: I don’t know how to best make that happen in your situation because to be successful those teachers really have to collaborate and if they’re not willing to compromise at all, I don’t know how you make that happen.

Similarly, almost half of Team Z’s discussion time, across all meetings, involved personal information and idea sharing (K1; Ke & Xie, 2009) with minimal probing or

connecting of ideas, indicating a lack of critical collegueship development. For instance, in the following excerpt from their fourth monthly in-person meeting, members of Team Z congenially discuss their work to help classroom teachers at their schools use more rigorous tasks during mathematics instruction. Although multiple individuals share their work, they do not take up or probe each other’s ideas or struggles but instead just share related experiences and express their agreement (e.g., “Right...”, “Yeah...”, and “Uh huh”).

Z2: I’ve just been spending time in K [-indergarten] and [grade] 1 shifting to working on how to choose tasks and help students really talk about them. I’m finding that a lot of my teachers struggle most with the management part of it. So, I need to just really look at what parts of this different teachers can handle.

Z3: Right, I have one grade level that can implement new things pretty quickly, but there are other grade levels that really struggle with it. And I struggle with supporting the younger grades with management for the same reasons as you because I just don’t have the background.

Z2: I was just thinking that even just being in K-2 classrooms for us is a really good thing with all of us being intermediate people...

Z3: Right.

Z2: ‘Cause I taught second grade for one year but everything else has been grades 5 or 6, so I find that I still have the knowledge base to support these teachers but just taking time to go in and hangout in the younger classrooms to see how they work and how the children think, I think is a really good thing.

Z3: Yeah, seeing how the kids react to things.

Z1: Right, how are we supposed to be able to develop really good tasks if we don’t really know our audience. I think that makes a lot of sense. I need to know where these little heads are in this room and where they are in that room.

Z3: Yeah, and in a lot of the classrooms the teachers don’t have the language and the routines, so it’s really hard to implement these types of tasks if they haven’t been given the tools from their teacher for one reason or another it becomes very difficult to, umm, that process is not easy.

Z2: Uh, huh.

The exchanges above from Team W and Team Z are evidence of a focus on congeniality versus critical collegueship, as members are sharing information but not probing or challenging those ideas from different perspectives. In contrast, Team X regularly connected to and probed each other's ideas and brought issues to meetings explicitly asking for support and advice. This discussion from the team's third in-person meeting is one such example:

X3: Just this year it seems like it's hard to find the time to do these observations... our group here we're working together well and everything's great, but we're finding it impossible to make any contact on the road and take that out and get it going.

X6: If it's okay, I'm thinking about just using a couple of the teachers who really have this up and running and to use the observational tool with them and to have it just be me and them, just the self-observation. Because I'm thinking if I get a couple of people really on board with this, especially a couple of vocal, on-board people, then I feel it would grow out.

X3: The early adopters.

X6: Yes, the early adopters, thank you. Then I think I can really roll this out.

X2: Thank you for that, that's a good perspective. I'm just feeling that I've been so frustrated not having time to role this all out...I feel so great after our meetings, but then I feel like when I get back to school...there's no intersection for me. ...And no matter how well I had it all planned out I just feel like I'm falling further behind. I feel like I'm not really accomplishing anything.

X1: Can I make a suggestion for framing this work?

X2: Sure.

X1: When you're talking about it with the teachers, they're going to focus in on an area that they are most attracted to whether it's by the questions we ask or something they're struggling with. We already know what the goals are and then it's like what are we going to do and then we pick this one little thing that we can already work on, right away. And then we just do that piece. Ideally then you'd be able to go in and do another piece. So, maybe it's just controlling the observation and making sure that it includes a debrief because without the debrief are we really doing anything? I don't know. You tell me.

X2: So, I wanted to do two grade levels, but maybe I just start by working with two teachers instead.

X3: Right to get something meaningful done, even if it's small.

This exchange differs from Team W's, in that in the earlier case W4's expression of frustration was met with collegial empathy but no offer of ideas or potential solutions (e.g., "I don't know how you make that happen") whereas in Team X's exchange critical collegueship was evident in that multiple team members pressed X2 to consider their struggle from different perspectives in a solution focused manner (e.g., "Can I make a suggestion for framing this work?" and "...maybe I just start by working with two teachers instead"), indicating a positive sense of collective efficacy instead of falling back on external blame and powerlessness.

