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An Examination of the Nature of Post-Observation Feedback Provided to Middle School Mathematics Teachers

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Abstract

The feedback mathematics teachers receive following an administrator's observation of instruction is a critical component of the teachers' professional development. This study examined the nature of feedback middle school mathematics teachers received from administrators who had differing formal mathematics education or experiences. Data included teacher evaluations, classroom artifacts, classroom observation field notes, and interviews with teachers and administrators. Within the framework of leadership content knowledge and complexity leadership theory, three major themes emerged with regard to how different mathematical backgrounds and/or evaluative roles of observers influenced their feedback. These themes focused on the form of the feedback (written and oral), the process for developing feedback (inductive and deductive), and the nature of feedback (content or pedagogical focus). The findings from this study most notably pointed to the difference in the nature of feedback to middle grades mathematics teachers from observers who had formal mathematics education or experience and those who had different subject backgrounds. The findings also provide evidence to support several implications for mathematics education leaders, which are discussed.

Introduction

Evaluation of teaching is a common practice with school districts nationwide investing significant time and resources into developing teacher evaluation instruments and protocols that assist administrators in documenting teacher effectiveness to meet federal policies (U.S. Dept. of Education, 2012). Although the passing of the Every Student Succeeds Act (2015) removed some of the restrictions on teacher evaluation, accountability is still a top priority in school districts. Evaluation models take many forms and researchers recommend models that include multiple methods of data collection (Milanowski, 2011). For example, Rockoff and Speroni (2011) found evidence to support that first-year teachers, who received subjective evaluations by trained mentors, produced greater gains in student achievement with future students but recommended both subjective evaluations by trained professionals and objective performance data to identify weaknesses in instruction. Similarly, Darling-Hammond, Amrein-Beardsley, Haertel, and Rothstein (2012) reported that effective systems utilized trained evaluators, provided frequent evaluation and feedback, and integrated measures (e.g. observations, videos, artifacts) that linked teachers' actions to outcomes.

These models are not only designed for evaluation purposes but also play a significant role in the professional growth and careers of many educators. Typically, evaluators are expected to provide feedback to multiple teachers in many content domains with the goal of improving

instructional practice. A critical component in a teacher's professional development is the feedback evaluators provide to teachers following the administrator's observation of instruction (Scheeler, Ruhl, & McAfee, 2004). Despite the importance of this post-observation feedback and the recommendations for specificity in accountability measures, there is little research pertaining to the ways in which administrators attend to subject-specific details in evaluation and instructional improvement (Lochmiller, 2016).

In concert with the national stir about teacher accountability is the nation's continued focus on students' mathematics achievement with federal initiatives seeking to increase the number of highly qualified STEM teachers, federally funded professional development programs, and partnerships between education and industry. In an effort to support the development of mathematics teachers, the National Council of Teachers of Mathematics (NCTM, 2014) recommended that leaders and policymakers empower teachers to create effective classrooms and learning environments by aligning accountability measures with mathematics teaching practices. These practices focus on clear mathematical learning goals, reasoning, problem solving, connecting representations, discourse, prior knowledge, conceptual understanding, and productive struggle. Considering the importance of observation and feedback to teachers' professional growth, coupled with the NCTM's recommendation for content-focused accountability measures, it is plausible that observers' content knowledge may influence the type of feedback provided and, hence, play a role in the professional growth of teachers.

Purpose of the Study

In this study, we examined the nature of feedback middle school mathematics teachers received from administrators who had differing formal mathematics education or experiences. We were particularly interested in teachers' perceptions of the feedback they received, in administrators' perceptions of the feedback they provided, and in comparing administrators' perceptions to the written feedback that teachers received. This exploratory study included 10 participants from three different schools and districts. We collected several forms of data including teacher evaluations, classroom artifacts, classroom observation field notes, and approximately 4 hours of interviews. We begin this paper by providing a review of literature relevant to teacher feedback and include a specific focus on feedback provided to mathematics teachers. Following this review, we include the theoretical perspectives that framed the study, our study findings, and the ensuing discussion and implications for mathematics teacher development. The research questions explored were:

1) In what ways does post-observation feedback differ among observers with different mathematical backgrounds and evaluative roles?

2) How does the mathematical background of the observer shape his or her use of the school district's teacher evaluation system observation instrument?

Relevant Literature

The Nature and Benefits of Observation and Feedback to Teachers

A commonly employed method for promoting dialogue between evaluators and teachers and one that is included in recommended evaluation models (Darling-Hammond & Snyder, 2000; Moss et al., 2004) is observation and feedback from administrators, with feedback being a critical component to this cycle (Darling-Hammond et al., 2012; Scheeler et al., 2004). For the purposes of our study, we used Hattie and Timperley's (2007) conceptualization of feedback as "information provided by an agent regarding aspects of one's performance or understanding" (p. 81). We interpreted performance to mean teachers' instructional choices and understanding to mean teachers' understanding of content and pedagogy that influenced instruction. A review of the literature on feedback to teachers conducted by Scheeler and colleagues (2004) found 208 articles that were published on feedback to teachers between 1970-2004; however, only 4% of those articles focused on in-service teachers, and the rest focused on pre-service teachers. They concluded, "Feedback is better than no feedback, immediate feedback is better than delayed feedback, and feedback that is immediate, specific, positive, and corrective holds the most promise for bringing about lasting change in teaching behavior" (p. 405). Although it is documented that providing feedback is important, the type of feedback provided to teachers is also important, as it plays a role in the feedback's efficacy (Cherasaro, Brodersen, Reale, & Yanoski, 2016).

Characteristics and teacher perceptions of effective feedback. Research-based characteristics of effective feedback for teachers often center on the specificity of the feedback. For example, assessment research indicates that feedback is most effective when it communicates the current level

of achievement in relation to specified goals and provides steps to attaining these goals (McMillan, 2011). Similarly, Milanowski (2011) purported that teacher evaluations should include specific and clear feedback so that teachers have the opportunity to use the results to improve their practice. Furthermore, quality feedback can be described as timely, specific, and frequent (Northcraft, Schmidt, & Ashford, 2011; Price, Handley, Millar, & O'Donovan, 2010).

In Ovando's (2005) study, which examined the experiences of teachers and administrators during their observation and feedback cycles, teachers noted the importance of specificity in written feedback, and they appreciated face-to-face conversations about the observation and the written feedback. These teachers believed that effective feedback included post-observation conferences between the administrator and teacher that focused on the strengths of the instruction, were based on observable actions, and resulted in professional development goals for the teacher. In this study, administrators reported that in order to provide this level of specificity in written feedback, they needed to develop a knowledge of quality instruction, scripting skills, and appropriate professional language during their graduate studies. Considering the personal nature of the observer-feedback evaluation cycle, these experiences and perceptions of teachers and observers are noteworthy.

Other studies that have looked at teacher and administrator perceptions and experiences emphasized: the need for multiple observers; specific, written feedback coupled with dialogue; and adequate time for the full cycle to be effectively employed (Collins, 2004; Ovando & Ramirez, 2006). In one qualitative study, teachers and administrators had different perceptions of the nature of the given feedback following teacher observations (Collins, 2004). Teachers in this study believed that when instruction was satisfactory, they received no feedback from administrators. This was problematic for teachers as they expressed a need for feedback, regardless of the nature of instruction. Collins recommended addressing teachers' concerns by including supplemental observers such as department heads and senior teachers who had subject expertise and believed that their inclusion would result in a more comprehensive evaluation.

Further, not having multiple observers can lead to subjectivity in evaluation as recognized by Sartain, Stoelinga, and Brown (2011). In their study, the researchers examined the effectiveness of a teacher evaluation framework that employed the observation/feedback model between administrators and teachers. To do this, the teacher was evaluated by both an administrator and a researcher. When reporting on the higher end of the scale (proficient or distinguished instruction), there were significant discrepancies between the observation ratings. Administrators were more likely than the researcher to rate a teacher as distinguished. In this same study, administrators were more likely to ask low-end questions that did not invoke reflective conversation than high-end questions that sparked deeper discussion about the instruction. The researchers concluded these forms of in-depth conversations were needed to improve teaching practice.

Subject-specific feedback. With the current focus in mathematics education on process standards, student mathematical dialogue, justification, and modeling (Common Core State Standards Initiative, 2010; NCTM, 2000, 2014), it is critical that administrators not only direct their attention to pedagogical and behavioral concerns in instruction but also value subject matter in both the content and the practice of disciplines (Nelson & Sassi, 2000). As noted by the NCTM (1989) in the *Professional Standards for Teachers of Mathematics*, central to the process of evaluation is the inclusion of multiple observations from more than a single observer. The teacher's role in these interactions is that of a reflective practitioner who provides information to the observer about his or her goals and self-analysis of teaching. The post-observation dialogue should be a means for developing a professional development plan focused on improving instruction.

Recently, the NCTM (2014) extended this work by outlining specific teacher and stakeholder actions in the publication, *Principles to Actions: Ensuring Mathematical Success for All*, which, they contend, should ensure students' success in mathematics. In particular, this document recommended that leaders and policymakers provide supports for ensuring student access to high-level mathematics education by aligning accountability measures with the Mathematics Teaching Practices and classroom observations that focus on these practices. These recommendations for teacher evaluation aligned with the research literature, which endorsed evaluation models that included multiple data collection sources.

Despite the NCTM's recommendation for mathematics-specific dialogue and evidence of content mastery, very few studies have taken a look at subject-specific observation

and feedback (Lochmiller, 2016; McDonald, 2008; Nelson & Sassi, 2000). Nelson and Sassi (2000) examined the nature of administrators' observations of a video-recorded fifth-grade mathematics lesson. The researchers reported that during the first observation, administrators noted the structural features of the lesson including "orderliness, good classroom management, understandable and well-executed structural components to the lesson and teacher behaviors such as wait time and gender equities" (p. 565). Following eight months of a professional development seminar for administrators focused on observation and supervision of elementary mathematics, the administrators viewed the video for the second time and noted subject-specific features of the lesson such as students' mathematical discourse. The observations shifted from teacher action and surface features of instruction to the development of mathematical ideas.

More recently, Lochmiller (2016) interviewed 51 participants, including 20 mathematics teachers, 19 science teachers, and 12 administrators, and examined these participants' perceptions of feedback that they received or provided. Findings indicated that the mathematics and science teachers perceived the feedback that they received as being general in nature and did not address content-specific instructional matters. Administrators used their past teaching experiences to help frame their feedback to teachers across content areas. Recognizing this tendency, Steele, Johnson, Otten, Herbel-Eisenmann, and Carver (2015) used Stein and Nelson's (2003) leadership content knowledge as a framework for designing professional development aimed at increasing principals' algebra content knowledge. The researchers found that the professional development experience changed principals' understandings and perspectives of algebra, which, in turn, influenced their leadership practice. These principals expressed that, prior to engaging in this content-specific professional development, observations were short in duration and feedback consisted of broad brushstroke statements. With the change in their content knowledge, the principals stated that future observations would focus on specific details of mathematical thinking. The researchers in this study did not follow principals into classrooms to document their evaluation practices, which was one way we intended to contribute to the knowledge surrounding teacher feedback in the current study.

Another study supporting the need for examining content-focused feedback was conducted by Cherasarso et al. (2016). The researchers used correlational analysis to explore teacher perceptions of the feedback they received and found that their perceptions were related to four characteristics with one of the most critical being the credibility of the evaluator. The researchers suggested that credibility was linked to the evaluator's knowledge of the subject being evaluated. The current study addressed the importance of evaluator credibility by examining the feedback provided by observers with mathematical backgrounds and those without.

Summary

Considering the importance of feedback for improving instruction, we sought to extend the literature centered on discipline-specific leadership and teacher development by examining the nature of feedback provided to teachers by observers with different content backgrounds. We were particularly interested in feedback for middle grades mathematics teachers because teachers in this grade band are challenged with building on elementary mathematics content in preparing students for high school content with many middle grades teachers responsible for teaching higher-level mathematics courses. Hence, teachers in these grades feel pressure from both the grade bands below and above them and effective feedback may support their instructional practice.

Feedback literature shows the importance of multiple perspectives, specificity, and timeliness (Collins, 2004; Northcraft et al., 2011; Ovando & Ramirez, 2006; Price et al., 2010) with little research centered on content-focused feedback (Lochmiller, 2016; McDonald, 2008; Nelson & Sassi, 2000). Our study examined the content, development process, and form of post-observation feedback provided to teachers. This study is unique in that the observations were conducted by both an observer with mathematical content background and an observer with a different subject matter expertise. These different perspectives allowed us to compare the types of feedback received by middle grades mathematics teachers from each observer while also considering teachers' and observers' perspectives about this feedback.

Theoretical Framework

We drew from two theoretical perspectives in the design and analysis of this study: leadership content knowledge (Stein & Nelson, 2003) and complexity leadership theory (Uhi-Bien, Marion, & McKelvey, 2007). Leadership content

knowledge contends that the subject matter knowledge of an administrator plays a role in his or her leadership functions. Stein and Nelson defined leadership content knowledge as "the knowledge of subjects and how students learn them that is used by administrators when they function as instructional leaders" (p. 445). At the school level, this form of knowledge may play a role in an administrator's feedback about lessons or instruction. Stein and Nelson explained that leadership content knowledge is at the crossroad between subject matter knowledge and leadership practice and stated, "Without knowledge that connects subject matter, learning, and teaching to acts of leadership, leadership floats disconnected from the very processes it is designed to govern" (p. 446). This intersection between subject matter and leadership framed our study.

Recognizing that school administrators cannot become experts in all content areas within one school, Stein and Nelson (2003) recommended a *distributed approach* to leadership that employed *postholing* to support disparities in leaders' subject matter knowledge. A distributed approach acknowledges that schools are complex entities with many resources for supporting leaders in increasing their subject matter knowledge. In mathematics, these resources may include mathematics specialists, teachers, curriculum coordinators, or tangible materials such as curricula, standards, or observation protocols. Leaders should draw from these available resources for building their own capacity in a subject area. Postholing refers to the process of learning a slice of one subject at a very deep level. In this way, administrators gain an understanding of how the subject is constructed, what conceptual meaning looks like in that subject, and how students come to understand the content. Administrators should have a firm understanding of one discipline. With regard to knowledge of other disciplines for which they are responsible, Stein and Nelson recommend postholing when providing instructional leadership.

In addition to the theory of leadership content knowledge, we drew from complexity leadership theory (Uhi-Bien et al., 2007) in analyzing the data for this study, because school leadership is a multifaceted arena, and our administrative participants held different evaluative roles within this space. This theory purports that there are three ways in which leadership manifests itself in a knowledge building environment: administrative leadership, adaptive leadership, and enabling leadership. A knowledge building environment positions organizations as "complex adaptive systems that enable continuous creation and capture of knowledge" (p. 301) and we believe that schools fit this description. Administrative leadership acknowledges the bureaucracy inherent in managerial leadership. This form of leadership takes a top-down, authoritative approach, which allows for assertive decision making. Within the realm of complexity leadership theory, administrative leadership considers the organization's need for adaptability and creativity as this consideration benefits the decision-making process and outcome. One example of this form of leadership in schools is the administrative use of an observation protocol. The administrator has the authority to use this protocol in an evaluative way. Adaptability and creativity come into play when the administrator adapts the protocol or the process for using it in a way that honors the teacher's professional goals. In contrast, adaptive leadership considers the fluidity and interactive nature of leadership that "produces adaptive outcomes in a social system" (p. 306). Adaptive leadership promotes change in an organization and does not result from one individual or entity but rather dynamic interactions between people and ideas initiated by a problem or struggle. Finally, enabling leadership assists in the emergence of adaptive leadership by providing resources, structures, systems or facilitating dynamics that catalyze adaptive leadership. "Catalyzing refers to activities that bring together the enabling conditions (mechanisms and contexts) necessary for adaptive leadership to emerge" (p. 309). Enabling leadership promotes interdependency, and complexity leadership theory posits that leadership exists in, and is a function of, interaction.

For the purposes of this project, we saw complexity leadership theory as providing a framework for the interactions among observers who held different roles in the school system (e.g., central office administration, principal and assistant principals, and mathematics specialists) and their interactions with veteran and novice teachers. Additionally, complexity leadership theory attends to the dynamics between these stakeholders and their material resources such as observation tools and curriculum and considers how these relationships and interactions fit into the larger school system. These dynamics may play a role in the nature of feedback that teachers receive.

We felt that leadership content knowledge and complexity leadership theory complemented one another in that both theories rely on interactions between leaders and personnel on multiple levels. We purported that leadership content

knowledge had the potential to promote enabling and adaptive leadership while administrative leadership would also be influential.

Method

We conducted a multi-case qualitative study using data collected from three middle schools located in three different school districts in a mid-Atlantic state. Our analysis was grounded in the theoretical frameworks (i.e., leadership content knowledge and complexity leadership theory), and as such we chose a multiple case design and employed replication logic as means for increasing external validity of the study (Yin, 2003). Because of the similarities among the experiences of the four teacher-observer groups, findings are reported as a cross-case analysis (Yin, 2003). In this way, single cases are not presented separately; they are threaded among the four themes, which frame the findings.

Site and Participant Selections

The study topic, middle grades mathematics teacher feedback, was initiated by a group of superintendents who were members of an educational research consortium. Members of this consortium included faculty from one university and school personnel from several school districts who were all located within the same metropolitan area. As part of this consortium, school district personnel worked in partnership with university-based researchers on investigating problems of practice within their districts. In doing so, researchers and school-based personnel formed a study team and worked collaboratively in identifying the study questions and designing the project. The school-based personnel each worked with the university researchers to identify and recruit participants from their school districts. The study design called for three-person teams consisting of two administrators, who had different levels of formal mathematics education or experience, and one teacher. These teams allowed for the teacher to be observed by each administrator (on separate occasions) and given feedback about his or her instruction. Four teams of teacher-administrators volunteered to participate in the study. Three of these teams included two administrators with contrasting mathematics backgrounds and one teacher. The fourth team included one teacher and one administrator who did not have a formal mathematics background (See Table 1). These participants were employed in three different schools and districts. The administrators completed surveys detailing their level of mathematics education/experience prior to the start of the study.

As noted in Table 1, the administrators held different roles within each of their school districts and these roles played a part in our analysis. Because Jennifer Garcia was employed as a mathematics specialist with Madison school district, she did not formally evaluate teachers. Therefore, Ms. Garcia will be referred to as a non-evaluative observer. The other five administrators all held evaluative roles in their districts and will be referred to as evaluative observers. When referring to the whole group of administrators (evaluative and non-evaluative), we will use the term observers. In the interest of protecting participants' identities and also to maintain the multi-case reporting in the aggregate, the pseudonyms used in Table 1 will not be used when reporting the data.

Data Collection Procedures and Sources

Data collection was conducted at the participating middle schools both in the classroom and during post-observation meetings in locations chosen by the teachers and observers such as offices or the school library. Data sources included: field notes taken during observations of teacher instruction; teacher evaluation and/or post-observation written documents; teacher lesson plans or other classroom artifacts; semi-structured interviews conducted individually with teachers and observers; mathematical background surveys completed by observers; and teacher evaluation protocols for each participating district.

Teachers were each observed on two occasions, one time by both the first author and an observer with a mathematics background and a second time with the first author and an observer without a mathematics background. Researchers recorded detailed notes during these observations. Observations were unannounced but the teacher was aware that a researcher and an observer would be watching his or her instruction within a two-week timeframe. Following instruction and the observer/teacher post-observation conference, the first author interviewed each observer and teacher separately. These interviews averaged 30 minutes each, were audio recorded, and were transcribed by the researchers. All but one observer, Margaret Dade, fully participated in this observation and interview process. Upon initiation of this study, Ms. Dade had already observed the participating teacher and engaged in a post-observation conference. Hence, the teacher shared

Table 1: Participants

School District	Teacher	Observer
Madison # of students: 19,400 Free/reduced meals: 17.17% Student demographics: White: 83.31% Black: 9.60% Hispanic: 2.83% Other: 4.24%	**Mary Thomas** # of years teaching: 11 years	**Beth Smith** Role: Assistant Principal 13 years science teacher, history & language arts 2 years; liberal studies/elementary education undergraduate; administration masters **Jennifer Garcia** Role: Mathematics Specialist Master's Degree in Education with focus on mathematics; 23 years teaching mathematics; mathematics undergraduate
Madison Same as above	**Lisa Niles** # of years teaching: 3 years	**Beth Smith** See above. **Kate Rand** Role: Central Office Administrator Master's Degree in Supervision with mathematics endorsement; 10 years mathematics teaching; elementary and middle education undergraduate with high school endorsement
Washington # of students: 2,451 Free/reduced meals: 28% Student demographics: White: 71.2% Black: 23.16% Hispanic: 3.7% Other: 1.2%	**Rob Russo** # of years teaching: 16 years	**Carol Jones** Role: Principal Counselor, Secondary Educational Leadership certificate*
Jefferson # of students: 58,000 Free/reduced meals: 36% Student demographics: White: 54.31% Black: 26% Hispanic: 11.54% Other: 7.87%	**Ann Mayer** # of years teaching: 1 year	**June Flowers** Role: Assistant Principal 7 years mathematics teacher; liberal studies undergraduate; k-8 mathematics and administration masters **Margaret Dade** Role: Principal Special Education*

*Ms. Jones and Ms. Dade did not complete the background survey. The information about the backgrounds of these participants in Table 1 is taken from our interview data and is not necessarily a complete description of each of their academic or professional experience but we were informed that neither of them had formal mathematics education or professional experience. All names are pseudonyms.

her perception of this conference and provided the written feedback she received. Teachers also shared the written evaluations they received from the observers during their post-observation conference and some provided lesson plans or other classroom artifacts.

Data Analysis

We used qualitative methods to analyze the data in this descriptive, exploratory study, employing three phases of analysis. In phase one, we analyzed the teacher and observer interviews using open and axial coding (Strauss

& Corbin, 1990). Although we were not seeking to develop theory, we felt that open coding was most appropriate given the limited research done on this topic. Given that our theoretical framework influenced the design of the study, we gathered data which also adhered to these guiding principles. Specifically, with regard to complexity leadership theory, we considered the many roles evaluative observers played that impacted their observations and feedback in terms of the administrative, adaptive, and enabling leadership. When coding, we recognized that, administratively, evaluative observers were required to use protocols that influenced the type of written feedback they provided. Similarly, we considered the ways in which observers interacted with teachers and provided feedback with potential for enabling change in this process. We also maintained that leadership content knowledge manifested itself in different ways depending on the leader's role, responsibilities (e.g., evaluative, non-evaluative), and depth of content knowledge. During coding, we explored these variations in leadership content knowledge and also considered the overlap between leadership content knowledge and complexity leadership theory. Hence, our open codes included many references to the nature, development, and perceptions of feedback through the lens of the constructs surrounding complexity leadership theory and leadership content knowledge. We then grouped these open codes into sensible themes during the axial coding phase. In this way, we came up with specific themes such as *inductive and deductive approaches to developing feedback*. Finally, these themes were analyzed against the written feedback teachers received in their post-observation conferences along with our observation notes in search of confirming or disconfirming evidence.

To increase the internal validity of the study, we employed a peer-debriefing process (Creswell & Miller, 2000; Lincoln & Guba, 1985). The first author conducted the primary data analysis and the second author acted as a peer debriefer. Although the second author had been involved in the study from the outset, she was primarily involved in developing the literature review and transcribing interviews, which allowed her to maintain a more objective role. Her professional and academic background was in educational psychology, which positioned her well to counter the first author's bias as a mathematics educator. The focus of the peer debriefing process was to carefully look for overemphasized points, underemphasized points, vague descriptions, general errors in the data, and biases or assumptions. To do this, the peer debriefer read the findings and compared these to the raw data. Based on this analysis and her accompanying report, the first author made modifications to the findings such as including more descriptive terminology for underemphasized points.

Findings

The design of this study involved a descriptive analysis of the differences in post-observation feedback provided to teachers, the teachers' and observers' perceptions of the feedback, and the alignment with the employed observation protocol. Feedback took both oral and written forms, with the written feedback from observers being influenced by the evaluative roles and school district protocols. Within the framework of leadership content knowledge and complexity leadership theory, three major themes emerged with regard to how different mathematical backgrounds and/or evaluative roles of observers influenced their feedback: the form of the feedback (written and oral); the process for developing feedback (inductive and deductive); and the nature of feedback (content or pedagogical focus).

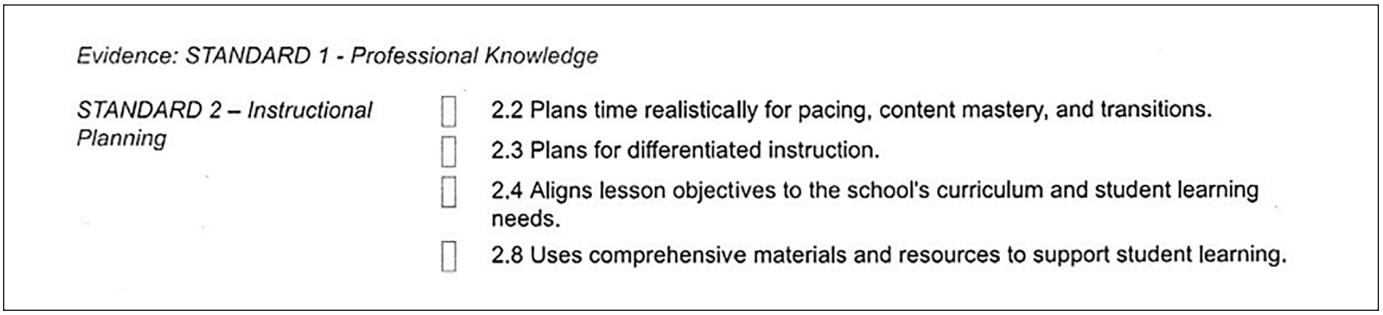
In this section, we begin by providing an overview of the two forms of feedback teachers received (i.e., oral and written), and the participants' perceptions of each of these forms of feedback. Next, we describe the differences in the approach observers, with different mathematical backgrounds, took to documenting observations and follow this with an exploration of the contrast between the natures of feedback produced from these observations. We conclude with a description and analysis of teachers' perspectives of the alignment between their evaluations and the mathematical learning goals of the observed lessons.

Forms of Feedback

The evaluative role of the observer seemed to influence the type of feedback provided (oral and/or written) to the teachers in that the non-evaluative observer focused more on oral communication with some written narrative, and the five evaluative observers prioritized written feedback and contextualized this with some level of oral discussion. We begin by describing the written and oral feedback the teachers received and participants' perspectives on the importance of these forms of feedback.

Written feedback. All observers commented on the importance of written feedback for teachers' reference and reflection, and our analysis revealed that the evaluation

FIGURE 1.
Pre-designed Observation Protocol.



protocol, required by the districts, influenced the nature of the written feedback. Five of the six observers held evaluative roles and one held a non-evaluative role. As part of the teacher evaluation process, school districts required the five administrators to submit pre-designed observation protocols, aligned with the state standards for the professional practice of teachers. These protocols included space for observers to include narrative descriptions of the observation; identify observed professional standards by checking boxes associated with each standard and substandard; and in one case, rate the level of observed implementation of professional standards on Likert scales.

Analysis of the written documentation revealed that the design of the protocols influenced the amount and nature of the feedback provided to teachers. Many evaluative observers, who used these protocols, included verbatim, scripted documentation of the interaction between teachers and students. For example, one evaluative observer scripted the teacher's actions and dialogue to document the instructional delivery standard: "With an orange marker, Ms. (teacher name) wrote a top, bottom chart on several students' papers. . . Student asks, 'Can I use a calculator?' You can do it first without a calculator, then check with a calculator." Scripting was consistent in all of the five evaluative observers' written documents.

In addition to scripting, evaluative observers checked boxes indicating that a teacher met various parts of each standard. One of the district's protocols included a pre-designed narrative describing teachers' attainment of each standard, as illustrated in Figure 1. All teachers in this district, regardless of discipline, received the same narrative feedback for each standard and custom feedback at the end of the protocol in the form of overall comments.

In all three districts, evaluative observers provided some level of personal, written feedback to the teachers, apart from the scripted documentation of the lesson or the pre-determined text. These narratives ranged from three sentences to two paragraphs in length. The following is an entry from one of these evaluation summaries.

> Mrs. [Teacher] is a valuable member of the [school] staff and the math department. She led a school improvement standard committee and was instrumental in planning activities that added to the positive climate this year. Her efforts to work with the team on grade level and with our math coach are commendable. Her warm and friendly demeanor, coupled with her professional knowledge make her an outstanding instructor. Mrs. [Teacher] has played a very active role in our school both in and out of the classroom.

The above quote illustrated feedback that was general in nature and did not directly address the instruction. This feedback did not align with our chosen feedback definition, which indicated the specific teacher's instructional choices: "information provided by an agent regarding aspects of one's performance or understanding" (Hattie & Timperley, 2007, p. 81).

The checked boxes, scripting, and general language used in the above examples provided the teacher with information regarding his or her performance, albeit at a very general level. Due to the lack of specificity, none of these forms of written dialogue attended to the individual teacher's understanding. The pre-designed protocol seemed to influence the level of detail pertaining to the uniqueness of the teacher's instruction, which directly impacted the narrative's alignment with the feedback definition. Devoid

of oral feedback that contextualized the protocol, these written documents did not represent our working definition of feedback because of the lack of specificity.

The mathematics specialists' non-evaluative role excused her from submitting a pre-designed district protocol for the teacher's evaluation file. She developed written feedback in the form of open notes during the post-observation conference with the teacher. The non-evaluative observer commented that she was interested in maintaining a non-evaluative relationship with the teacher and did not script observations. Instead, she focused on building teacher capacity for reflective thinking as evidenced by her statement:

> So when I meet with them I try to look at more – get them reflective thinking about what they did, how it worked, what could we do differently, and I think the angle is here is what these students need to know.

This statement illustrated the non-evaluative observer's interest in crafting a conversation centered on the unique needs of the teacher's students and helping the teacher reflect on his or her practice. The written documents from her post-observation conference included four quadrants titled (1) what's working, (2) focus-concerns-challenges, (3) teacher's next steps, and (4) coach's next steps. The non-evaluative observer and teacher collaboratively responded to each of these quadrants during the post-observation conference. Examples of this feedback included: "Couple of the numbers were too hard (changed the order in subsequent blocks)," and "Continue to develop activities to engage students." This feedback was noteworthy because the observation protocol (or absence of a protocol) influenced the form of the observer's written feedback. The non-evaluative observer took an inductive approach to observations and was not required to link her written observations to a set of pre-determined standards. As a result, the written feedback aligned with our aforementioned definition in that the non-evaluative observer provided information specific to the teacher's instruction. This differed from scripted or Likert-style protocols in that these written, standardized protocols documented teacher actions but did not speak directly to the teacher in a personalized way. These forms required a follow-up conversation to situate the narrative and, hence, the written documentation was not feedback but instead evidence to support the oral conversation.

Oral feedback. Both teachers and observers noted the importance of oral post-observation feedback. Teachers expressed that engaging in discussion about the complex interactions occurring in the classroom was more beneficial than only reading written feedback. For example, one teacher commented, "For me what I take out of it is what I hear from them." Another teacher explained, "The one-on-one conversation is more effective than this [written feedback] because I can sit here and read this but . . . I take so much more from talking to someone than just reading through it." Another teacher described the importance of conversation because of the emotional and physical characteristics embedded in communication. Similarly, observers felt that oral communication provided an opportunity for contextualizing the feedback and several of the observers credited this conversational feedback with teacher understanding. One observer stated, "The oral piece is what helps teachers understand what you can't always say because you're limited to a document or a form." These quotes showed that both teachers and observers valued the opportunity to have an oral discussion of the written feedback. These statements implied that feedback provided only in written form may not include enough information.

Oral feedback also provided an opportunity to solve problems of practice. "I think that your problem-solving piece comes out of the oral discussion with teachers if there is a problem. It doesn't come out of the written piece usually." This statement aligned with the idea that oral conversations provided more context than written feedback and allowed teachers and observers to address issues. Even in situations when the observation protocol did not require a post-observation debrief, the evaluative observers commented on the importance of finding the time to discuss written feedback.

> For informals and formals, I tend to still schedule that conversation especially if it's not someone who necessarily knows me, because I think you begin with the conversation but you try to capture what you said in written form for people to go back and reflect on.

As noted, teachers and observers valued the oral communication surrounding observations. The literature showed the importance of feedback to teachers (Scheeler et al., 2004), and in our study, observers also held such strong feelings toward oral feedback that they sought this discussion out even when it was not required, as illustrated in the above quote.

Summary. Although observers' mathematical backgrounds did not influence their choice of including written or oral feedback in their post-observation communication, the evaluative observers' roles required them to use a pre-designed protocol. This protocol illustrated a form of administrative leadership (Uhi-Bien et al., 2007), while the non-evaluative observer's freedom in selecting the focus of her feedback was not influenced by an administrative provision. The use of a pre-designed protocol seemed to limit the specificity of the feedback, and hence, observers and teachers expressed appreciation for engaging in oral dialogue in an effort to contextualize the written documents. The non-evaluative observer's freedom to develop her own narrative supported her in choosing the focus for the observation and ensuing discussion.

Processes for Developing Feedback

While observers' evaluative roles influenced the form of written feedback that they produced in terms of aligning observations to professional standards or providing open notes, their mathematical backgrounds also seemed to influence the approach each took when engaging in their observations and developing feedback. Observers with mathematical backgrounds took inductive approaches and observers with non-mathematical backgrounds took deductive approaches to preparing feedback. As noted, evaluative observers were required to submit a post-observation protocol for the teacher's professional file, but they were not required to use these forms when developing feedback. We found that the evaluative observers who did not have mathematical backgrounds chose to use the post-observation protocol as a guideline while observing teacher instruction and those with mathematical backgrounds did not.

Inductive approach. When asked to describe the process that they used to prepare feedback to teachers, all three of the observers with mathematical backgrounds described an inductive approach to documenting observations and preparing feedback, taking extensive notes while observing the teachers' instruction. These accounts were supported by the first author's observations in the classrooms. This process for documenting teachers' discourse and actions did not begin with a pre-determined list of standards or look-fors; instead, each observer used his or her expertise, experience, and teacher's personal growth goals to decide where to focus her attention. One observer described her process in this way: "I type everything, I just take notes the whole time and then I ask question within my notes."

Another observer began her observation by documenting student engagement and student-teacher mathematical discourse on a student roster then summarized those notes for use in the post-observation conference. Similarly, the third observer listened for student discourse and documented circulation and student activity on a seating chart. Her focus was on patterns that emerged during instruction. This observer described her process (in part) in the following way:

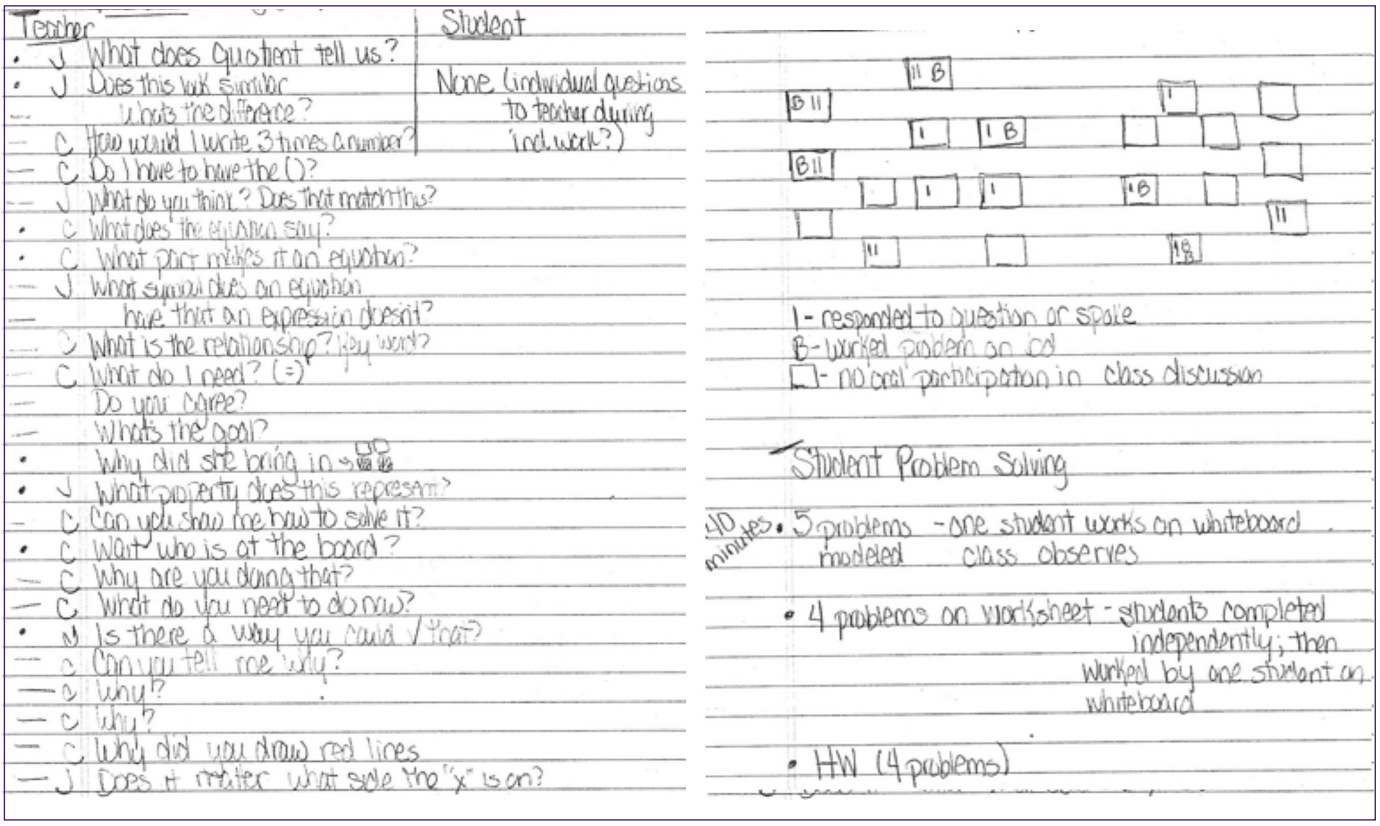
> Initially, I try to take in everything and see if I see a pattern emerge. You'll see lots of different data points in my notes. I tend to capture a lot of questions that teachers are asking so I'm really looking at that level of questioning and engagement. I look for what students are saying . . . so that's my entry point of conversation for her, is to kind of present what I've collected in my observation and for the teacher to really have a point of analysis with it before I make a judgment or suggestion. . . . I'll also take that and put it into the seven standards.

In addition to aligning the narrative with the professional standards on the district's evaluation protocol, the observer also included a copy of her observation notes to the teacher (Figure 2, next page). All three observers with mathematics backgrounds commented that their open notes drove their post-observation conferences, and two of the three provided these notes to the teacher for the purpose of teacher reflection.

The above quotes represented a selection of observers' descriptions for inductively developed feedback. These quotes showed the observers' focus on interactions within the classroom, which is different from a focus on matching a list of standards with the classroom interaction. These observations were then used to drive the post-conference between observer and teacher.

Deductive approach. The two evaluative observers with non-mathematical backgrounds who were interviewed for this study stated that they used their district's evaluation protocols when developing notes for teacher feedback. These statements were supported by the first author's observations of these classroom visits. One of these evaluative observers explained that she looked for an engaged classroom environment, with an agenda, standards, and objectives posted on the board, and a variety of other management strategies such as bell ringers and transition time. The evaluative observer used the district's electronic

FIGURE 2.
Inductively generated observation notes.



evaluation protocol to rate the level (i.e., exemplary, proficient, developing, or unacceptable) for which she observed the standards that aligned with her observations. For example, Standard 3.5 stated, "Uses a variety of effective instructional strategies and resources," and the evaluative observer checked a box for exemplary. She also provided a narrative summary at the end of the document.

The other evaluative observer also used an online system, but the teacher received the written feedback in hard copy form during the post-observation conference. This evaluative observer used the district evaluation protocol to structure her note taking during the observation and then re-organized her notes prior to discussing them with the teacher. Her process is illustrated in the following quote.

> While I'm watching the class I have this form on my computer, and taking notes, and I really do go back and forth between the seven standards. So a lot of what I saw today in the lesson. . . . I documented under instructional delivery because that's usually what you see the most of, you're giving feedback on the delivery. But then as I go back to it later in my office. . . . I'll dissect it a little bit more and figure out where would then our district form fit.

These statements represented the ways observers without mathematics backgrounds approached observations and feedback generation. The pre-designed form, containing the seven professional standards, provided a focus for observation.

Teachers' perspectives. Three of the four participating teachers received feedback from both an observer with a mathematical background and an observer with a non-mathematical background, which enabled teachers to make comparisons across the two different sets of feedback. There were notable differences between teachers' perceptions of the feedback they received in cases when the inductive, open notes were shared and cases where teachers only received the formal observation protocol. All teachers appreciated feedback, regardless of the format, but the two teachers who were given the open notes were particularly impressed by the specificity and comprehensiveness of the narrative. These teachers viewed the purpose of feedback as a means for improving instruction

and the open narrative as an added support to the formal observation protocol.

In comparing the inductively versus deductively designed feedback, one teacher indicated that both were valuable and the open notes coupled with oral conversation provided specific information about instruction that supported the formal observation protocol. Below is her description of the feedback from the two observers.

> [Math specialist] is a math person and so she can come in and give me very specifics of things that she thought I should touch on. . . . She would say, "Hey you really need to emphasize this a little bit more," and [administrator] is going to give me the nuts and bolts, making sure everything stays together. [Math specialist] gets to dig a little bit deeper into the math end.

This teacher appreciated the specificity of the inductively developed feedback and held a particular appreciation for the content focus of the feedback.

The other two teachers in this study received the formal observation protocol from their evaluative observers and did not see any open notes from these observations. One of these evaluative observers prepared her observation using an inductive approach, but these notes were not shared with the teacher in written form and were only summarized into the standards of the formal protocol. The teacher in this situation described the purpose of the feedback as documenting evidence of her work for her accountability and "keeping everyone on task and in the right direction." She commented that her mathematics-focused evaluative observer (who developed inductive open notes but did not share these with the teacher) provided valuable suggestions specific to improving her mathematics instruction, and she noted that the difficulty lay in that these were not written down. The teacher described her conversation with this evaluative observer as discussing the formal observation protocol bullet points and "on top of that she'll tell me, well here's how we work on that because she's had experience in the classroom teaching math." This case illustrated the teacher's perception of the value in mathematics-specific feedback.

Similarly, the other teacher who did not receive this form of inductive feedback indicated a preference for mathematics-specific suggestions, which were not present in the formal observation protocol. While this teacher (and all teachers in this study) highly valued the feedback they received, it was noted that immediate changes to classroom instruction often resulted from pedagogical, content-specific suggestions.

> If it is an administrator talking about the layout of the classroom or student engagement that feedback might take longer to implement but when a colleague comes in and says, "Well you are using the slide and divide method for factoring and we really want you to use grouping," that is an immediate change I can make.

This teacher compared the ease of changing a specific strategy for solving a mathematical task to the difficulty in changing a broad classroom culture such as student engagement. Again, this statement supported the importance of concrete feedback.

The data indicated a relationship between mathematics content knowledge, inductively developed feedback, and the level of specificity of the feedback. These characteristics played a role in teachers' perceptions of the purpose of feedback. Teachers perceived instructional improvement as the goal of feedback developed inductively and "keeping everyone on task" as the goal of deductively developed feedback. It seemed that the comprehensiveness of inductively developed feedback provided teachers with information centered on their instruction as per Hattie and Timperley's (2007) feedback definition. Indeed, it is not surprising that teachers perceived instructional improvement as the goal of this form of feedback.

Summary. As shown in Figure 1, evaluative observers using a deductive approach relied on the pre-designed district protocol as a framework for the criteria in an observation. Observers who used the inductive approach explained that they were looking at classroom discourse, development of mathematics, student engagement, and activity. The standards listed in the pre-designed protocol seemed to support observers with non-mathematical backgrounds by providing a focus for their observations. Alternatively, observers with mathematical backgrounds chose not to use any observation protocol and relied on their content expertise to drive their observation.

Feedback Focused on Content and Pedagogy

All participants in this study believed that the most effective form of feedback came in specific and concrete suggestions for improving instruction. Moreover, all

four of the teachers observed a difference in the nature of feedback, and hence, the kinds of suggestions, they received from observers who had formal mathematical backgrounds and those who did not. Analysis of the written documents supported teachers' perceptions of these differences with observers who had mathematics backgrounds providing more mathematics-focused feedback and observers with backgrounds from non-mathematics disciplines focusing more on pedagogy and classroom management. Observers recognized challenges in providing feedback outside of their content areas and provided examples of the ways in which they addressed these challenges in order to provide effective support for their teacher colleagues.

Teachers' perspectives. Teachers perceived the nature of feedback from observers with mathematics backgrounds as focused on the development of the mathematics in the lesson and the feedback from administrators with non-mathematics backgrounds as centered on general pedagogy and classroom management. When asked about the difference in the nature of feedback from each observer, teachers noted the ability of observers with mathematics backgrounds to (1) provide guidance on vertical alignment of content, (2) suggest mathematics-specific pedagogy, and (3) give recommendations for how to increase the level of questioning. When asked to describe differences in feedback between observers with mathematics backgrounds and those with different disciplinary knowledge, one teacher stated:

> Certainly, someone with a math background would be able to look at my lessons, pick them apart, more so than someone without a math background. Um, because they are going to be willing to ask questions like, "Why do you use this method of factoring versus another" or "Why is it that you teach laws of exponents before you teach some other topic?" So they could ask more pointed questions. And I also think that person if they are evaluating the vertical team, going from the algebra to the geometry to the algebra II to the pre-calculus, they probably could give feedback along the lines of what you are doing is setting students up for the next level.

This quote detailed the teacher's belief that observers with mathematical backgrounds used their specialized knowledge to promote reflective thinking centered on instructional choices in a different way than an observer without a mathematical background. Moreover, this teacher suggested that subject matter knowledge has the potential for supporting the teacher's vertical articulation of the content.

Similarly, teachers perceived the feedback they received from observers with non-mathematics backgrounds as focusing on instructional strategies and classroom management. For example, one teacher speculated, "I think [administrator with non-math background] will talk to me about how everything ties together. Like the professional knowledge, the classroom behavior and demeanor, my management system." Another teacher described the type of feedback she received from her evaluative observer as focusing on discipline and classroom management with suggestions such as using popsicle sticks for selecting students, working on transitions, and other classroom management tricks. A third teacher stated that these observations focused on a broad spectrum of topics such as scaffolding for students with individual education plans, behavior, a little bit of content knowledge but "less focused on specific math content rather than more so everything overall." The fourth teacher noted that the evaluative observer with non-mathematical background "is going to look at classroom environment or classroom engagement or those types of things." As shown in these statements, teachers recognized the feedback from observers without mathematical backgrounds as focused on student behavior and classroom management with little to no content focus.

Our analysis of the written observation protocols supported these perspectives. Specifically, observers with mathematics backgrounds focused on the development of the mathematics. For example, one observer documented, "Students were asked questions that required them to draw on prior knowledge and connect new learning to prior learning. Examples: What does the quotient tell us? What property does this represent? Does this look similar?" This feedback recognized the importance of utilizing prior knowledge, which aligned with the NCTM (2014) evaluation recommendations. Another observer noted, "Students were able to readily manipulate algebra tiles (1, -1, and $-x$) which indicated that the use of modeling and the use of algebra tiles has been part of instruction to develop conceptual understanding." This statement highlighted the importance of modeling mathematics for developing conceptual understanding, which is a tenet of mathematics education.

The inductively developed feedback included more specific details surrounding mathematics content than deductively developed feedback. The process for developing this feedback may have influenced the specificity of the information provided to the teacher in that observers were not limited to a pre-designed list of standards. As noted earlier, much of the written narrative from evaluative observers with non-mathematical backgrounds was in the form of scripting. Evaluative observers also made broad, general statements such as:

> You consistently incorporated 21st century skills in your delivery. It is evident that students enjoy your class, understand the content and are able to apply what they know. The learning environment you have created challenges students and is actively engaging.

The protocols used in deductively developed feedback included general statements about instruction. While these may have aided evaluative observers in providing feedback, they also seemed to impede the specificity of the written suggestions provided for instructional improvement. Arguably, the use of the protocols may have inadvertently impacted teachers' perceptions of the goals of the observation-feedback cycle.

Observers' perspectives. All observers indicated that there was a difference in the level of discipline-specific feedback they provided when they were conducting observations outside of their content area than when they were observing in their own field. They noted the value in collaborating with administrators or teachers in each discipline to support their understanding of these fields and, in turn, use this understanding to provide content focused feedback. This interdependent practice aligned with Stein and Nelson's (2003) definition for distributed leadership and these interactions enabled adaptive leadership (Uhi-Bien et al., 2007) in that, together, stakeholders worked toward solving problems of practice. When asked to describe the kinds of difficulties they faced in providing effective feedback, one evaluative observer commented:

> My personal difficulties lie in that I don't have a math background, so in order to talk about math with someone who has been teaching Geometry and Algebra 1 for years, I have to do a lot of thinking about math that, it's not part of my background, it's not innate to me.

This statement reflected the challenge felt by this observer in developing feedback outside of her content area. This disconnect between content preparation and the observation cycle presented itself in all content areas, as some observers with mathematics backgrounds recognized their difficulties in conducting observations and providing effective feedback in other disciplines. One of the observers described her challenges and strategies for overcoming these difficulties when observing in oral language classes.

> For me probably one of my most challenging was oral languages. I had no background in it. . . . I couldn't give them content feedback. . . . That's when I called a lead teacher specialist from central offices and. . . we would do the observation in tandem but then often talked about it together so that lead teacher specialist in world language would say. . . look for these types of things. . . . There are usually resources within your district to help you if you've been given a department which you really it's not your background to try to build that capacity to give me full feedback. . . . Instructional strategies, student engagement, that would be more where I probably would end up giving more feedback.

This observer noted his/her inability to provide content-focused feedback to a teacher and the value in taking advantage of district resources and other colleagues for support. Similar to teachers' perceptions of feedback from observers with different content backgrounds, this observer commented that, without the support of using other resources, he/she was limited to providing feedback about student engagement or instructional strategies.

These observers referenced their abilities to provide guidance about general practices with regard to classroom management and instructional strategies. They translated their expertise and experiences in other subjects to other classrooms. One observer without a mathematical background noted deep understanding in at least one discipline or teaching practice and described drawing from this understanding and collaborating with a mathematics peer to build a knowledge base for providing feedback to mathematics teachers (Stein & Nelson, 2003).

> I work with my math, we have a math coach who is part time with us and part time at the high school. So if I see something I will say, "Coach, tell me about this, I saw this in a math class, why were they doing that?" And she will say, "I don't know, that's crazy," or she will

> say, "That makes perfect sense to me, let me tell you why they are doing that." And so if I see something mathematical that I don't get she'll help me. I guess I have to say I rely on her a lot.

This statement shows the evaluative observer's use of a peer as a resource for helping the observer better understand the mathematical content which, in turn, aids the development of content-focused feedback. All observers indicated difficulty in providing feedback outside of their content area (mathematics or otherwise) and used their expertise in instructional strategies and classroom management to parlay this challenge into beneficial feedback for the teachers. These observers recognized that, when working with teachers from different disciplines than their own, they needed to draw from another colleagues' expertise. Leaving the content expertise to a peer allowed them to focus on pedagogical and behavioral aspects of instruction. This interaction between observers and available content-focused resources illustrated a form of adaptive and enabling leadership (Uhi-Bien et al., 2007). Adaptive leadership takes advantage of dynamic interactions when seeking to make a change in an organization or structure and enabling leadership provides the resources or tools to enable this change to occur. In this way, the evaluative observers were enabled by their content area colleagues to adapt their leadership knowledge in a way that enabled this observer to provide content-focused feedback to the teacher.

Teachers' feedback preferences. The teachers appreciated both content-specific and general pedagogical and management feedback for different reasons. They were particularly enthused about receiving suggestions or commendations that focused on the mathematics content and recognized this as critical to their instruction. Teachers noted that observers with mathematics backgrounds provided specific suggestions for improving instruction, and these observers also acknowledged the positive aspects of the mathematics in the instruction. One teacher noted:

> She definitely has a math background and she touched on a lot of the content. . . . I feel like maybe there is a little bit more recognition of my content knowledge by somebody who has a math background recognizing the way that I'm saying things, how I'm saying things, how I'm scaffolding things. Maybe being able to recognize the thought that I put into how I conduct my lessons based on the math content. So maybe it's, the feedback is not any less significant by those who aren't math-content related but there are certain things that are capitalized on and are more noticed by those people than I guess the ones who are not.

Similarly, a different teacher offered:

> I do like it when someone who does have a math background so that they can either share specific examples of how they taught that or how they would teach that or just recognizing how I'm teaching the content. So I do, I think I do prefer someone with a math background and I do think that sometimes things are noticed more by the math people, like whether it's an assessment or a warm-up, noticing that was a really great math content that you pulled in there and how you pulled that in.

