COACHES' AND TEACHERS' NOTICING THROUGH ANNOTATIONS: EXPLORING ANALYTIC STANCE ACROSS COACHING CYCLES

Julie M. Amador
University of Idaho
jamador@uidaho.edu

Jeffrey Choppin
University of Rochester
jchoppin@warner.rochester.edu

Ryan Gillespie
University of Idaho
gill6762@vandals.uidaho.edu

Cyndi Carson
University of Rochester
ccarson3@u.rochester.edu

We share results of a study on the analytic stances of coaches' and teachers' as they annotated key moments from classroom video of the teacher's lessons. In the analysis, emphasis was on the analytic stances of the coaches and how their annotations related to trends in teachers' annotations. Findings indicate differences in how coaches and teachers noticed across the coaching cycles, suggesting the annotations were influenced by the interactions between the coaches and teachers and the teachers' perceptions of coaching process. As a result of our analysis, we characterized one coach as having a high ratio of questions to suggestions, another as having annotations coded as interpretation, another as having more evaluations and suggestions, and the fourth as having asked more questions. Some teachers mirrored the analytic stance of their coach over time and other teachers shifted their analytic stance in ways that suggest they were responsive to their coach's analytic stance.

Keywords: Middle School Education, Teacher Education, Technology, Annotation, Video

Noticing is a crucial practice for teachers attempting to engage in responsive or ambitious teaching. Noticing is defined as attending to students' thinking, interpreting that thinking, making decisions in response to what they have noticed, and making connections to broader principles of teaching and learning (Jacobs, Lamb, & Philipp, 2010; van Es & Sherin, 2008). Researchers have noticed differences in how novice and expert teachers notice students' mathematical thinking; experts are more likely to notice relevant aspects of student thinking, while novices initially focus on superficial aspects of instruction (van Es & Sherin, 2008; Walkoe, 2015). However, novices improve their noticing as a result of interventions or training (e.g. Huang & Li, 2012; van Es & Sherin, 2008).

Researchers have documented the impact of a number of interventions on teachers' ability to notice student thinking, but coaching as an intervention to influence teacher noticing has not been adequately explored. Coaching is an emerging form of professional development; researchers highlight the impact of coaching on teacher learning and students' mathematical understanding (Gibbons & Cobb, 2017; Kraft, Blazar, & Hogan, 2018). Multiple models for coaching have been used in mathematics education, including instructional coaching (Knight, 2006), student-centered coaching (Sweeney, 2010) and content-focused coaching (West & Staub, 2003). Content-focused coaching emphasizes mathematics content learning goals as an outcome of coaching cycles. In a content-focused coaching model, teachers and coaches meet to plan lesson that is then collaboratively taught. Following the lesson, the coach and teacher meet to debrief the lesson, with attention to the mathematical learning goals of the lesson. Recently, we adapted the content-focused coaching model for an online context (see Author, 2019). We included an asynchronous annotation component in which the coach and teacher recorded written reflections tied to specific moments in the video of the teacher implementing the lesson. Engaging educators in annotating is not new in mathematics education, but annotating video through a coaching cycle is new.

Non-coaching professional development contexts show how interventions influence annotations. Stockero, Rupnow, and Pascoe (2017) engaged secondary prospective teachers in field experience

In: Sacristán, A.I., Cortés-Zavala, J.C. & Ruiz-Arias, P.M. (Eds.). (2020). *Mathematics Education Across Cultures: Proceedings of the 42nd Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*, Mexico. Cinvestav / AMIUTEM / PME-NA. https:/doi.org/10.51272/pmena.42.2020

interventions focused on noticing and analyzing video to mark moments that were mathematically important. Similarly, as part of a video club, Walkoe (2015) had teachers tag video where they noticed interesting student algebraic thinking. Findings showed evidence that the annotation process, as part of a larger professional development project, impacted teachers' noticing of students' algebraic thinking. Based on these findings, and our prior experience with annotations (Author, 2019), we engaged coaches and teachers in the process of annotating as part of online content-focused coaching cycles. We focused primarily on the analytic stances of the coaches' annotations, with a secondary focus on the teachers' noticing to illustrate the relationship between the frequency of particular analytic stances for coach-teacher pairs. Van Es and Sherin (2010) define analytic stance as an aspect of noticing to describe *how* noticing occurs. The analytic stance is the way one approaches and analyzes practice through noticing and the process through which they communicate noticing. We answered the following research questions: 1) What analytic stances do coaches assume as they annotate? 2) How do teachers' analytic stances relate to coaches' analytic stances across coaching cycles?