Similarly, Team Y members regularly connected to and probed each other's ideas and brought issues to team members explicitly asking for support and advice. When discussion centered on developing and discussing teaching and learning, Team Y members had multiple interactions involving allocentric elaboration (K3; Ke & Xie, 2009), with individuals synthesizing and challenging the ideas of others to deepen their shared understanding and broaden individual perspectives. These types of interactions are indicative of high-functioning critical collegueship and support individual and collective transformative PL.

The following exchange from Team Y's month four in-person meeting illustrates that when critical collegueship is present individuals willingly expose struggles and openly listen to alternative perspectives that may lead to improved teaching and learning:

Y3: ...that was the classroom I was talking about that doesn't do any whole group instruction. They only do small group because they have so many severe kids. You know, what would be the point of doing that whole class when they wouldn't be getting anything out of it. I'm not trying to be mean, but we have some really unique kids at our school that just need something else...But anyway.

Y2: But I think you're asking the right question. What is the purpose? Just getting into what are their needs and how are you meeting them.

Y3: Those kids are just so isolated in that classroom already, and if I went in there and was like we're going to do a number talk with everyone. I would just be setting things up for failure.

Y4: So, why don't you just go in and set it up for the kids that it would be appropriate for, so the teachers can see how it works.

Y2: Right and then they could think about how to adjust it to work for the other students.

Y3: Oh yeah. That might work. I mean there are only a few students who are really severe...

Like the example from Team X, this discussion ends with a statement that indicates a sense of agency ("Oh yeah. That might work.") resulting from multiple team members offering diverse perspectives and probing the specifics of the conversations ("But I think you're asking the right questions" and "So, why don't you..."), as opposed to congenially offering empathy as was seen in Team W's discussion ("That's so maddening").

Discussion of External Barriers. Another discussion characteristic indicative of high-functioning critical collegueship and positive C-MEFT perceptions was a solution focused approach to discussions of systemic and structural barriers, such as a lack of time, teacher buy-in, and principal support. Unlike some of the other teams, Team Y's members responded to the discussion of barriers by engaging in collaborative problem solving. For instance, during their second virtual meeting a team member brought up a struggle they were having with two barriers, finding time for CIT work and getting buy-in from her teachers:

Y2: I wonder...I'm feeling like if there is something that we are doing for someone else how we can incorporate this into our daily work. I'm feeling like I'm having trouble getting traction into this work. Maybe it's because I'm new this year and I missed all of the work last year.

Y3: So, I have a question. Do any of the small-wins help bring this [our CIT work] to your day-to-day?

Y2: I think maybe. I feel good about it when I'm filling out this form, but then when I'm back at my school I'm having trouble seeing how this fits into what I'm trying to do.

Y4: I'm wondering if you should try to find one teacher that you can start this work with and then build from there.

Y2: Yes. Absolutely. That might work.

In this exchange, Y2 appears to have trusted their team members to support as opposed to judge their struggle to implement the team's action plan at her school. Instead of empathizing with them (as was seen in the discussion excerpt from Team W above, "I don't know how you make that happen"), team members (Y3 and Y4) provided suggestions for small steps Y2 could take to move forward with the CIT work within their own context (e.g., "I'm wondering if you should try..."). Professional exchanges where team members share struggles and offer suggestions for overcoming potential barriers promote positive C-MEFT perceptions by demonstrating collective capacity. This type of open exchange of problems and potential solutions has been found to also support critical collegueship development through collective reflection on teaching and learning practices connected to specific practice-based incidents (Hamann et al., 2001; Males et al., 2010; van Es, 2012). This mutual trust and development of productive collaboration were evident in a team member's comment at the final session: "I was really hesitant at first ... to work with my team. To be honest, I figured I'd just continue to do my own thing. But...we're really getting on as a team and helping each other get some really good work done" (Y1).

