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Beginning Teachers' Attending To Students' Thinking

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Özet

Bu makale üçüncü-sınıf öğretmenlerinin öğrencilerin matematiksel düşüncelerini fark etmeleri ile ilgili çoklu durum çalışmasından kesitler sunmaktadır. Bu makalede mesleğe yeni başlamış olan iki sınıf öğretmeninin öğrencilerin matematiksel düşüncelerini fark etme becerilerini kulaklarına takılı taşınabilir kamera aracılığıyla seçtikleri kayıtlar yoluyla inceledim. Derslerden sonra öğretmenlerle yaptığım röportajlar sırasında öğretmenlerin video klipleri neden çektiklerine dair verdikleri bilgiler onların değişik olayları fark ettiğine dair kanıt sundu. çalışmadaki iki öğretmenin de ders sırasında en çok ilgi gösterdiği olaylar öğrencilerin matematiksel düşünmeleri ile ilgiliydi. Bulgular hem öğretmenlerin dikkatini inceleme konusunda geliştirilen araştırma metotları konusunda hem de yeni başlayan öğretmenlerin dikkat becerileri konusunda çıkarımlar içermektedir.

Anahtar Kelimeler*: Matematik öğretimi, öğretmenlerin fark etme/dikkat becerileri*

Abstract

This article presents findings from a multiple-case study that investigated third-grade teachers' noticing of students' mathematical thinking. I investigated two beginning teachers' attending to student thinking during teaching by allowing teachers to select interesting moments of instruction via a portable camera attached to their ear. Subsequent interviews revealed teachers' rationale in selecting the video clips, which provided evidence of attending to different events. Student thinking was the major element that both teachers attended during instruction. The results have implications for both research methods in studying teacher noticing and understanding beginning teacher noticing skills.

Keywords*: Beginning teachers, teacher noticing, mathematics.*

1. Introduction

Adaptive teaching as recommended by National Council of Teachers of Mathematics (NCTM) (2000) involves *in-the-moment* instructional decision-making based on assessment of students' mathematical thinking. Given the simultaneous, unpredictable, and multidimensional nature of classroom teaching practices (Sabers, Cushing, & Berliner, 1991), negotiating different aspects of classroom teaching and attending to different ways of students' mathematical thinking is not an easy task, even for expert teachers (Ball, 1993). Therefore, it is not surprising that beginning teachers often fail to implement recommendations of building instruction on the basis of student understanding.

Previous research indicates novice teachers have a difficult time in adapting their teaching according to the needs of their students: they tend to ignore student comments, and focus on their lesson plans instead of student thinking (Westerman, 1991). According to some researchers, novice teachers may not attend to significant events in the classroom because they are in the process of learning effective classroom management strategies (Kagan, 1992). There is a need for teacher educators to investigate how beginning teachers attend to student thinking in order to help them improve their teaching and shift their attention to significant elements of instruction such as student thinking. In this paper the construct of *teacher noticing* is used to investigate beginning teachers' attention dependent skills.

Teacher Noticing

While teacher noticing has been conceptualized in several different ways, Sherin, Philipp and Jacobs (2011) argued that in general researchers discuss teacher noticing as involving two main processes (or a subset of those processes):

- *Attending to particular events in an instructional setting*. To manage the complexity of the classroom, teachers must pay attention to some things and not to others. [...]
- *Making sense of events in an instructional setting*. For those features to which teachers do attend, they are not simply passive observers. Instead teachers necessarily interpret what they see relating observed events to abstract categories and characterizing what they see in terms of familiar instructional episodes. [...](p. 5)

Jacobs, Lamb, Philipp and Schappelle (2011) stated that noticing children's mathematical thinking plays an important role in the moment of instructional decisions, and conceptualized the construct of *professional noticing* of *children's mathematical thinking* as a set of three interrelated skills: (a) attending to children's strategies, (b) interpreting children's understandings, and (c) deciding how to respond on the basis of children's understandings.