Method

Using a cohort model, we engaged nine coaches and twenty-eight teachers teachers in an intensive two-year professional development model that focused on supporting teachers to engage in ambitious, responsive instruction. For this study, we focus on four coaches and five teachers in the first cohort because they completed four coaching cycles. The four coaches all had experience with a variation of face-to-face content-focused coaching articulated by West and Staub (2003). We explored the analytic stances of the four coaches; we looked for variation in the coaches' stances and the ways that variation had an impact on the nature and evolution of how the teachers reflected on their lessons. We also explored the analytic stances of the teachers in the annotation process to better understand the associative relationships between the annotations of the coaches and teachers.

Participants

Each coach (Alvarez, Lowrey, Bishop, Riess) was highly knowledgeable about mathematics education and mathematics teacher education, with extensive experiences leading professional development opportunities for mathematics teachers. Three of the coaches had more than a decade of mathematics coaching experience. Each coach was partnered with a middle grades mathematics teacher for up to four coaching cycles. Alvarez, Lowrey, and Riess all coached one teacher and Bishop coached two teachers.

Data Collection

Teachers in the project took part in a professional learning model that included three components: a course based on the *5 Practices for Orchestrating Mathematics Discussion*, (Smith & Stein, 2011); demonstration lessons that we termed *teaching labs* (similar to studio model or lesson study, e.g. Fernandez & Yoshida, 2004; Higgins, 2013; TDG, 2010); and online content-focused coaching cycles. During the annotation process, the coach and teacher were each asked to annotate the lesson video of the teacher's own implementation of the collaboratity planed lesson, with the teacher always annotating before the coach. The following prompt was provided to teachers:

Add your comments, questions, and thoughts to the video segment in Swivl at any points in the video that might be interesting to discuss further. For example, were there any moments that surprised you? (i.e., misconceptions that emerged, strategies that you did not anticipate, struggles/challenges, or any "Ah-ha" moments) Were there particular instances that showed evidence of student thinking? Is there something that you see as you watch the lesson that relates to the goal you set for this coaching cycle?

The coaches were not given specific instructions for how to annotate the videos. The goal for this study was to understand what the teacher and coach noticed from the video, particularly because the video was the coaches' first view of the lesson, as they were not present in person during the lesson. To enter the comments, the coach or teacher paused the video and typed their comments, which were then synced to the video with time-stamps. This allowed the teacher or coach to watch the video and comment on specific moments. The purpose of the coaches' annotations were to spur dialogue for the lesson debrief meeting, so we note that some comments were intended as conversation catalysts and were influenced by what the coach wanted to discuss with the teacher. The unit of analysis for this study was the annotations from the coaches (n=328) and teachers (n=213) as they took part in coaching cycles across a two-year span. The coaches annotations accounted for 60.6% of the total annotations (n=541).

Data Analysis

We considered each annotation a separate data unit for analysis. Given the focus on understanding noticing, we created a codebook with four main categories: subject (who), specificity (general or specific; coded as specific if there is some connection in the annotation) analytic stance (how noticing was communicated), and content (see Figure 1). For the purposes of this paper, we focus on analytic stance. We based our articulation of analytic stance largely on the work of Sherin and van Es (2008) and van Es (2011). Their list of stances included tag, describe, evaluate, interpret, suggest, and question. Based on the literature, we considered the codes of *tag* and *describe* to reflect less advanced noticing and *evaluate* and *interpret* to reflect more advanced noticing because of the attempt to assign a value judgment (evaluate) or provide some meaning (interpret). The code of interpret was assigned when the annotation included an inference to make meaning (e.g. Sherin & van Es, 2009). We consider *suggest* and *question* to be less advanced forms of noticing than evaluate and interpret because the content of suggestions and questions do not necessarily center on something that happened or could be noticed. The code for *tag* was only used in the absence of any other code for analytic stance.

To analyze the annotation data, three researchers met initially and coded a subset of the annotations, representing approximately 10% of the total data set. In this process, the codebook was refined to its current status (Figure 1). Following the finalization of the codebook, the three researchers analyzed another 10% of the data together to ensure consistency with coding. After several rounds of coding to ensure reliability, pair coding commenced with two researchers independently coding all annotations from a given coach-teacher coaching cycle. We calculated Kappa for each coaching pair and the two researchers met to reconcile differences in codes, resulting in final codes for each coach-teacher pair for each coaching cycle. Kappa ranged from 0.63 to 0.70, indicating good to excellent reliability (Landis & Koch, 1977). Following the assignment of codes, we conducted frequency counts related to all codes for the coaches and teachers across coaching cycles. We then conducted frequency counts for the coaches as a group.

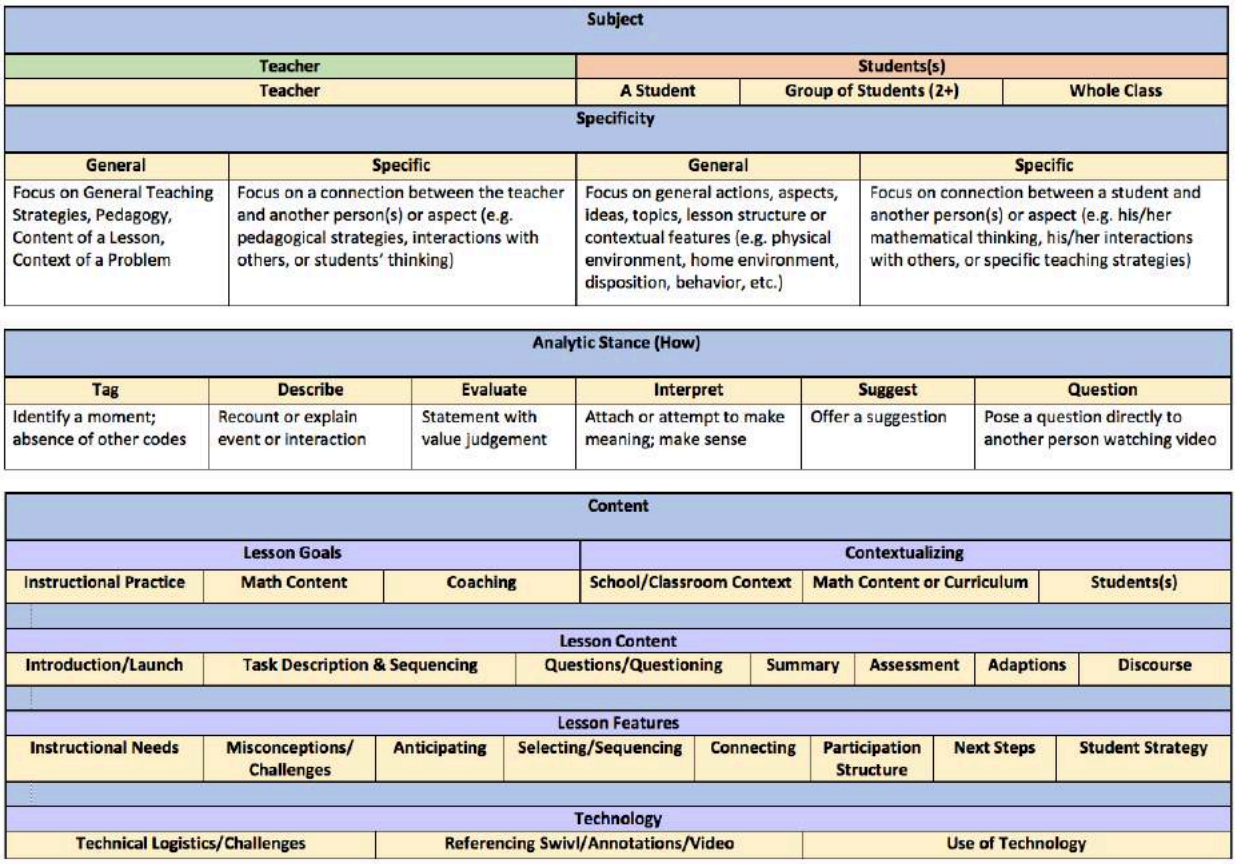

Figure 1. Codebook for Subject, Specificity, Analytic Stance, and Content of annotations.

Results

The analytic stance varied across the coaches. Collectively, the coaches' annotations were coded as evaluation 23.8% of the time, interpretation 21.3% of the time, suggestion 30.2% of the time, and question 42.4% of the time. Table 1 reports the percentages for each analytic stance code for each coach. The codes were not exclusive, as each annotation was coded with as many analytic stance codes as applied.

Table 1. Analytic stance of coaches

	Evaluate	Interpret	Suggest	Question
Alvarez	14.9%	7.5%	10.5%	49.3%
Lowrey	17.6%	48.3%	22.0%	40.7%
Bishop	39.0%	12.7%	46.6%	27.1%
Riess	11.5%	11.5%	32.7%	71.2%

Analysis across coaches reveals differences in the frequency with which we applied the codes of evaluation, interpretation, suggestions, and questions. Alvarez, Lowrey, and Riess were coded as evaluative in approximately 15% of the annotations. In contrast, Bishop was coded as evaluative in 39% of the annotations. Coaches also varied the extent to which they were coded as interpretative. Lowrey was coded as interpretative in 48.3% of the annotations compared to 7.5%, 12.7% and 11.5% for Alvarez, Bishop, and Riess, respectively. There were also differences in the application of the suggestion code, with Alvarez' annotations coded least frequently and Bishop most frequently. Riess's annotations were coded as questions far more than the other coaches. Given the variation in

analytic stance across the coaches, we provide profiles of each of the four coaches to illustrate the differences in how coaches annotated, based on what they noticed. We then consider coaches' analytic stances in relation to trends in the analytic stances of the teachers they coached.

Alvarez: High Questioner to Suggestion Ratio

Alvarez had the highest question to suggestion ratio of any of the coaches. By the third and fourth coaching cycles, Alvarez posed questions in nearly 70% of the annotations she wrote. As an example, in one annotation, she wrote:

> How did you decide who to call on? This question gets at the idea of always paying attention to the instructional strategies laid out in the 5 Practices. So even at a "micro share out level", how do you decide who to call on and why? (I think about this a lot in my own practice and there are a variety of answers! The key is to make those decisions as often as possible to support students' thinking and understanding!)

In this example, Alvarez included both a question and a suggestion in the same annotation. She used questioning to prompt the teacher to consider certain aspects of practice and then suggested that the teacher be purposeful when deciding who to call on during discussions.

Over the coaching cycles, the annotations of the teacher Alvarez worked with were increasingly coded as interpretation, although the interpretation code was still infrequently applied. During the first and second coaching cycle, the teacher did not make any interpretations; however, during the third and fourth coaching cycle, 13% of the teacher's annotations included an interpretation. In the third coaching cycle, the teacher wrote, "Students were saying that the dependent variable is being multiplied every time, but they meant that the previous y-value is multiplied by the growth factor to get the next value." In this example, the teacher interpreted by providing an explanation about what students were saying to make meaning from the experience. The data from the annotations matched data from our analysis of the pre- and post-lesson debrief meeting transcripts for conversations between the coach and teacher, in which Alvarez was more likely to elicit information from the teacher than other coaches (Authors, 2019).

Lowrey: High Interpretive

Lowrey's annotations were coded as interpretation 48.3% of the time, a much higher frequency than other coaches. Lowrey also posed questions to the teacher in many of her annotations (40.7%). During the first coaching cycle, Lowrey annotations were coded as interpretation 60.4% of the time. As an example of an interpretation, Lowrey wrote, "How is the independent think time then moving into group talk working for your students? It seems natural for the students to work in this way and I was wondering your take on how it supports student learning." The example was coded as interpretive because Lowrey referenced students having think time and then made meaning of the situation, noting that the process seemed "natural" for the students. In the interpretation, Lowrey described how she made sense of the teaching move with respect to the students. In addition to frequent interpretations, Lowrey asked questions, with the prevalence of questions increasing across the coaching cycles. She included questions such as, "Moving to the back of the room puts the focus on the problem rather than on you. Was this an intentional move? Is it a typical move for you?"

The increased frequency of Lowrey asking questions across the coaching cycles coincided with a decrease in the frequency of annotations of the teacher with whom Lowrey worked. During the first coaching cycle, the teacher wrote 44 annotations. During the second coaching cycle, the teacher wrote three annotations. During this same coaching cycle, Lowrey there was an increase in the number of annotations coded as questions. This increase in asking questions, such as, "Do these partners see the connections between their ideas? Are they working independently or as a partner group?" was evident in the third coaching cycle as well, when the teacher wrote only four annotations. The questions Lowrey wrote often asked about specific aspects of the lesson that may

not have been obvious from the lesson video. The increase in Lowrey posing questions suggests Lowrey may have been responding to the teacher's lack of annotations. This raises further questions about the purpose behind Lowrey's increase in questioning and the intentionality of Lowrey's decisions in response to the teacher. Perhaps Lowrey posed questions to the teacher to encourage the teacher to increase the frequency of annotations. Lowrey and the teacher were not able to complete a fourth coaching cycle because of a lack of participation from the teacher.

Bishop: High Evaluation and Suggestion

Bishop's annotations were more frequently coded as evaluations and suggestions. Bishop's annotations were coded as evaluation 39% of the time. As an example, she made statements such as, "I like how you gave these students advance warning that they would be sharing with the whole class. This helps them prepare and feel more comfortable doing so." In this example, Bishop evaluated the teacher's decision to tell students they would be presenting to the whole class. She initiated the annotation with a statement of what she liked and followed up by including text about why that teaching move was important. In addition to including evaluative comments in the annotations, Bishop provided suggestions to the teachers much more often than the other coaches, with 46.6% of the annotations coded as suggestion. The following is a suggestion Bishop provided:

I noticed that earlier in the video, you read the problem to the class. I was wondering if you might consider using a literacy strategy to introduce the problem to the class. There is a lot of information to deal with in this problem. So, I was wondering if a literacy strategy designed to focus students on all the important information might result in more students (during the individual think time) incorporating the tax into their thinking.

In this example, Bishop made the suggestion to use a literacy strategy to support students. In contrast to Alvarez and Lowrey, Bishop's rate of asking questions was much lower. She asked questions in approximately one-quarter of the annotations.

The annotations of the two teachers with whom Bishop worked both had high numbers of annotations coded as evaluation, with 23.8% of their combined annotations containing some type of evaluation across the four coaching cycles, as compared with approximately 10% of the annotations of the other teachers. At the end of the four coaching cycles, the annotations of both teachers were coded as evaluation at a similar frequency as Bishop, suggesting that the teachers may have followed Bishop's lead to view the lesson videos with an evaluative perspective. Additionally, both teachers and Bishop evaluated the students as well as the teacher. As an example of one teacher providing and evaluation of herself, Parsons wrote, "That was a very thorough explanation!" Bishop regularly included evaluations of the teacher, such as, "Another great move! 'What do you like about ___ answer?' A great assessing question." In this example, Bishop evaluated the assessment question that Parsons included. Evaluations focused on students included text such as, "I loved how they got right into the discussion." Across the four coaching cycles, evaluative comments were frequent for both Bishop and the teachers with whom she worked, which may suggest similarities in how the coach and teachers perceived the annotation process. Analysis of Bishop's coaching debrief meetings show consistent patterns; there was a high percent of conversation dedicated to evaluative comments and direct suggestions for teachers.

Riess: High Questioner

Riess's annotations were coded as questions at a much higher rate than any of the other coaches, more than 70%. Questions included "Do we know if they really understand what the words independent and dependent mean? How could you check for understanding here?" The frequent use of questions was evident across all of the coaching cycles. During the second coaching cycle, Riess included a question in every single annotation she wrote (n=10). The other coaching cycles included frequent questions as well. In addition to posing questions, Riess provided a suggestion to teachers in

32.7% of the annotations. This rate of providing suggestions was not all that different from other coaches, but was the second most common analytic stance associated with Riess's annotations. The frequent use of questioning distinguished Riess from the other coaches.

Interestingly, the two most notable trends across the coaching cycle for the teacher with whom Riess worked related to suggestions and questions. Across the coaching cycles, the teacher reduced the number of suggestions she provided for herself through the annotations and increased the frequency of questions she asked to Riess. Initially, the teacher included comments to suggest to herself what she should have done pedagogically, as compared to what actually transpired. In the first and second coaching cycle, she included suggestions 30.0% and 50.0% of the time. Suggestions included, "Missed connection about 13 and Baker's Dozen; could have asked more questions." In this example, the teacher provided an evaluation and then suggested to herself that she should have made a connection for students and then asked for questions. By the fourth coaching cycle, the teacher did not include any suggestions to herself in the annotations. Instead, in the third and fourth coaching cycles, the frequency of posing questions increased. Questions were written directly to the coach, as a way to ask for input from the coach, most commonly about instructional moves. As an example, the teacher wrote, "When should I have gotten the students more involved? For them to ask clarifying questions or have them restate task expectations?" The teacher sought direct input from the coach on student participation. This type of interaction points to the function of the annotations as a way to initiate conversation prior to the debrief meetings that followed the annotation process. We conjecture that the teacher may have started to write questions to the coach that she wanted answered during the debrief meeting, when the two of them would discuss the lesson.

Discussion and Implications

Annotations were an intermediary for communication that occurred after the teacher's lesson implementation and before the debrief meeting between the coach and teacher as part of online content-focused coaching cycles. Substantive differences existed in how coaches annotated aspects of instruction and learning, meaning how they approached and analyzed practice. Additionally, results show an associative relationship between the analytic stances of coaches and teachers. The analytic stances of the coaches and teachers illustrate aspects of the coach-teacher relationship. The following elaborates on the trends in noticing, with conjectures grounded in research literature to explain the results.

First, the findings of this study highlight the perceived relationship between the coach and teacher, from the teacher perspective. Data from Alvarez and her teacher show stark differences in the analytic stance, with the coach having a high question to suggestion ratio and an absence of the teacher posing direct questions to the coach in any coaching cycle. We conjecture that the teacher had perceived roles for the participants in the coaching process (i.e. coach and teacher) and may have assumed it was the coach's responsibility to pose questions to the teacher, not vice versa. As another example of a perceived relationship, we found evidence in other coaching interactions to suggest that teachers began to annotate in ways similar to coach, in a process similar to enculturation. The situated perspective of the teacher (e.g. Lave & Wenger, 1991), in relationship to the coaching cycles, appears to have influenced the analytic stance of the annotations.

Second, we conjecture that over the coaching cycles, the shift in some teachers' annotations may have been the result of thinking about how the annotation process coordinated with the coaching debrief meetings. Over time, the teacher working with Riess began to ask more questions, directly posed to the coach. It is possible that these questions were intended to be reminding prompts to support the synchronous debrief meeting that would follow the annotation process; over time, we believe the teachers may have recognized the relationship between the constituent parts of the content-focused coaching cycle (i.e. planning meeting, lesson implementation, annotations, debrief

meeting) in a way that supported increased integration (i.e. annotations were discussed during the debrief meeting). Further analysis of the coaching debriefing meetings, in coordination with the annotations will allow us to draw substantive claims about this interaction.

Third, we conjecture that coaches used the annotations to be responsive to the teachers beyond the video lesson and debrief process. In the case of Lowrey, the teacher began to show signs of decreased participation in the online professional development project. In turn, Lowrey increased the number of questions she posed directly to the teacher, as a way to elicit reactions from the teacher. It is possible that Lowrey's questions were intended to encourage increased the teacher's participation in the coaching cycles. Interviewing the coaches about their rationales for their annotations will help us understand their annotations.

The focus on analytic stance for both coaches and teachers is important to understand *how* individuals notice within the context of online coaching cycles. Researchers have emphasized the importance of noticing to enact ambitious instruction (Jacobs et al., 2010; van Es & Sherin, 2008). Many researchers have focused on the noticing of particular participant groups, such as prospective teachers (e.g. Roth McDuffie et al., 2014; Schack et al., 2013) or practicing teachers (e.g. van Es & Sherin, 2008), but few have focused on the noticing of individuals with different experience levels as they interact with the same representations of practice. Researchers have shown notable differences in expert and novice noticing (e.g. Huang & Li, 2012); we contend that our study provides data on the interactions of different participants in a way that highlights the importance of coaching to support teachers. Researches have shown that coaching impacts teacher practice (e.g. Gibbons & Cobb, 2017; Kraft et al., 2018; Sailors & Price, 2015), but knowing exactly how coaches approach noticing provides a clearer understanding of how to support both coaches and teachers. As evidenced in the data, the four coaches analytically approached their noticing in very different ways. These findings raise questions about the intentionality with which particular coaches are assigned to work with particular teachers. Perhaps some teachers would respond better to the practices of some coaches over others. Knowing these various trends in coaches' analytic stances and knowing how the teachers interacted with the coaches provides increased understanding for professional developers as they consider coach-teacher pairs and how to support coaches. We encourage others to be aware of the differences in coaches' noticing and recognize the associative relationship that may develop between a particular coach and teacher based on how the two analytically notice.

Acknowledgments

The material is based upon work supported by the National Science Foundation under Grant #1620911.

References

Gibbons, L. K., & Cobb, P. (2017). Focusing on teacher learning opportunities to identify potentially productive coaching activities. *Journal of Teacher Education, 68*(4), 411-425.

Huang, R. & Li, Y. (2012). What matters most: A comparison of expert and novice teachers' noticing of mathematics classroom events. *School Science and Mathematics, 112* (7), 420-432.

Jacobs, V. R., Lamb, L. L. C., & Philipp, R. A. (2010). Professional Noticing of Children's Mathematical Thinking. J*ournal for Research in Mathematics Education, 41*(2), 169–202.

Knight, J. (2006). Instructional Coaching. *School Administrator, 63*(4), 36-41.

Kraft, M. A., Blazar, D., & Hogan, D. (2018). The effect of teacher coaching on instruction and achievement: A meta-analysis of the causal evidence. *Review of Educational Research, 88*(4), 547-588.

Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. Biometrics, 33, 159–174.

Lave, J. & Wenger, E. (1991) *Situated Learning: Legitimate Peripheral Participation.* Cambridge: Cambridge, University Press.

Roth McDuffie, A., Foote, M. Q., Bolson, C., Turner, E. E., Aguirre, J. M., Bartell, T. G., et al. (2014). Using video analysis to support prospective K-8 teachers' noticing of students' multiple mathematical knowledge bases. *Journal of Mathematics Teacher Education, 17*(3), 245–270.

Sailors, M., & Price, L. (2015). Support for the improvement of practices through intensive coaching (SIPIC). *Teaching and Teacher Education, 45*, 115-127.

Schack, E. O., Fisher, M. H., Thomas, J. N., Eisenhardt, S., Tassell, J., & Yoder, M. (2013). Prospective elementary school teachers' professional noticing of children's early numeracy. *Journal of Mathematics Teacher Education, 16*(5), 379–397.

Smith, M., & Stein, M. K. (2011). Five practices for orchestrating productive mathematical discourse. Reston, VA: National Council of Teachers of Mathematics.

Stockero, S. L., Rupnow, R. L., & Pascoe, A. E. (2017). Learning to notice important student mathematical thinking in complex classroom interactions. *Teaching and Teacher Education*, 63, 384-395. doi:10.1016/j.tate.2017.01.006

Sweeney, D. (2010). *Student-centered coaching: A guide for K-8 coaches and principals*. Thousand Oaks, CA: Corwin.

Teachers Development Group (TDG). (2010). Mathematics studio program. Retrieved from: http://www.teachersdg.org/Assets/About%20Studio%20Brochure%20.v.3.0.pdf

van Es, E. A. (2011). A framework for learning to notice student thinking. In M.G. Sherin, V. Jacobs, & R. Philipp (Eds.) *Mathematics teacher noticing: Seeing through teachers' eyes*. 134-151. Routledge: New York.

van Es, E. A., & Sherin, M. G. (2008). Mathematics teachers' "learning to notice" in the context of a video club. *Teaching and Teacher Education, 24*(2), 244–276.

van Es, E. A., & Sherin, M. G. (2010). The influence of video clubs on teachers' thinking and practice. *Journal of Mathematics Teacher Education, 13*(2), 155-176.

Walkoe, J. (2015). Exploring teacher noticing of student algebraic thinking in a video club. *Journal of Mathematics Teacher Education*, *18*(6), 523-550.

West, L., & Staub, F.C. (2003). *Content-focused coaching: Transforming mathematics lessons*. Portsmouth, NH: Heinemann.

The material is based upon work supported by the National Science Foundation under Grant # [Blind].