On the other hand, similar to Team W, when members of Team Z identified external factors (e.g., district initiatives) that appeared as barriers to their shared work and their ability to engage in instructional coaching work they were acknowledged as personal sharing and there was no effort by team members to probe the issues or work to overcome them. For example, in this discussion at their month three in-person meeting members brought about the same issue that Y2 brought up in the excerpt above, not having enough time for their CIT work, but instead of offering possible solutions ("I'm wondering if..."), here Z1's concern is met with agreement that these external demands are a shared problem ("Right..." and "That's frustrating.") similar to the example from Team W above:

Z1: Right, and I feel like I don't have the time to really work with the teams at my school because there are so many other things on the agenda all the time.

Z3: Right, and the next CPTs are going to have to focus on the interim assessments, so then what are you supposed to do. And then there'll be something else procedural that will come up.

Z1: Right, all the paperwork and analysis of the assessment data eats up a lot of time.

Z4: Even getting the kids to be able to complete the assessments on the computer takes a ton of time.

Z3: Right, I find they can't even get into it sometimes. That's frustrating.

Team Z completed the study at the beginning stage for all three indicators of critical collegueship development, lower than where they started (see Figure 1), which may indicate individuals lacked confidence in their collective capacity and had limited readiness to engage in transformative PL.

Appreciation of Time Together. Although most of Team Z's and Team W's discussions did not include the collaborative discourse indicative of high-functioning critical collegueship, team members spoke positively of the opportunities for collaboration and the exchange of ideas the CIT work provided. For example, a member of Team W stated, "We are like-minded and enjoy sharing ideas with each other" (W3, month 2 feedback survey) and one Team Z member commented:

... it's kind of nice at these meetings to just be able to talk and catch up with you guys about what is going on at our different buildings, because it's been so structured [in the past] that we hadn't really been able to debrief and talk (Z1, month 3 meeting transcript).

Based on Wenger and colleagues' (2011) framework for assessing value creation in professional learning communities, Booth and Kellogg (2015) propose participants find value in different ways, moving through a developmental cycle that begins with enjoyment of engagement with peers by discussing and sharing ideas. The types of statements above (e.g., "it's kind of nice...to just be able to talk and catch up...") as well as Team Z's final presentation statement, "bouncing ideas off each other was a great benefit," may indicate that members of Team X and Team Z were at this beginning stage of value creation. Over time, this initial stage, where members simply enjoy engaging with peers, provides opportunities for trust development and vicarious success experiences as members listen to

peers' ideas. So, although Team X's and Team Z's discussions did not reflect the discourse and interdependence characteristic of high-functioning critical collegueship, the idea exchange and trust development occurring during these meetings may still account for members' satisfaction with their CIT work, but their continued identification of external factors as barriers to their collaborative work and lack of willingness to critically examine issues and ideas brought up in the conversations may also indicate a lack of readiness to engage in a process of transformational PL.

Discussion

The key variable of interest in this study was the development of critical collegueship within the four CITs, as it is engagement in public reflection and collaborative discourse around practice that promotes transformational PL (Hamann et al., 2001; van Es, 2012). Critical collegiality and discourse, when connected to daily practice, create the cognitive disequilibrium needed to promote meaningful change as educators consider multiple perspectives, examine new ideas, and debate their usefulness for achieving goals (Benoliel & Schechter, 2018; Puchner & Taylor, 2006; van Es, 2012).

Ernest and colleagues (2013) propose that collaborative learning goes beyond exchanging information (Ke and Xie's, 2009, level K1 and van Es, 2012, beginning stage), involving reciprocity and comparing points of view (Ke and Xie's, 2009, level K3 and van Es' 2012, high-functioning stage) to produce higher quality knowledge construction than could be developed individually. Critical collegueship development, or the progression from a focus on individual interests and references to discourse around diverse perspectives to promote shared understanding (van Es, 2012) and positive beliefs in collective capacity, stems from active and collaborative participation. Thus, this comparative analysis focused on determining how differences in engagement in a structured collaborative inquiry process, including the development and use of team charters and action plans, influenced the development of critical collegueship amongst these teams of instructional leaders over time. Based on an examination of this study's results and existing empirical literature, it appears that two features of the structured collaborative inquiry process were influential: (a) explicit attention to teamwork culture development and ongoing collaborative functioning and (b) development of a shared measurable goal and action plan.