Research Questions and Purpose

This paper is part of a larger study, which compared beginning teachers and an expert teachers' noticing of student thinking and instructional actions mainly based on the framework by Jacobs et al. (2011). Although the larger study investigated teachers'

attending to student thinking, interpretation based on student understanding and their instructional actions in response to student thinking, in this paper results with regards to one component of teacher noticing *attending to student thinking* among two beginning teachers are presented. This paper answers the following research questions:

What are the characteristics of beginning third-grade teachers' attention to student thinking in-the-moment as they teach multiplication and division? To what extent do they select interesting moments because they want to document student thinking in the moment of teaching?

Literature Review

Attending to students' mathematical thinking is considered as the foundation of making sense of their strategies and responding to them (Jacobs, Lamb, & Philipp; 2010). Jacobs et al. (2011) assessed teachers' attention to children's strategies regarding to what extent teacher descriptions of student strategies include mathematically significant details in their written reflections in a professional development program. The authors investigated the relationship between skills of attending to student thinking and strategies and deciding how to respond on the basis of children's understanding. The results indicated that when teachers decided how to respond on the basis of children's understandings, they were also likely to attend to children's strategies. Although this study provided insights on teacher noticing in professional development environments, Jacobs et al. did not focus on actual teacher practices or attention to student thinking during teaching.

A review of literature indicates a scarcity of studies that specifically focused on teachers' attention to student thinking during instruction. Levin et al. (2009) investigated teachers' attention to student thinking via observations of teaching and found that novice science teachers were capable of attending to student thinking in both their teaching and throughout reflections of their teaching. Levin et al.'s findings contradicted the common view that novice teachers are not ready to notice student thinking and that teacher education should focus on classroom routines and teachers themselves (Kagan, 1992). Levin et al., however, argued that novice teachers could attend to student thinking when their professional environments emphasized and encouraged novices with regards to paying attention to student thinking.

Studying teacher noticing in a novel way. Much of previous research in teacher noticing focused on how teachers noticed elements of teaching through watching video clips of their own teaching or other teachers. While this line of research proved useful in helping teachers notice important elements of teaching (Sherin & Han, 2004; van Es & Sherin 2008), it is difficult to assess how teacher noticing of video clips translate into teacher noticing in actual classrooms (Sherin, Russ, & Colestock, 2011). Schifter (2011) noted teacher noticing could not be fully captured in a professional development setting because "in the moment of teaching, noticing is guided by what the teacher is trying to teach and is followed by an action" (p. 218).

Being aware of methodological challenges in assessing teacher noticing during teaching, Sherin, Russ, Sherin and Colestock (2008) studied teacher noticing through an innovative way: teachers wore head-mounted cameras and selected moments of instruc-

tion through their head cameras, which had the capability of saving the last 30 seconds as well as the whole lesson. Teachers later explained why they chose specific moments of teaching as they taught, which enabled the researchers understand what teachers actually paid attention to during teaching.

This methodology of studying teacher noticing seems to be the most appropriate for my research design because my primary purpose is to explore in-the- moment noticing of teaching. Using a portable camera affords an opportunity to document the extent to which teachers attend to student thinking while they are engaged in other complexities of teaching.

Two studies (Colestock, 2009; Luna, Russ, & Colestock, 2009) focused on different aspects of teacher noticing using the same methodology, and provided further insights into the research design of my study.

Teacher noticing through teacher perspective. Luna et al. (2009) investigated one high school biology teacher's selection of interesting events using a portable camera and her reflection on those events. The authors analyzed the reflections of the teacher as she talked about the reasons for selecting each video clip. Their analysis of teacher reflections yielded the following categories for capturing the video clips: student thinking, student engagement, student characteristics, discourse, and task management.

Similar to Luna et al. (2009), Colestock (2009) investigated one mathematics' teachers' noticing because this particular teacher focused mainly on student thinking in his selection of video clips of instruction. Colestock described different types of student thinking that the teacher reflected on during the interviews: student justification of a solution, student thinking through a problem, student difficulty solving a problem, and students' insightful mathematical questions. This teacher's instructional moves, his selection of video clips and reflections about them indicated that he noticed and assessed student thinking constantly throughout the class and adapted the lesson according to his assessments.

Different than Luna et al. (2009) and Colestock (2009), my research study was designed to understand how beginning teachers notice student thinking. Furthermore, because content plays an influential role on attention dependent knowledge (Seidel et al., 2011), there is a need for studies in mathematics education that focus on how teachers attend to students' mathematical thinking as they teach similar topics so that content does not add to differences in teacher noticing among participants. The results of my study have the potential to eliminate this gap in the literature and inform the field with regards to attending to student thinking.

2. Methodology

In this study, qualitative methods were employed to investigate beginning third-grade teachers' noticing of students' mathematical thinking. The choice of a qualitative research design indicates a focus on participants' meaning-making and presenting the complexity of situation-classroom teaching (Creswell, 2008). Because this study explored a phenomenon in natural settings between two first-year teachers, it specifically rep-

resents a multiple case study (Yin, 2003). A cross-case analysis among purposefully selected cases enabled me to examine similarities and differences across cases (Yin, 2003).

Participants

Two first-year teachers from a prestigious Fellows Graduate Program (Gilles, Davis, & McGlamery, 2009) located in the Midwest, in the United States were recruited. As a culminating project, all fellows are required to conduct action research in their classrooms in partial fulfillment of the master's degree. Both teachers, Ally and Sarah were teaching third-grade in the same school district.

Research Methods

This study used an innovative methodology which entails the use of a potable camera introduced by Sherin et al. (2008, 2011b) to capture instances of teacher noticing. The camera is a Looxcie Cam XL2, which can be worn as a Bluetooth device on the ear or could be attached to a hat. In this study, both teachers wore the camera on one ear. This portable camera has only one piece with two different buttons for different functions: (1) continuous recording, and (2) selective recording. When a teacher decided to choose a specific, interesting moment, she pushed the selective recording button and the previous 30 recorded seconds was saved on a digital-media file.

Data Collection

After teachers provided consent to participate in the study, I met with each teacher individually and inquired about their mathematics lesson plans in the near future. In both beginning teachers' classes, students learned to apply properties of operations as strategies to multiply during the observations. By choosing the topic similar in each classroom, differences in teacher noticings due to the nature of a mathematical topic were minimized, since research suggests that noticing is subject-specific (Seidel et al., 2011). Identifying topics of multiplication and division as the focus of observation was also a conscious choice. Previous research suggests that multiplicative thinking develops very slowly in children (Clark & Kamii, 1996), and therefore might be challenging to teach, especially for beginning teachers.

Three consecutive classes were scheduled to observe each teacher's classroom during one week. Interviews with individual teachers took place shortly after the observed mathematics lesson. It is important to note that each teacher devoted similar amounts of time to classroom instruction and to post-instructional interviews about their teaching.

Data Analysis

In characterizing how teachers attend to student thinking and strategies, teacher interviews were analyzed by paying special attention to the excerpts when teachers provided rationales for their selection of interesting clips (Luna et al., 2009). When teachers reported that they selected a clip because they wanted to document a particular event during the lesson, it provided evidence that they had paid attention to that particular event.

The framework for analyzing teachers' attending to different classroom events (Fi-

gure 1) draws on the studies by Luna et al. (2009) and Colestock (2009). Because the purpose of my study is to analyze the way teachers attend to third grade students' mathematical thinking specifically, dimensions with regards to different types of students' mathematical thinking that teachers referred to during the interviews when they provided the rationale for selecting clips via their portable camera were incorporated. Two researchers used *Framework for analyzing teacher's attending* (Figure 1) to code a total of 76 reflection episodes: 62 by Ally, 14 by Sarah.

3. Findings

Ally

Background and classroom environment. Ally was a first-year teacher and part of a fellows program when she participated this study. During the period of data collection for this study, she was working on her action research project for the fellows program. Within her action-research project, Ally's research question was to explore what happens when students explain their thought processes and question each other's thoughts and see how their thoughts are related to their peers' during whole class discussions. Ally considered such discussions to be an important part of students' learning. In the following excerpt from our initial interview, Ally stated that her goal was to have students lead mathematics discussions:

So far my students have been doing a nice job of asking questions when they are confused or seeing how their thinking is similar to peers and so I really want to keep taking that further and having them lead the math discussion eventually (Ally, the first interview).