These two quotes represent a larger group of statements by all of the teachers interviewed. The teachers all noted their affinity for receiving content-focused feedback. While teachers appreciated math-specific feedback, they also saw great value in pedagogical and behavioral feedback. Teachers noted that the evaluative observers detected different aspects of the mathematics instruction than they would have recognized themselves, and they broadened the teachers' understanding of instructional strategies. There was a consensus among evaluative observers and teachers that feedback took on a different focus based on the lens of the observer. Evaluative observers used strategies to help them provide the most useful feedback they deemed possible, while teachers appreciated receiving both forms of feedback and made use of these forms for different purposes.

Discussion

This exploratory study looked at the nature of feedback provided to middle school mathematics teachers from observers with differing content expertise. The findings extended the research literature pertaining to discipline-specific feedback, particularly in mathematics education (Nelson & Sassi, 2000). Through the lens of leadership content knowledge and leadership complexity theory, we found that observers used their subject-specific knowledge and past experiences to develop feedback for teachers, which supported current research (Lochmiller, 2016; Steele et al., 2015), and their evaluative roles required them to use a pre-designed observation protocol, which influenced

the depth and form of written feedback that teachers received.

In this study, we recognized forms of administrative, enabling, and adaptive leadership (Uhi-Bien et al., 2007) in the ways that observers approached the task of providing feedback. In particular, evaluative observers were required to submit a pre-designed protocol, which influenced the feedback that they provided to teachers and illustrated a form of administrative leadership. Concurrently, some observers provided teachers with comprehensive, specific feedback in both written and oral form, which enabled teachers to reflect on their instruction, and, in some cases, held potential for adaptive leadership. Uhi-Bien et al. (2007) defined adaptive leadership as "a collaborative change movement that emerges nonlinearly from interactive exchanges" (p. 306). Indeed, we observed these interactive exchanges between teachers and observers and recognized the potential for adaptive change resulting in the form of instruction from these exchanges.

We speculated that the difference in the inductive and deductive approaches that observers took to documenting classroom activity was, at some level, attributed to the observers' expertise in the content area. As the pre-designed observation protocols did not include discipline-specific standards, it is possible that the observers with mathematical backgrounds were interested in capturing the development of the mathematics and student learning of the mathematics, knowing that this could later be translated into more generic terms for the purposes of the evaluation protocol, hence, an inductive approach. In the same vein, administrators for whom mathematics was not their formal discipline may have used the evaluation protocol as a framework to direct their (deductive) observations because they were interested in observing non-discipline-specific instructional strategies. These assertions are merely speculation as our interviews did not include questions pertaining to why observers chose inductive or deductive approaches. The process for developing feedback is an area that holds potential for further investigation.

Our findings supported research citing teachers' preferences for specific, concrete feedback (Northcraft et al., 2011; Price et al., 2010). All teachers in our study expressed a need for specific feedback that informed their instruction. Along these lines, teachers noted their appreciation for content-specific feedback indicating its immediate impact on instruction. Even in cases when the school district did not require oral feedback, administrators engaged in post-observation discussions with the teachers, noting their importance. This finding aligned with Collins' (2004) study, which recognized the value in providing feedback regardless of the level of student achievement or teacher instructional capacity.

The findings from this study most notably pointed to the difference in the nature of feedback to middle grades mathematics teachers from observers who had formal mathematics education or experience and those who had different subject backgrounds. Similar to Nelson and Sassi's (2000) findings, observers in this study with mathematics education or experience focused on the development of mathematical ideas while the other observers looked at structure or management aspects of the lesson. Furthermore, the feedback provided by the mathematics-focused observers included content-focused pedagogy, which indicated that content and pedagogy are intertwined and unique to each discipline (Nelson & Sassi, 2000).

Stein and Nelson (2003) purported that administrators do not need to be experts in all subject areas, rather a distributed approach to leadership yields a solution for leading teachers in various disciplines. In each of our cases, observers called upon their subject matter expertise, whether that was in mathematics, special education, counseling, or science, to provide instructive feedback to teachers. Evaluative observers conducting observations outside of their content expertise (both mathematical and other subject areas) described using mathematical resources, such as colleagues, to help them develop and provide effective, content-focused feedback, which exemplified a distributed approach to leadership. Their use of outside resources held the potential for developing observers' understanding of the content. This approach coupled with deep content knowledge in their respective fields positioned observers well for postholing (Stein & Nelson, 2003). Although we did not observe postholing in our study, we did recognize the ways in which observers were employing facets of this process. Alternatively, observers with mathematical backgrounds provided detailed feedback focused on content while also integrating pedagogy.

Feedback has implications for teacher development and, in turn, student achievement; as such, it is critical that teachers receive productive oral and written feedback from their observers. This study was limited in that we were unable to observe the post-observation meetings between teachers

and observers. We were not granted access to these conversations because school district research office personnel felt that including an observer in these meetings would be invasive to the teacher. This form of data would increase the robustness of a study like this one and complete the picture for the full spectrum of feedback that teachers received. Hence, this study provided evidence that further research is needed in examining the nature of feedback that is provided to teachers from observers with different content backgrounds and administrative roles. Despite this limitation, the findings indicated teachers' preference for specific, content-focused feedback, which calls for a closer look at the type of subject-specific preparation observers received, similar to that proposed by Steele et al. (2015).

Implications for Mathematics Education Leaders

Our findings have several implications for mathematics education leaders centered on the form, the nature, and the generation of post-observation feedback to teachers. In our study, teachers considered feedback most effective when it was provided in both written and oral forms. Conversations surrounding the written documents presented teachers with opportunities to ask questions and discuss the observations. Additionally, this dialogue allowed leaders to contextualize the written feedback. Hence, mathematics education leaders should be purposeful about dedicating time to discuss observations with teachers, and these conversations should be crafted to meet the unique needs of the teacher and includes specific, concrete feedback for instruction.

Content-focused feedback provided teachers with specific, concrete suggestions for improving their practice. In cases where observers did not have the mathematical background to provide this form of feedback, they described their reliance on a colleague with subject matter expertise to support their thinking about mathematics instruction. Considering the importance of specific, content-focused feedback for teachers' professional growth, mathematics education leaders should seek opportunities to support and collaborate with observers from non-mathematical backgrounds. Additionally, mathematics education leaders should advocate for observations to include multiple observers that include both observers with mathematical backgrounds and those from other disciplines.

Understandably, many school districts require leaders to utilize an observation protocol standardizing observations across disciplines. In these cases, teachers in our study particularly appreciated receiving written observation notes, generated inductively, in conjunction with the observation protocol. Mathematics education leaders should consider developing written feedback that goes beyond selecting proficiency ratings or scripting teacher and student dialogue. The written documentation should include content-focused feedback, that is centered on a specific teacher's instructional decision making and is supported by observation data.

Conclusion

In the current era of teacher accountability, a school district's evaluation model has the potential for influencing the effectiveness of the feedback teachers receive. Feedback is a critical component in instructional improvement and, hence, an important consideration when crafting plans for teachers' evaluation and professional development (Cherasaro et al., 2016). Research literature points to the need for increased attention toward content-specific feedback for mathematics teachers (Lochmiller, 2016). The current study addressed this need and expanded the literature by including the written feedback and perspectives about this feedback from observers in evaluative and non-evaluative roles, some with mathematics backgrounds and others with different subject matter expertise. Findings indicated differences in the form, development process, and content specificity between evaluators with mathematics backgrounds and those without mathematics experience or training. These differences seemed to impact the specificity of the feedback, which held the potential for influencing its efficacy. In conclusion, this study supports the current body of research surrounding the importance of specific, timely feedback crafted to meet the individual instructional needs of the teacher receiving the feedback. ✪

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