Proactive and Ongoing Attention to Teamwork Functioning

Developing a team charter at the beginning of the inquiry process provided an opportunity for team members to determine agreements for social interaction and measures of accountability (Anderson, 2008; Servais et al., 2009). As Team Y found in this study, not engaging in collaborative development of a charter at the beginning of the CIT process can lead to individuals lacking a sense of how to move forward as an effective team (e.g., “I don’t know how this is going to work...”). The detailed operating norms Team Y eventually developed were referred to at every subsequent meeting and promoted critical examination of ideas and practices as all members knew what was expected of themselves and others. This provides evidence for Servais and colleagues’ (2009) proposition that “developing a set of operating norms is an important first step to guide the [collaborative inquiry] process and assure accountability to the team” (p. 8). These agreements support members as they develop relationships and build a foundation of trust. In addition to establishing these collegial expectations at the beginning of the process, both Team X and Team Y referenced the agreements within their charters regularly and spent time coordinating their work together at all meetings. This contrasts with Team W and Team Z who, although they established expectations within their charter, did not reference these agreements or spend time on teamwork coordination at subsequent meetings. As Team X and Team Y progressed to higher levels of both critical collegiality and knowledge development and completed most of their action plan goals, while Team W and Team Z did not, it appears explicit attention to and documentation of team functioning and culture both at the beginning and throughout the collaborative inquiry process was an influential factor.

Shared Measurable Goals and Action Steps

Although all four teams established a long-term goal their use of the action plan template within their collaborative inquiry process differed. Team X and Team Y both established a shared, measurable goal and steps to achieve that goal and then used their action plan to set meeting agendas and to support active, collaborative engagement during and between meetings by all members in efforts to achieve their shared goal. Both teams progressed to high-functioning stages of critical collegiality and had multiple exchanges involving allocentric elaboration (K3) and application (K4), Ke and Xie’s (2009) highest levels of knowledge development. On the other hand, although

they established a shared long-term goal, neither Team Z nor Team W collaboratively worked toward that goal through shared action steps. Members of Team Z each had different sub-goals and worked independently toward achieving their goals, as opposed to having shared action steps around which to collaborate. And, although Team W collaboratively accomplished work, the tasks they completed did not align to their established goal. Additionally, neither team used their action plan template to support their collaborative work, including not assigning tasks to members or developing meeting agendas. Neither Team W nor Team Z progressed past an intermediate stage of critical collegiality and had few exchanges that progressed past knowledge sharing or egocentric elaboration. Evidence from this study supports and builds on findings from other empirical studies that, although agency around goal setting and meeting agendas promotes positive efficacy perceptions, having and purposefully using clear structures to focus and coordinate shared work appear necessary for promoting critical collegiality, transformational PL, and team productivity.

Implications

This study examined the impact of engagement in structured collaborative inquiry on inter-school mathematics coaches’ critical collegiality development in their work to promote impactful and cohesive mathematics teaching and learning across district elementary schools. The findings around what structures, systems, and routines promoted successful team functioning and outcomes have implications for both district level support of coaches’ ongoing PL as well as coaches’ ability to facilitate transformational learning experiences for the teams of teachers whom they are tasked to support. This includes providing transformational PL opportunities for coaches and promoting the explicit development and use of structures to support effective facilitation of PL within regularly scheduled meetings to help promote and sustain transformational PL in support of students’ academic achievement.

Mathematics coaches are well positioned to be change agents within schools. To achieve this potential, they need ongoing opportunities to engage in collaborative learning with other instructional leaders (e.g., coaches from other schools and principals) to build the repertoire of skills, knowledge, and dispositions needed to effectively lead PL within and across schools (AMTE et al., 2022; Desimone & Pak, 2017; Voelkel et al., 2021). Structuring these

learning opportunities as collaborative inquiry into problems of practice arising from their daily work can enable coaches to see the value of this type of transformational PL. This practice-based inquiry can also help them rethink mental models of traditional top-down PL and coaching, thus building their change building capacity (Desimone, 2009; Voelkel et al., 2021). Being able to speak to specific challenges and benefits of these types of PL experiences also supports coaches' ability to help teachers engage in collaborative work and to share their needs and goals (Elfarargy et al., 2022; Fennell et al., 2013). Similar to new teachers who are apt to revert to teaching the way they were taught, as novices in the role of instructional leaders, mathematics coaches need to experience, firsthand, this type of transformational learning, not just be exposed to new ideas (Elfarargy et al., 2022).