***Figure* 1 Definitions of the codes in framework for analyzing teachers' attending.**

Student thinking
• *Student strategies*: A student's strategy in solving a mathematics problem. • *Student understanding*: Student understanding of a concept or a problem. • *Student difficulty*: Student difficulty in understanding a concept or solving a problem or misconceptions. • *Making connections*: A student makes a connection between two different problems, or two different concepts. • *Providing explanation*: Student's explanation, which could be a valid or invalid explanation from the teacher's perspective. • *Mathematics-related question*: A student's mathematics-related question.
Classroom norms
• *Checking work*: A student checks her answer in solving a mathematics problem or fails to check her answer. • *Admitting\learning from mistakes:* A student realizes or admits making a mistake. In some cases it indicates student learned from a mistake. • *Partnership*: Partnership and the way two students interact in solving mathematics problems. • *Providing feedback to a peer:* A student provides feedback to a peer. The teacher typically refers to the quality of feedback.

Student characteristics • Student characteristics such as students' personality or attributes as learners.
Student participation • Student participation in classroom activities. It may indicate that a student is engaged in a classroom activity or the opposite.
Mathematics discussion • *Restating an idea*: A student restates a peer's claim or answer in other words during classroom discussion. • *Mathematics vocabulary*: Mathematics vocabulary revealed during discussion.

During observations, Ally's students were working on adding partial products and using distributive property of multiplication over addition. In the previous weeks they learned multiplication strategies such as doubling and repeated addition. Because there were almost no interruptions to the lesson flow, Ally did not spend time on classroom management issues.

Attending to student thinking and other elements of classroom instruction across three classes. Ally chose a total of 23, 22, and 17 clips during each lesson (62 clips in total) and later confirmed their selection. Out of all other elements of classroom teaching, Ally mentioned students' mathematical thinking most frequently (108 times) in her rationale for selecting the video clips. Ally reported selecting most of these clips because she wanted to document some type of student thinking. The most common way of student thinking that Ally documented highlighted *student strategies* (23 times) and *student understanding* (32 times). Other forms of student thinking she documented included *making connections* (13 times), *providing explanation* (17)*, student difficulties* (19), and *asking a mathematics-related question* (4). Less frequently mentioned reasons for selecting clips were to document when students were able to *admit and learn from their mistakes* (3) and *partnerships* (5), which were both included among *classroom norms* she aimed to instill in her students. Other reasons for selecting particular moments included documenting *mathematics discussions* (11), *student characteristics* (9), and *student participation* (2).

Even when Ally attended to elements that were not directly related to students' mathematical thinking, she tied these dimensions to students' thinking. For instance, in the following excerpt from the second interview, Ally explained that she selected a particular moment to document when two students were not working well as partners and both were having difficulty understanding the problem they were working on. The students were working on a worksheet to find price of apples for different pounds. It was given that 5 pounds of apples cost 8 dollars and students were asked to find how much 6, 9, or 10 pounds of apples cost.

Not only they did not seem to be working together but they did not understand the concept of partial products so I definitely worked with them a lot more...so this is a big red flag for me that's why I chose that (Ally, the second interview, Lesson 2).

In this case, Ally attended to both *classroom norms* related to working with partners and also *students' difficulty* in understanding the concept of partial products.

Although Ally did not mention *mathematics discussions* as frequently as other elements of classroom instruction (11 times across three lessons), she nevertheless referred to them more frequently than the other beginning teacher. *Restating a peer's claim* (6 times) and noticing *mathematical vocabulary* (5 times) students used during mathematics discussions were two common ways of referring to mathematical discussions. Ally noticed more about mathematics discussions during the first session compared to other sessions. The first session was different than the other sessions since it was dominantly based on a whole-class discussion instead of working with students individually.

It is important to note that Ally attended to different elements of classroom instruction depending on the nature of the instruction. The focus of Ally's second lesson was working on a worksheet in groups and solving problems related to finding the price of different pounds of apples. Ally worked with students in groups to help them with the worksheet. During the interview following the second day of instruction, Ally attended to *student difficulties* more frequently than she did in the first day. The interview on second day revealed that Ally attended to *student characteristics* more frequently in second lesson (6 times) when she worked with students closely compared to other lessons (1 and 2 times).

Table 1 shows examples of how Ally described her selection of clips while reflecting on particular moments of classroom instruction and illustrates how Ally's reflections were coded based on the framework attending to student thinking.

Table 1 Evidence of Ally's attention to various classroom elements

Dimensions	Examples
Student thinking	
Student strategies	"She did the basic repeated addition of 7 plus 7 plus 7 plus 7 so that showed me that I need to go back and explain to her what we had accomplished in the previous lesson since she was not there I just kind of wanted to see what how she would add those 7s together that's why I picked it just to get a formal assessment of where she was since she was not here yesterday" (Ally, the second interview)
Student understanding	"So I just documented another way to state 8 groups of 10. So this lets me know that Muhsin and Bill do have an understanding of place value" (Ally, the third interview).
Student difficulty	"Not only did that show me that he is wanting to learn but also showed me that he did not have that number sense of or could not follow how Darya rounded up 99 cents to a dollar and then taking away penny so I don't know if it is more of pennies to dollars that he is confused with or if it is the number sense that it is 1 away from 100" (Ally, the third interview).
Making connections	"I picked both those clips, the fact that he was able to use the past two problems we were using one was subtraction so like my objective taking those 10 groups of 8 and subtracting one group to get 9 that showed me he was able to make that connection and to realize that 10 is one greater than 9" (Ally, the third interview).

Dimensions	Examples
Providing explanation	"I chose that one because not only was she able to tell me that 2 times 7 plus 2 times 7 was the same as 4 times 7 but she explained how she knew that that's something I am trying to instill in my students is to explain their thinking as well" (Ally, the second interview)
Mathematics-related question	"Darya's question I picked that I think because that shows me that she is still not a 100 % on this distributive property. The fact that she is asking if there is a different strategy you could use shows me she is not as confident maybe when the numbers are bigger" (Ally, the second interview).
Classroom Norms	
Admitting being wrong, learning from mistakes	"I chose this one because one thing I am trying to instill in my students is it is okay to make mistakes and it is okay to learn from them and the fact that Darya was able to admit that she changed her thinking and wanted to change her answer showed me that she was thinking through the problem and checking her answer" (Ally, the first interview).
Partnership	"This group was a red flag right off the bat that not only they did not seem to be working together but they did not understand the concept of partial products so I definitely worked with them a lot more and just observed their work more throughout the lesson so this is a big red flag for me that's why I chose that" (Ally, the second interview).
Student characteristics	"She realized we could not double whatever number to get 6 we just need to add 1 more to the group of five. So once again this is a struggle between her defiance and her math" (Ally, the second interview).
Student participation	"So that showed me that since he was listening he is not an active participant very often and so it shows me that he was listening paying attention" (Ally, the first interview).
Mathematics discussion	
Restating idea	"I had someone else restate what she said and so it showed me that multiple students could restate a peer's thinking and understand it" (Ally, the first interview).
Mathematics vocabulary	"Once again Muhsin used the vocabulary there and explained Randy's thoughts using the math vocabulary so that was my reason to pick that" (Ally, the first interview).

Note. It is important to note that the excerpts could be coded for more than one category of the framework, indicating that teachers may be attending to more than one element in the moment of instruction. However, for the purpose of clearly introducing examples of how Ally attended to various classroom events, each of the following excerpts in Table 1 is associated with one code from the framework in general.

Criteria for selecting clips. At the end of first interview, after discussing the clips she selected, Ally realized that most of the clips she chose repeated the same pattern of capturing students' understanding of a strategy and recording how she knew that her students understood the strategy. She offered the following description for selecting the video clips as part of conducting formative assessment:

This is kind of formative assessment where it is not for grade but more for my knowledge of okay how they understand that strategy I am able to move on whereas some students are still using repeated addition or skip counting so...I make a mental note of "tomorrow I need to observe their work and push them to figure out more efficient strategies on their own" (Ally, the first interview).

Use of camera. Ally believed that using the camera might have been a positive influence on her reflections on her teaching, and support her assessment of student learning by reflecting on student thinking and planning for future lessons:

The camera helped me to focus on either what they [students] said or focus on their questions. Honestly it really helped me enhance my reflections: Okay, what did I learn from my students on that day? How can I use that tomorrow? Who can I work with tomorrow? (Ally, the third interview).

Sarah

Background and classroom environment. Sarah considered mathematics to be the subject that she had the least confidence to teach. Therefore, she did not choose mathematics as the focus of her action research project. Instead, her action research project focused on improving third-grade students' writing skills.

Sarah had a more difficult time in her first semester of teaching because of the wide range in student abilities. She had classroom management problems and found it challenging to facilitate whole-class discussion. During the data-collection phase of this study, Sarah and her students were working towards developing efficient multiplication strategies through use of properties of multiplication. The students were familiar with repeated addition and skip counting strategies and they started working on adding partial products and using the distributive property of multiplication through worksheets that asked them to calculate prices of different amounts of turkey and carrots.

The curriculum materials Sarah used suggested that students would come up with efficient multiplication strategies on their own during classroom discussions. In spite of what the curriculum materials suggested, Sarah planned to model strategies for her students before they attempted to solve the worksheet themselves, because she anticipated that some of her students would have difficulty in finding efficient strategies. Unlike Ally, Sarah did not believe that classroom discussion alone would yield understanding of efficient strategies of multiplication:

I am thinking of modeling first because if I would have thrown it out like Fosnot unit [curriculum materials] explains like "oh just have the kids do it"- nothing comes out of it. It is like two days of instruction where it is pulling teeth to having them get the answer, let alone to use a strategy that was helpful. So we will do a little modeling (Sarah, the first interview).

As evident in the above excerpt, Sarah was worried that classroom discussion would not yield to improvement in her students' learning. These statements by Sarah are consistent with her frustration of managing classroom discussions that are further revealed in her reflections on video clips of her teaching and during observations.

Sarah's attending to student thinking and other elements of instruction across three classes. Sarah selected five clips during the first lesson, seven clips during the second lesson and two clips during the third lesson. Sarah's statements were most frequently coded as the *student thinking* category more than any other elements of classroom instruction.

The most frequently mentioned student-thinking category was *student strategies* (7 times). In her elaboration of why she chose particular clips, Sarah referred to specific strategies that her students used such as doubling, or skip- counting. Following student strategies, Sarah also focused on *students' understanding* (4 times) and *difficulties* (3 times) related to a concept or a problem, the way students *made connections* between different concepts or representations (4 times) and the way students *provided explanations* (4 times) and *mathematics-related questions* (2 times). Other than the category of student thinking, Sarah focused on *classroom norms* (5 times), and *student characteristics* (4 times). She mentioned *mathematics discussion* (*restating ideas*) 1 time. She did not show evidence of attending to student participation. In most of her reflections on the short clips, Sarah mentioned *classroom norms* and *student characteristics* together with *student thinking*.

Below is an example of a typical reflection for Sarah in which she explained why she chose a particular video clip while teaching. In this video clip, a pair of students explained their strategy for finding the price of 7 pounds of turkey, when a one-pound turkey cost $1.05. Their strategy was to use skip-counting. After their explanation, Sarah invited other students to direct questions to them about their solution on the board. There are several student questions, but one of them stands out to Sarah, namely "How did you know how many times to skip count?" The following excerpt was coded as *attending to student math thinking* (specifically, *math related question*), and *student characteristics*. The italicized sentence indicates where attending to a dimension of classroom event is evident and brackets indicate how I coded for teacher attending.

...Sally's [question] *when she asked how did you know how many times they count by* [student math thinking-math related question] that is I ask that a million times I feel like because there are kids when they solve a word problem they don't know how to pull one piece of information out *and so Sally is a very quick mathematician* [student characteristics] she knows the answer but she is asking it to clarify the other two and so there are so many kids that I want them to think about that question "how many times do you multiply back and forth" so I needed to call attention to what a good question that was (Sarah, the first interview, Lesson 1).

Sarah primarily attended to different categories of *student thinking* but she also paid attention to *classroom norms* and *student characteristics*, similar to Ally. Comparing across her three mathematics lessons, Sarah selected more clips of instruction from the second day of instruction and referred to student thinking more frequently during the corresponding interview. Sarah explained that she was able to observe more examples of student understanding of the material on the second day of instruction compared to other days. Subsequently, she wanted to document student understanding and therefore selected more clips.

Sarah did not make frequent reference to classroom teaching elements related to mathematics discussion, such as *restating ideas* (1 time) or *mathematics vocabulary* (none). Restating peers' ideas was not as big part of the classroom culture as it was in Ally's class.

Table 2 shows examples of how Sarah describes her selection of clips while reflecting on particular moments of classroom instruction and illustrates how Sarah's reflections were coded based on the analytic framework.

Table 2 Evidence of Sarah's attention to various classroom elements

Dimensions	Examples
Student thinking	
Student strategies	"Colin in his poster technically used 1 added up 7 times and 5 added up 7 times but it did look different because Colin's group had broken the addition down even more." (Sarah, the second interview)
Student understanding	"Patrick just said it so quick it was like effortless, would not raise his hand and share it to whole class but shows he has a real solid understanding is 7 times 1 is actually the same as 1 plus 1 even though this is the kid we talked about yesterday when he worked with Ian always chooses the least efficient strategy" (Sarah, the second interview).
Student difficulty	"Daphne and Haley are talking about it too and Haley has that problem completely wrong " (Sarah 2nd problem).
Making connections	"Patrick is connecting I think it is even more difficult than looking when he said one plus one plus one is the same on both posters because he is looking at it they are not in the same operation. 1 added up seven times and one times seven or seven times 1 and he can connect these two together" (Sarah the second interview).
Providing explanation	"I knew that between the two of them and the explanation that they had prepared this is the style of presentation I hope my students get to it looks as if they prepared to they have got it ready and they could easily explain it" (Sarah, the first interview).
Mathematics-related question	"Sally's question when she asked: how did you know? how many times they count by that is I ask that a million times I feel like because there are kids when they solve a word problem they don't know how to pull one piece of information out" (Sarah, the first interview).
Classroom norms	
Partnership	"So I left her hoping that Daphne could coach Haley" (Sarah, the second interview)
Providing feedback to a peer	"The way Kate said I don't agree with that that I got 12.50 is that one of the things we work on the congress is not tell Sally that she is wrong but to say that the idea is wrong so I thought the way that Kate put it was so respectful." (Sarah, the third interview)
Student characteristics	"So Sally is a very quick mathematician. She knows the answer but she is asking it to clarify the other two" (Sarah, the first interview)
Mathematics discussion	
Restating idea	"Elsa just shared like the culminating idea that "multiplication is going to be faster " and so I am reading all these texts from my fellows classes and they say oh have kids restate and rephrase each other's ideas they are not very successful with it because when I ask it three same kids are answering all the time and when I say it, it does not seem to spark ideas in kids" (Sarah, the second interview).

Note. It is important to note that the excerpts could be coded for more than one category of the framework, indicating that teachers may be attending to more than one element in the moment of instruction. However, for the purpose of clearly introducing examples of how Sarah attended to various classroom events, each of the following excerpts in Table 2 is associated with one code from the framework in general.

Criteria for selecting clips. Sarah's criteria for selecting clips were based on two primary reasons: evidence of meeting her teaching goals and moments of teaching and learning that indicated student understanding or "deep thinking" as she described in the following excerpt:

I either wanted to define those high moments when kids were exactly meeting the objective I had- like Elsa's comment about 'multiplication is so efficient.' All three videos I selected about doubling because that is like what the whole day was gonna be about that doubling idea. So when they are hitting my learning target that was important or when a kid did something very...I don't know *deep thinking*…if they are able to provide a good explanation and it was a high for them as a personal student that to me is worth I think of the selecting videos as timely celebrations as "oh that was such a great moment" in teaching or learning, just personal triumph that that is worth selecting" (Sarah, the second interview).

Sarah chose 5 clips during the first classroom visit, 7 clips in the second and 2 clips in the last. There was no limit or guidance with regards to number of clips to select during each class. Yet, compared to other lessons of Sarah, only a few clips during the third class made me wonder why she selected very few clips especially during the third lesson. When asked her to speculate on the reasons as to less number of clips during the third lesson, she answered in the following way.

What I was hearing were more expressions of doubt than I heard solid thinking coming out and so as the teacher I would rather hear lots of solid thinking than lots of kids say they don't understand it (Sarah, the third interview).

These excerpts helped to clarify what Sarah valued as worthwhile to document. According to Sarah, student understanding or realization of an idea was more important than documenting students struggling with mathematical ideas. Therefore, she did not select as many clips during the third lesson when students experienced ambiguity about the problems. In other words, it does not necessarily mean that she failed to notice student thinking but rather she did not want to focus on it.

Use of camera. In contrast to Ally**,** Sarah did not find that using the portable camera influenced her teaching in any way.

4. Discussion

The number of clips each teacher chose and their criteria for selecting the clips appears to have influenced the nature of interviews. In particular, Ally chose many clips compared to the other teacher, Sarah. Although the number of clips does not tell us about the nature of teachers' attention to student thinking, it might suggest what teachers value most and find important to document during their instruction. In Sarah's case, one could argue that her classroom management problems might have led her to select fewer clips, especially considering that these issues may have hindered her from thinking about picking clips because she was instead focused on her teaching. Sarah thought evidence of *student understanding* or an important *mathematical norm* were particularly worthwhile moments to document, whereas she did not consider it to be interesting or worthwhile to document when a student exhibited *difficulty in understanding*. In contrast, Ally wanted to document *all* events important to her teaching, especially the ones illustrating student thinking.

While teacher criteria might have an influence on the way teachers documented evidence of their attention to different classroom events, their descriptions of those 30-se-

cond clips during the interviews revealed what they actually paid attention to. My analysis of the six interviews suggested that the primary reason for selecting the video clips for both teachers was providing insights into different types of student thinking, such *as student strategies*, *student understanding*, *student difficulties*, *connections they make* and *questions they ask*. Teachers did also refer to *student characteristics* and the *classroom norms* in their class, but they always connected these elements to *student thinking*.

We know from previous research that teacher noticing is connected to the particulars of the classroom environment (Sherin & van Es, 2005). Similarly, in this study, what happened in each class influenced what teachers paid attention to. For instance, math discussion and building on each other's thinking was an important component of Ally's class as evidenced by how much she paid attention to it. Furthermore, perhaps because of the action project Ally was involved in, it was natural for Ally to attend to mathematics discussion, students' restating ideas and math vocabulary used during discussion

The findings of my study suggest that the novice teachers were able to attend to significant features of instruction, most dominantly, student thinking. These findings are in stark contrast to many of the previous research findings that suggested novice teachers have difficulty focusing on student thinking and needed to learn to attend to pertinent features of classroom (Kagan, 1992; Sherin & Han, 2004; Star & Strickland, 2008). In some studies, focusing on student thinking was evident only after experiencing long-term and focused teacher-learning opportunities (Star & Strickland, 2008; van Es & Sherin, 2008). However, the findings of my study where teachers paid close attention to student thinking are in line with findings by Levin et al. (2009) where participants were encouraged to do so in their professional environments. Furthermore, my results may stem from the fact that the novice participants were part of a teacher education program that emphasized understanding student thinking and building instruction on student thinking. An explanation of novice teachers' focus on student thinking in my study may perhaps be the use of portable cameras. Different perspective through portable camera might have allowed teachers focus on students and not themselves (Miller, 2011). This may have led teachers center their explanations on students' mathematical thinking.

5. References

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