We know that not all educators are self-directed learners willing to take initiative and persist in the learning process. This study's findings indicate that putting specific structures in place and supporting the coaches' use of team charters and action plans throughout the collaborative learning process promoted both critical collegueship development and transformational PL. Specifically, the collaborative development of team charters enabled teams to get to know each other, to consider the diverse strengths each individual was bringing to the work, to proactively discuss common teamwork challenges, and to create clear expectations for collaboration and communication. Once in place, these documents also provided a tool to support and monitor teamwork functioning throughout the process.

Additionally, the collaborative development of an action plan with clear goals and success criteria as specific, incremental work to be done supported both individual and collective accountability. Regularly referring to these collaboration plans and charters appeared to have promoted goal accomplishment and team functioning. It also appears that facilitation by an instructional leader, whether that be a coach for a team of classroom teachers or a district level curriculum coordinator for a team of coaches would further

support critical colleague development and transformational PL. This knowledgeable other can help create and sustain a safe learning environment, promote intentional discourse, help individuals overcome a sense of avoidance, and bring new ideas and perspectives to the surface (Elfarargy et al., 2022). In this study, this type of facilitation enabled Team Y to move past their initial teamwork roadblocks to develop high levels of critical collegueship and it may have helped Team Z determine how to develop shared sub-goals and action steps and Team X to move their discussions past congenial exchanges of ideas and toward the critical discourse needed for transformational PL. Although some teams of educators are capable of effectively leading their own learning (as was the case for Team X), it is important for mathematics instructional leaders to recognize this is not always the case and that their active support in establishing time for educators (whether they be teachers or coaches) to meet regularly and attending to the explicit development and use of PL structures and processes will support success (Voelkel, 2022).

This study was limited in scope and leaves open opportunities for future research, including examining how instructional leaders can use structures such as team charters and action plans to facilitate collaborative inquiry opportunities for the teachers whom they support. Additionally, mathematics teacher educators in higher education, or mathematics coaches themselves, may use the structures and processes to create professional learning networks across districts where there are only one or two instructional leaders as a way to broaden perspectives and further change efforts. And finally, as was evident in Team W and Team Z in this study, educators can find value in working together even when not engaging in high levels of critical collegueship or knowledge development. Examining how instructional leaders can help educators (both teachers and coaches) use this sense of satisfaction with collaborative PL to move toward a willingness to engage in critical collegueship to sustain transformed knowledge and practice through honest reflection and constructive discourse is a potential area for future research. ✪

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Appendix A

Qualitative Coding Rubric for Examining Critical Collegueship

	Beginning	Intermediate	High Functioning
Collaborative Interactions	Discussions dominated by 1-2 participants	Discussions involve some members but not distributed among the group	Discussion involves most participants
	Conversation initiated not taken up by the group.	Conversation initiated and taken up by only 1-2 group members.	Conversation initiated and taken up by most members of the group.
	Participant talk is one-sided and egocentric.	Participants begin to listen to each other and validate ideas; some support of each other and some one-sided talk.	Participants listen to each other and pursue each other's ideas; try to understand other's ideas and experiences; offer support to others.
	Participant talk is not connected. Participants shift focus.	Participants begin to have collaborative conversations but still redirect to own interests	Participants raise issues and pursue one another's issues and ideas
Participation and Discourse Norms	Only one perspective represented	Different ideas and perspectives are raised but not always discussed	Different ideas and perspectives are raised and consistently discussed
	Little or no references are made to shared referents or specific school/classroom incidents to build discussion	Some evidence from shared referents or specific school/classroom incidents is used to build discussion	Consistently use evidence from shared referents or specific school/classroom incidents to build discussion
	Little elaboration, probing, or pressing of ideas	Some elaboration, probing, and pressing of ideas	Elaborating, probing, and pressing on one another's ideas frequently occur
Focus of Activity and Discussion	Topics of discussion are peripheral to progress on team's goal, is general in nature and may address a variety of topics peripheral to mathematics teaching and learning.	Discussions focus on progress made on team's goal but are not necessarily connected to mathematics teaching and learning in district schools	Analysis of progress on team's goal is directly connected to mathematics teaching and learning in district schools
	Participants' talk is primarily sharing general experiences and not grounded in shared referents or specific school incidents	Ideas developed with both general experiences and shared referents or specific school incidents	Discussions are grounded in specific mathematics learning and teaching through shared referents or specific classroom incidents

Note. Adapted from van Es' (2012) framework for development of teacher learning community in a video club (Table 4, p. 186).

Appendix B
Collaborative Inquiry Team Charter Template

Team Member Names	Contact Information (email, cell, etc.)	Preferred Contact Method & Limitations (i.e.: no calls after...)
Team Member Names	Strengths related to teamwork & the team's chosen POP	Weaknesses related to team-work and chosen POP

1. **What roles will each member have during and between meetings?** (Consider both logistical tasks, such as arranging meetings, preparing agendas and meeting minutes, and keeping materials organized online; as well as team process roles, such as questioning, ensuring everyone's opinion is heard, etc.)

2. **When will your team hold its monthly Google Hangout meeting?** (Day and Time)

3. **What are your team's expectations regarding meeting attendance?** (Being on time, leaving early, missing meetings, etc.)

4. **What constitutes an acceptable excuse for missing a meeting or a deadline? What types of excuses are not considered acceptable?**

5. **What process will team members follow if they have an emergency and cannot attend a team meeting or complete their individual work/deliverable on time?**

6. **What are your team's expectations regarding the quality of team members' preparation for team meetings and the quality of the deliverables members bring to the team?**

7. What are your team's expectations regarding team members' ideas, interactions with the team, cooperation, attitudes, and anything else regarding team-member contributions?

8. What methods will be used to keep the team on track? (How will your team ensure that members contribute as expected to the team and that the team performs as expected? How will your team celebrate members who do well and manage members whose performance is below expectations?)

Adapted from CATME Smarter Teamwork tools <http://info.catme.org/catme-tools/>

Appendix C Collaborative Inquiry Team Action Planning Template

Action Plan for _____

Long Term Goal(s):	Small-Win Strategy #1: <hr/> Small-Win Strategy #2: <hr/> Small-Win Strategy #3:			
Small-Win Strategy #1:				
Planned Work, Activities, and Tasks	Resources Needed	Timeline	Person(s) Responsible	Evidence of Success

Appendix D

Monthly Feedback Survey

Indicate approximately how often you performed each action as part of your inquiry team work over the past month (never, once or twice, weekly, almost daily):

- I communicated with team members through email
- I shared resources with team members through email
- I created a new Google Doc or Sheet on my own
- I collaborated with teammates using a Google Doc or Sheet
- I added new resources to a Google Drive folder
- I used resources someone else had shared on Google Drive
- I created a new folder on Google Drive and shared it with colleagues
- I participated a Google Hangout meeting/discussion
- I accessed a link or notification through the communication Stream
- I posted a link or notification on the communication Stream

For each Google Classroom tool, indicate how valuable it was for supporting your team's inquiry work over the past month (it made it more difficult, it helped a little, it was somewhat helpful, it was vital to our success):

- Email
- Google Docs/Sheets
- Google Drive
- Google Hangout sessions
- Communication Stream

Do you have any other comments you would like to share related to the use and availability of tools within Google Classroom?

Respond to the following statements related to how your team worked together over the past month.

- For each work format, indicate how productive you feel your team was during the past month (not at all, somewhat, productive, very):
 - In-person meeting
 - Video meeting
 - Collaborating online
 - Working individually
- This month my team accomplished (choose one): all of its work goals, most of its work goals, some of its work goals, few of its work goals
- Because (choose all that apply): we collaborated and everyone completed their assigned responsibilities, one or two members completed all or most of the work, our work plan was not realistic, we could not come to consensus on critical decisions, other:
- This month my team members and I adhered to our team charter, in terms of expectations for communication and collaboration online between meetings: strongly disagree, disagree, agree, strongly agree
- This month my team members and I adhered to our team charter, in terms of expectations for communication and collaboration at both our video and in-person meetings: strongly disagree, disagree, agree, strongly agree

Do you have any other comments related to how your team worked together over the past month?

Final Thoughts:

Over the next month, I hope my team continues to:

One change I would like to see in our inquiry work is: