WHEN THE JOB OF TEACHING GETS IN THE WAY OF THE WORK OF TEACHING: LESSONS FROM A VIDEO CLUB OF MATHEMATICS TEACHERS

A Dissertation Presented to the

Faculty of the College of Education

University of Houston

In partial fulfillment of the requirements for the degree

Doctor of Education

Whitney Grese Hanna

December 1, 2016

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A Dissertation for the Degree of Doctor Education

By

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Dedication

To my parents, David and Gaylan, who instilled in me a love of learning and the belief that I could do anything. Thank you for your faith in me, for knowing that I was capable of things like this before I even conceived of them.

To Craig, I am eternally grateful for your love and support. You make life fun, and you're the best dad a partner could want for her kid. I love you. You're my favorite.

To Vaughan, whose smile lights up my day, whose curiosity reminds me what it means to learn something new, thank you for letting me be your mama, and for giving me a new perspective on what it means to be a good teacher. You are my favorite buddy.

And to the children I've served over the years, who taught me to love teaching, whose needs pushed me to learn all I could in order to be worthy, this is for you.

Acknowledgements

This dissertation is the culmination of seven years that took a series of twists and turns, all for the better. I could not have gotten here without the support of my committee - Dr. Jennifer Chauvot, Dr. Mimi Lee, Dr. Lee Mountain, and Dr. Shea Culpepper. Your unflagging belief in this research and my ability to conduct it well was vital to my success.

I am so grateful to my colleagues at the Relay Graduate School of Education, and my participants, who shared their teaching and gave up their time in the interest of professional growth. Your generosity is very much appreciated.

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Abstract

The use of video for teacher professional development is a growing practice (Sherin, Jacobs, and Philipp, 2011). One established method of using video when working with teachers is to invite them to watch clips of classroom instruction and discuss what they notice in a video club setting (Sherin & van Es, 2009).

Acknowledging the importance of student thinking as a driver of learning (NCTM, 2000), this study aimed to investigate what practicing classroom teachers notice about student thinking in their own mathematics classrooms, and how sharing video footage of their instruction in a video club setting can impact their teaching. Transcripts of the video club sessions were analyzed to determine what participants noticed when watching the shared footage, and how this aligned to current literature on mathematics teacher noticing. Additional data analysis led to further categorization of participants' comments around proposed pedagogical alternatives.

Overall, the participants did not show a growth in their abilities to notice and use students' mathematical thinking as a result of the video club sessions. One possible reason for the participants' lack of focus on students' mathematical thinking when viewing many of the video clips may be the way classroom instruction was captured – one cannot notice what isn't presented.

Despite this lack of success, participants expressed appreciation for the time spent in the video club sessions, and indicated an interest in future use of video to develop their own practice and that of their colleagues. The researcher offers some lessons learned about conducting a video club-style professional development so that others may better help teachers develop their noticing skills.

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CHAPTER I: INTRODUCTION

In the directory for a typical public school district, it is easy to find the section of listings for curriculum specialists. For content areas from the arts to the sciences, from early childhood to high school programs, there are specialists who determine what materials teachers will have on hand to teach their classes, and which professional development opportunities will be made available to them. This investment in staffing dollars indicates that school boards across the nation are aware that teachers require ongoing learning opportunities in order to hone their crafts in the classroom. While this need is widely agreed upon, the way to best develop teachers' skills is not.

For mathematics teachers, one avenue for teacher learning is to examine students' mathematical thinking and discover ways to use that thinking to support student learning. But what if teachers are not able to identify all of the mathematical thinking that their students exhibit? How can teachers learn to teach with students' thinking in mind when the thinking is not always obvious?

Guiding Literature

According to the National Council of Teachers of Mathematics (NCTM), the teacher's role is that of a guide, where classroom discourse about the mathematics at hand shapes the classroom environment into a place where students' ideas are examined and tested. Instead of doing the majority of the talking by delivering the information to students via lecture, teachers are encouraged to use students' thinking to drive the learning by encouraging reasoning and sense making (NCTM, 2000). Unless a teacher is able to identify and understand students' mathematical thinking, she cannot use it as a resource to guide learning.

The Study

This study examines what teachers notice about students' mathematical thinking in the context of engaging in a video club where they will examine videos of their own instruction, and that of their fellow teachers. As a medium, video allows teachers to look at their instructional decisions in the moment, and consider whether the choices they have made have been a good use of the student thinking that is evident during the lesson; has it driven the learning? Teachers examine these videos in the club, gathering with approximately 4 of their peers once per month to share clips of their instruction, and discuss how student thinking is being capitalized upon during those lessons. Because teachers work together over a period of several months, and meet regularly, it is possible to track changes in their individual responses to the video clips.

Methodologies of Noticing

Studying what teachers notice and how noticing skills develop is a prevalent idea in current mathematics education research. There are three methodologies in work surrounding teacher noticing (Sherin, Jacobs, and Phillipp, 2011) - teaching by responding and adapting to what happens in the classroom; ongoing learning by teachers; and deconstructing teaching practice into essential elements for practice and improvement. This study is focused on the ongoing learning of teachers, and will apply frameworks to describe and track that learning that were developed by Sherin, van Es, and their colleagues (Sherin & van Es, 2009; van Es, 2011; Barnhart & van Es, 2015). These frameworks allow teachers' noticing to be categorized into levels that indicate how well they focus on students' mathematical thinking, and use their pedagogical knowledge to develop an appropriate response to that thinking.

The Accessibility of Video

Use of video in a professional development is also a common practice within mathematics education. Due to the wide availability of inexpensive video technology, and the acknowledgement of the power of video as an instructional medium for teacher learning (Wang & Hartley, 2003), teachers may record themselves or their peers and use that recording as an observation and learning tool. Video is frequently used to show preservice teachers the many elements of a classroom in action (Bliss & Reynolds, 2004; Lampert & Ball, 1998). Sherin and her collaborators (van Es and Sherin, 2002; Sherin and Han, 2004) used video with practicing teachers to develop their ability to notice classroom events, and improve their focus on important learning moments.

Video Club as Community of Practice

Communities of practice (CoPs) are defined as “groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly” (Wenger, 2000). A video club model of professional development has the potential to be an excellent example of a community of practice. Learning to notice is a social practice – videos are not watched and reflected on in isolation. Teachers watch the clips of the group members’ instruction and share their feedback with their peers, driving to a better quality of instruction. By including a CoP lens in this study, the researcher hopes to better understand how teachers can collaborate and be guided to build their ability to notice student thinking.

Putting Teachers in the Drivers’ Seat

Research on video clubs has been done with preservice and practicing mathematics teachers, but the focus on student thinking has not been used to this degree, and with teachers in so much control of the videos that are watched by the group. Rather than having the research team collect and choose video clips for the teachers to watch, thereby choosing what teachers will see and potentially limiting what they can notice, this study asked teachers to collect and curate their own video footage. They recorded their teaching and then watched their own video in order to choose two examples to share. They were asked to share an example of student thinking being noticed and used in some way in the classroom. The other could have been a missed opportunity to use student thinking, or a time when student thinking wasn't evident at all. Seeing how teachers respond to these clips over time, both in writing and in discussion, allowed the researcher to see if a change occurred in teachers' noticing abilities. Giving the participating teachers so much control over what is shown to the group also allowed the researcher to examine the choices the teachers have made in selecting their video clips, possibly yielding additional information about how teachers learn.

The Research Questions

This study was conducted during the spring semester of 2015 with a group of teachers from urban, public, Title one elementary, middle and high schools in a southcentral region of the United States. The study was conducted to answer the questions: a) How does teachers' noticing of students' mathematical thinking change over time when participating in a video club style professional development? And b) What impact does the participants' selection of a video clip have on teachers' ability to notice students' mathematical thinking?

Structure of the Study

It was decided to use a video club model for this study, based on the researcher's desire to apply some of the Teacher Noticing and Community of Practice frameworks developed by van Es and colleagues in their video club work. Focusing the video club on how teachers notice and use students' mathematical thinking aligns to tenets of the National Council of Teachers of Mathematics, which proposes that the teacher serve as a guide for student learning (NCTM, 2014), and also speaks to a desire of teachers everywhere – that the professional development they receive be truly useful, and applicable to the daily work they do in the classroom.

Participants in the study took turns recording and bringing video clips of their mathematics instruction, with an eye towards capturing examples of students' mathematical thinking. They watched the video clips without discussion first, recording their thoughts about what they saw, and then shared their ideas with the group. The researcher collected both individual written reflections and transcribed the group conversation to serve as data sources. These meetings occurred five times from January to September of 2015, and were 60 to 90 minutes in length. The researcher also interviewed the participants when they submitted video clips for the group to watch, in preparation for the video club meeting, and to understand the thinking of the teacher whose video clips will be watched. Additional data sources are survey responses and the video clips of teachers' instruction.

Why Noticing?

There are countless worthwhile areas to consider when designing professional development for teachers, particularly when considering the needs of elementary school teachers, who must become proficient in multiple content areas. However, current trends in the development of careers in the STEM fields make it clear that students must develop a deep understanding of mathematics in order to successfully compete for these positions. To satisfy these needs, it is vital that teachers possess a knowledge of mathematics and of teaching mathematics that goes just as deep. Teachers who notice students' mathematical thinking are better equipped to engage students in reasoning about the mathematics that they are learning and therefore develop lifelong skills and knowledge of mathematics to prepare them for the future. Achieving this vision is a worthwhile use of professional development resources.

CHAPTER II: LITERATURE REVIEW

A recent boom of interest in teacher noticing has resulted in a number of perspectives on how the study of noticing can be used to guide teacher learning for both preservice and in-service teachers. The literature that grounds this study has been organized into the following areas: What is noticing and why does it matter, current issues in mathematics education related to noticing, methodologies of noticing, the use of video for professional development, and communities of practice.

What is noticing and why does it matter?

How does such a common word, like *noticing*, become powerful? What is it about the word that carries weight among teacher educators today? *Noticing* – also called *professional vision* (Goodwin, 1994) – happens when teachers take in a scenario and are able to determine what is worth paying attention to, and what can be disregarded depending on his or her current purpose. When working with students, every teacher must sift through a great deal of extraneous information in order to determine if students are successfully grasping the concepts that are being taught. She must pay attention to students' expressions, their comments and questions, what work they produce and how they explain that work. She must learn to disregard less informative elements, like messy handwriting or spelling errors. Then she must integrate this information about the students with her own knowledge of the content.

When teachers see what students know (and don't know), they can develop appropriate plans of action to ensure that everyone in the classroom reaches their full potential as a learner. Teachers with well-developed noticing skills are able to respond to students, and use the students' thinking to guide learning. Reform mathematics initiatives and curricula encourage teachers to work closely with students to understand and use student thinking to guide learning experiences in the classroom (NCTM, 2014). In order to guide learning experiences in direct response to students' thinking, teachers must be able to notice what students are thinking based on what they say, and on the work that they do. To do this, the teacher must have the mathematical knowledge surrounding the topics that students are learning, the pedagogical knowledge to help students connect these ideas as they learn, and the willingness to cede some of the control over the learning that happens in the classroom. When student thinking is guiding the learning, teachers must maintain some flexibility in the direction that a class will take, and their ability to notice the cues that indicate the required direction is vital.

Teachers' knowledge of content and pedagogy is closely tied to their noticing skills. Because many teachers are at a disadvantage as evidenced in their lack of confidence in their own mathematical knowledge (Ball, 1990), one can infer that it must be difficult for them to notice students' thinking as it pertains to the development of that mathematical knowledge as well. Teachers may be able to identify – to notice – an area of misunderstanding that a student exhibits without knowing how to remedy the confusion. When looking at video of a student at work on a math problem, a teacher's comment on a student's need for better understanding of place value, for instance, does not imply that the teacher knows what work to do with that student to build that understanding.

The term *noticing* is used throughout the literature, and most agree that it involves both, "attending to particular events in an instructional setting and making sense of those events (Sherin et al. 2011, p.9)." The disagreement arises when researchers seek to define *making sense* in terms of noticing. Some believe that *making sense* is limited to interpreting the event (van Es, 2011b), while others include what a teacher decides to do in response to the noticed event as part of the sense making (Jacobs et al., 2011). In reflecting on his work on noticing with early grades teachers in the 1980s, Erickson (2011) proposes that one reason teachers notice is "in order to take action (p. 24)." Similarly, Schoenfeld (2011) writes, "…teachers' decision making is shaped by what teachers notice (p. 233)." Recently, Blomberg, Sherin and colleagues (2014) identified these three levels of analysis that teachers apply when reflecting on video: "(1) *Description* identifying and differentiating between observed events without making any further judgments; (2) *Evaluation* reflecting on observed events regard to consequences for student learning including judgements; (3) *Integration* linking events to professional knowledge and classifying them according to underlying teaching and learning components in making inferences about what took place" (p.445).

This study was conducted based on the definition of noticing that aligns with the dual processes of identifying events and making sense of them, but does not include deciding how to act. The actions a teacher may opt to take are considered a reaction to what is noticed.

Current Areas of Study in Mathematics Education Related to Noticing

Teacher noticing as a field of study is gaining ground in three main areas of mathematics education (Sherin, Jacobs, and Phillipp, 2011): teaching by responding and adapting to what happens in the classroom; ongoing learning by teachers; and deconstructing teaching practice into essential elements for practice and improvement. The first category addresses the recommendations of reform mathematics education researchers, who examine how students develop mathematical knowledge, and how teachers can best support this learning by facilitating students' exploration of mathematical ideas and constructs, rather than simply delivering information (NCTM, 2000). They must notice what goes on in the classroom in order to respond and adapt.

Leatham and colleagues (2014) have worked to define what makes a significant moment in the classroom, upon which a teacher can capitalize in order to drive student learning. Their work focuses on student thinking, and they posit that while some student thinking can be referred back to later to help a teacher make a point or teach a concept, there are some instances of student thinking that are important to act on in the moment. This takes three skills: "(a) identifying what is important in a classroom situation, (b) making connections between the particulars of the situation and broader educational principles, and (c) reasoning about the situation in context" (p.90). Their framework is potentially helpful because it offers educators the opportunity to learn how to recognize these mathematically significant moments of student thinking and decide how to help the entire class make connections to larger mathematical ideas. Leatham, et al. focus on a math teacher's work that begins with a student's mathematical thinking, decides if it is directly related to the mathematics that is being learned, and therefore worth addressing with the class, ultimately to the benefit of all students. Teachers who identify mathematically significant moments and apply appropriate pedagogical strategies give their students a chance to dig deeper into mathematical ideas that strengthen their overall understanding of the content they are learning.

The second focus responds to the idea that teachers are still learners themselves, and therefore can learn to be better noticers of their own practice in order to grow as professionals. They can learn to notice particulars of students' mathematical thinking in a classroom setting, or to see the ways that they should change a lesson to better impact student learning. The seminal author on this topic is John Mason, whose book, *Learning to Notice: Researching Your Own Practice* (2002), has been a guide for many education researchers interested in this field.

The third category allows researchers to focus on particular skills of teaching, such as connecting a new concept to prior knowledge, or creating an effective sequence of lesson elements. When it comes to noticing, researchers are focusing on how noticing allows for the demystification of teaching as a holistic process – its parts can be identified and described, and therefore better understood. This is a more metacognitive approach to learning about teaching in that it asks participants to consider how they think about many different elements of teaching, rather than just developing a checklist of activities to fulfill. Work by Heather Hill, Deborah Ball and others on the elements of the Mathematical Quality of Instruction framework (Hill, et al., 2008), for instance, has sought to identify and label the aspects of teaching that determine high quality math instruction.

The study described in this paper falls into category two, ongoing learning by teachers, as it examines what in-service teachers notice about student thinking and the teacher's response (or lack thereof) when watching video clips of mathematics instruction. By examining what participating teachers notice about student thinking in these clips, the researcher will able to identify gaps in teachers' pedagogical and content knowledge for teaching mathematics, and develop interventions to address them. Sharing these interventions and their results with the greater mathematics education community may offer other mathematics teacher educators insight into the use of video clubs for professional development, providing a focus on teachers' noticing and use of students' mathematical thinking in that work. Successes and failures that occur during this study may guide mathematics teacher educators in designing their own video club programs. As a faculty member in the graduate program these teachers attend, the researcher may be able to offer continued support both during the study, and beyond its conclusion. Nurturing continuing relationships with these teachers may provide additional data about a higher ed – school partnership model that can continue to impact teachers' learning about and use of students' mathematical thinking, offering insight into long-term support for teachers.

Sophia Cohen (2004) writes that teachers who develop the ability to examine students' thinking are better able to respond to and make use of that thinking when it arises in a lesson. If the goal of teaching mathematics is to help students make sense of mathematical ideas, then understanding and using student thinking is an integral part for teachers to master. It is hoped that this study will shed some light on how teachers can develop this important skill set.

Methodologies of Studying Noticing

According to Sherin, Russ and Colestock (2011), there are three methodologies for the study of teacher noticing that have been adopted thus far. The first is to provide teachers with samples of teaching and ask what they notice (Colestock & Sherin, 2009; Copeland, 1994; Kersting, 2008). By doing these studies with a variety of teachers, it is possible to get a range of interpretations as to what is going on the classroom that is worth noticing. However, because the teachers often lack context for the class and its students, the elements that are noticed might not actually be the most pertinent.

The second methodology consists of asking teachers to recall their own noticings from a recent lesson. This can be done without prompts or reminders of the lesson's content

(Borko & Livingston, 1989), or with a video record of the lesson (Ainley & Luntley, 2007; Rosaen, Lundeberg, Cooper, Fritzen & Terpstra, 2008). For these studies, follow-up interviews may also be a way to gather data about noticing.

Finally, researchers have chosen to use a video club setting where the teacher can discuss their lessons with peers (Sherin & van Es, 2009). The challenge to this method comes from the notion that what a teacher actually noticed during instruction may not be accurately recalled, and may differ from what other viewers notice about the video clip. Brunvand (2010), drawing on cognitive load theory, reminds us that viewing video can be overwhelming, looking at a large amount of data. He suggests that teacher educators remove anything extraneous and find ways to reduce that cognitive load with specific prompts or clear goals for the video viewing session.

This third manner of studying teacher noticing involves studying video clips of teaching and then detailing the actions that a teacher undertakes, implying that they have noticed something worth responding to in the course of instruction. Levin, Hammer & Coffey (2008) used this method to determine how much attention teachers were paying to students' thinking. It is a less frequently used method of studying noticing, but is often used in other areas of education research, particularly around teacher beliefs and teachers' pedagogical content knowledge. This is a challenging method of studying noticing because it is difficult to tell just what the teacher may have noticed that caused an observable response. Since much of what a teacher notices occurs entirely inside the mind – elements are noticed, analyzed, and then discarded or acted upon, usually without a word being said – it is particularly tough to study.

Jacobs, Lamb and Philipp offer a framework for looking at how teachers notice children's mathematical thinking by examining the evidence of that thinking that teachers are able to provide (Jacobs, et al., 2010). Responses were categorized as having a *lack of evidence, limited evidence,* or *robust evidence* by how detailed the teachers in the study were able to be about what student thinking they saw. Further, Jacobs and her colleagues were able to categorize the participants in the study by the amount of professional development on children's mathematical thinking they had received. They identified an increasing trend in teachers' abilities to cite student thinking with robust evidence as they attended professional development over a longer period of time.

Van Es writes that teachers in her study exhibited levels of noticing from a Level 1 (Baseline) to a Level 4 (Extended). These levels of noticing indicated how sophisticated a teacher's ability was to focus on the relationship between a student's thinking and the teaching strategies that were employed in a lesson. Teachers operating at a Level 1 tended to pay more attention to whole class environment, student behaviors, and teacher pedagogical moves, rather than student thinking, while teachers with Level 4 noticing abilities could see how student thinking and teacher strategies can be connected. Van Es found that the video club sessions in her study led teachers to grow in their level of noticing over time. It is notable that van Es and her research team videotaped their participating teachers and selected the clips for them to review during their video club sessions. This study will apply van Es' framework for the development of noticing skills, but ask participants to focus on students' mathematical thinking from the outset, and consider the choices teachers make in selecting their own video clips to share with their peers, rather than having them selected by the researcher.

A recent study presented by Barnhart and van Es (2015) offer a set of guidelines for the sophistication of noticing skills when studying the abilities of pre-service teachers to notice students' mathematical thinking. Building on previous work by van Es and others, Barnhart and van Es acknowledge that teachers must learn to attend to, analyze, and respond to student thinking. They offer that each of those three types of skills can be executed with a low, medium, or high level of sophistication. For instance, it is entirely possible that a teacher may display a high sophistication level for attending to student thinking, but a low sophistication for responding to it. This framework will be applied to the participants' responses regarding students' mathematical thinking in the analysis portion of this study.

Use of Video for Teacher Professional Development

Ten years ago, it was expensive to purchase a video camera for personal use. Currently, however, a digital video camera with several hours of recording memory can be purchased for less than two hundred dollars. Additionally, most mobile phones now have video recording ability and large hard drives, making it even easier to capture moments in the classroom for sharing and study. This increased availability of inexpensive video equipment means that it is no longer unreasonable for teachers to record themselves in the classroom, or to record their students at work. Video offers a complex look inside a classroom in the way that even the most careful descriptions and anecdotes never can (Wang & Hartley, 2003). The availability of video affords teachers the opportunity to examine problems in which they are most interested (Putnam and Borko, 2000).

It is easier than ever to obtain videos of classrooms for the purpose of developing teachers' skills, and for those working with pre-service teachers, there are many ways to use video. Star and Strickland (2008), for instance, have focused on what pre-service teachers attend to when faced with video clips of a classroom in action. Bliss and Reynolds (2004) studied the use of video as a means to illustrate how learning theory can be seen in classrooms. Lampert and Ball's (1998) materials provide an entire year's worth of video showing different elements of a classroom at work that can be used to guide preservice teachers to examine student work, episodes of teaching, classroom tasks and more. Sherin and her collaborators (van Es and Sherin, 2002; Sherin and Han, 2004) found that viewing video with others improved teachers' ability to notice classroom events. Due to their participation in Sherin's video clubs, preservice teachers were able to focus on a few important moments in the lesson – an improvement over simply recording a sequence of lesson events.

When working with teachers who are already practicing their craft, Sherin and colleagues used video clips provided by the participating teachers as the material to be discussed. These video club meetings developed practicing teachers' abilities to notice what students were saying during a lesson, rather than focusing on the teacher. Additionally, time spent in the video club sessions supported the teachers' shifting their comments from general evaluations of the classroom and lesson to interpretations based on specific evidence shown in the video clips. This researcher has designed this study based on Sherin and colleagues' work, with updated frameworks for examining teachers' noticing skills, and the additional lenses of studying communities of practice and the choices teachers make when selecting their own video clips.

When allowing teachers to supply the classroom video themselves, van Es (2012) cautions,

"For video clubs to become a viable setting for the type of sustained, supportive

> inquiry characteristic of learning communities, teachers need assistance capturing video, identifying interesting interactions to discuss, and learning how to talk about these segments. It may be that as teachers develop ways of noticing with guidance from a designated facilitator, they can take on roles that will enable them to facilitate meaningful analysis of video (p.190)."

It is important for teachers to have a clear idea of the purpose of their video collection, so they can bring clips to share that help video club participants focus on the objective of the session.

In some of the existing literature, the video clips shared with in-service teachers were not from their own classrooms at all. Arcavi and Schoenfeld (2008) used video materials from the Trends in International Mathematics and Science Study (TIMSS) research as a way to encourage teachers to be reflective about their own practice. They called this, "using the unfamiliar to problematize the familiar" (p.280) so that teachers might use the teaching done by others to develop strategies to improve their own instruction. Seago (2004) has also used video cases to develop practicing teachers' knowledge of teaching and learning in a professional development sequence. Teachers participating in the study watched short clips of a high school algebra classroom as a means to spark their discussion of the mathematics involved in the lesson, and to examine and develop their own knowledge of the content and the optimal pedagogical strategies for teaching these topics. In keeping with Nelson and Slavit (2008), the most effective teacher learning happens when "inquiry [is] conducted by teachers (as opposed to on or with teachers)" (p.100). The teachers involved in the above studies may have been provided with curated video clips, but it was still up to them to investigate the mathematics and the pedagogy used to teach it.

More recently, in Baecher and Kung (2014), teacher educators have watched video footage of prospective teachers and their reflections showed a variety of what was attended to, typically related to each faculty member's area of expertise (i.e. language faculty focused on the PST's use of vocabulary, while early childhood faculty focused on the PST's methods of student engagement). Faculty members reported a high value of this shared video review as a means of professional development, giving them an opportunity to hear from their peers and broaden their own perspectives. One participant said, "I think it's very enlightening to hear what others see in the same lesson; it opens my eyes to things I missed or didn't give enough weight to" (p.108).

Communities of Practice

Of the literature on noticing and the use of video for professional development, none offered studies where teachers watched videos alone. The act of learning to notice, of learning through the use of video, is a social practice. The video club structure used by van Es and Sherin (2002), for instance, is one that relies on social constructivism – where knowledge about teaching is better seen as a 'subject to be created rather than a created subject' (Korthagen, Loughran and Russell, 2006, p.1027) - and the concept of a community of practice (Lave & Wenger, 1991). Kimble and colleagues write, "Communities of Practice (CoPs) are important for learning in any organization because learning is an act of participation and is therefore an essentially social activity" (Kimble, Hildreth and Bourdon, 2008, p. x). As van Es and Sherin's participants watch videos of teaching and then discuss what they see with their colleagues, the teachers are constructing their own knowledge of what effective instruction looks like, and what student behaviors may show evidence of learning. While they are, in part, grappling with these ideas internally, the discussions lead to the reconciliation of old ideas with new ones (Cooney, 1994).

This kind of grappling requires that the participating teachers have a sense of security about their standing in the group – one cannot express an opinion or admit a lack of understanding if there is a fear of judgment by others. “Relationships are the key to a Community of Practice and are often what differentiates a team or group from a CoP. Informal relationships form based on trust and confidence and the source of legitimation changes in emphasis” (Kimble, Hildreth and Bourdon, 2008, p. xii). Because the nature of teaching can be so personal, developing strong group norms and relationships is vital to group members being open to sharing their videos and listening to others’ feedback.

Additionally, the work that teachers do when engaged in thoughtful analysis of themselves and their peers could not be done without a sense of shared purpose – to learn and grow as professionals (Grossman, Wineburg and Woolworth, 2001). These researchers remind their readers that there is an immense difference between a “*community of teachers* and a *group of teachers* sitting in a room for a meeting (p. 945).” The sense of shared purpose, shared experience, and security within the group is what ensures that the teachers are operating as the former rather than the latter.

Most teacher professional development occurs outside of the classroom, on evenings, weekends, and during school breaks. This tendency to ask teachers to invest hours learning something away from their home environment, and then successfully return to the classroom and implement a new program or strategy is unrealistic (Sandholtz, 2002; Lieberman, 1995). It sends the message that abstract learning done away from school and students is more valued than authentic practice done with colleagues, developed in their own classrooms, and tested immediately on students (Lieberman, 1995). According to *Principles to Actions*, the latest publication from the NCTM, it is a "troubling and unproductive realit[y] that…Too many teachers of mathematics remain professionally isolated, without the benefits of collaborative structures and coaching, and with inadequate opportunities for professional development related to mathematics teaching and learning (NCTM, 2014, p.3)." This study is designed to facilitate the development of a collaborative group of mathematics teachers who will reflect on their own practice and learn from each other as well.

Van Es (2012) conducted a 10-session video club series and examined how the group of 7 fourth and fifth grade math teachers (attendance at sessions ranged from 4 to 7 participants) developed as a community. Referencing numerous studies on Communities of Practice, (Grossman et al., 2001; Rogoff, 1994; Rosenholtz, 1989a), van Es designed her study with the idea that a community of teachers would develop a "group identity, with shared goals and interests" that also took individual strengths and weaknesses into account so each member could grow (p.183). She highlighted the following characteristics of a teacher learning community: "collegial and collaborative interactions, participation and discourse norms for productive collaboration, and focus of activity on teaching and learning" (p. 186) and analyzed her study data to examine how her participants developed these characteristics over time.

It's also worth noting that the teacher inservice method of professional development does not correspond to what we know about how adults learn (Putnam and Borko, 1997).

> "Constructivist approaches to adult learning suggest that an effective professional development system should be based on sound assumptions about learning: 1) inquiry into underlying assumptions deepens the learning process; 2) learning is an

> active process that occurs over time; 3) learning is driven by the learner around meaningful issues; 4) learning is experimental by nature; 5) learning is fuelled by rich, diverse accessible sources of information (Wald, 2000, p. 9); and 6) learning is a social and an ongoing process which can be promoted through opportunities for individuals to work with and learn from others of similar position (Sandholtz, 2002, p. 816)" (Yildirim, 2008, pp. 234-235).

Designing professional development for teachers with these tenets in mind requires finding ways for teachers to collaborate, try new ideas, report back, and try again. A community of practice allows teachers the safe space to examine their own practice, and the encouragement to focus on what truly matters – student learning.

There are different kinds of communities of practice, depending on the goals of the group. Klein and Connell (2008) offer that communities of practice are typically either Stratified or Egalitarian. In a stratified CoP, knowledge flows down from more experienced individuals to novices, while an egalitarian CoP operates under a more open framework, where all members have knowledge to share with the group. Both stratified and egalitarian communities of practice can be either sharing or nurturing communities. A sharing group exists to help individuals learn new skills by bringing them into the community from elsewhere, while a nurturing group seeks to develop that knowledge from within, in a collaborative manner. This framework aligns to the work of Wenger, et al. (2002), which named the strategic intent of a community of practice as one of four: Helping communities, Best-practice communities, Knowledge-sharing communities, and Innovation communities. Klein and Connell (2008) recognize that it is rare for any community of practice to align to just one type of group. For instance, helping communities and best-practice communities both tend to be sharing groups, but they may be either egalitarian or stratified in function.

For the purpose of this study, the Egalitarian-Sharing CoP model (Klein et al., 2005) is likely the best fit, where teachers of all levels have something to offer, and are seeking to find best practices around noticing and using students' mathematical thinking. "The value in an egalitarian-sharing CoP lies, in particular, in its facilitation of the evolution of the knowledge base by encouraging the full contribution of novice members to sharing knowledge" (p.75). While our group will be fixed, consisting of the research participants only, the varying experience levels of the participating teachers in each grade level may feel like a novice vs. expert continuum. Having all teachers share clips of their instruction shows that all participants' ideas and contributions have value.

Summary

Teacher noticing is a growing field of research in education, and this study examines just a single fragment of that field. Categories that are most relevant to this study's examination of what mathematics teachers notice about student thinking when viewing clips of math instruction are: What is noticing and why does it matter, current issues in mathematics education related to noticing, methodologies of noticing, the use of video for professional development, and communities of practice. Situating the study within these contexts offers insight into considering the limitations of the study as well as its potential for future research on teacher learning.

CHAPTER III: METHODS

Introduction

This chapter details the methods of this study which includes: the chosen research design, its participants and context, the description of the professional development, data collection methods, data analysis methods, and limitations of the study. The purpose of this chapter is to detail the methods used in this video club-based study with mathematics teachers. This is a qualitative study, employing critical qualitative methods as outlined by Carspecken (1996).

This paper details a study that took place in the Spring and Fall of 2015 with a group of teachers from urban, public, Title one elementary, middle and high schools in a southcentral region of the United States. The study was conducted to investigate two questions:

a) How does teachers' noticing of students' mathematical thinking change over time when participating in a video club style professional development?

b) What impact does the participants' selection of a video clip have on teachers' ability to notice students' mathematical thinking?

Research Design

Throughout the study, Carspecken's methodology for Critical Qualitative Research (Carspecken, 1996) was used. The researcher acted as facilitator of the video club, but also as observer, taking detailed notes and transcribing video and audio recordings of the sessions to form a rich primary record. A preliminary analysis was done of each session, coding the data to tease out references and determine common themes that consistently emerge in the discussions. Low-level coding started the process, with peer debriefing to check the researcher's inference level and ensure the researcher was aware of any biases or potential blind spots in her interpretation of the data's meaning. Member checks were done to turn up additional themes. Validity reconstructions were done to better analyze the data, noting the kinds of validity claims that are made, and the foregrounding or backgrounding of a claim, allowing for the formation of high-level codes of the data. Once again, peer debriefers were asked to examine the codes and provide feedback. Analysis of the transcripts of the video clips, the video club sessions, and the post-study interviews allowed the researcher to unearth trends in the data, and determine how participants' ability to notice and use student thinking changed over time. A framework for categorization of mathematics teachers' abilities to notice student thinking (van Es, 2011) were applied to the data to see how participants' responses aligned.

Carspecken's fourth and fifth stages of research were deemed to be unhelpful to this research design. The participants of the study all teach at different schools, but the schools are part of two different public charter school networks, both with a similar mission and attitude toward teaching and learning. The schools are all located in low-income communities and offer students a school environment with an emphasis on college matriculation and completion. It is unlikely that site visits at these schools would yield helpful context for the participants' comments during the video club discussions.

Participants and Context

As part of her work, the researcher serves as an assistant professor of practice for a private graduate school of education. Her responsibilities include advising students, teaching core education content, and supporting teachers in the classroom. There were eight teachers in this class of students who exclusively teach mathematics of grades 4 – 10. Four of the teachers, teaching grades 4 – 8, chose to participate in the study. They received mathematics pedagogy instruction from a faculty member other than the researcher, and for the duration of the study, another faculty member served as their advisor and graded any student work that would have otherwise been the responsibility of the researcher. In this study, the participating teachers watched video clips of experienced teachers unknown to them, and of themselves in the classroom, looking for instances of student mathematical thinking, and examining whether and how the teacher in the video made use of that thinking in class. The teachers watched the clips and responded to them in an adaptation of a video club (Sherin and Han, 2004), a kind of professional learning community where video serves as the medium for launching discussions about teaching and learning. The goal of the project was to determine how teachers' noticing of student thinking changes over time, and what impact that has on their instructional practice.

Five video club sessions took place over an eight-month period, from January to September, lasting between sixty and ninety minutes each. Sessions were scheduled to take place immediately following the graduate students' mathematics content courses, on Saturday afternoons approximately once per month (January through April). The fifth and final video club session, originally scheduled for May, was moved to September at the request of the participants, who cited end of school year and summer schedule conflicts. The attendance of anyone other than these four teachers and the researcher were only allowed with the group's advance permission. Sessions were video-recorded to capture the teachers' conversation and interaction, with audio recording as a back-up.

The study was conducted on the professional development campus of a local school district, where the participants' graduate courses also took place. The participants teach mathematics in grades ranging from 4 – 8, from general elementary mathematics content, through pre-algebra. These teachers all work at urban, public, Title one schools with diverse populations. The participants are two male and two female, with a range in classroom experience from four to sixteen years (see Table 1). All are state certified. The teachers range in age from the mid-twenties to the late-forties. They have a variety of curricula available to them, either as official adopted text, or as resources.

TABLE 1: PARTICIPANT INFORMATION

Teacher Pseudonym	Grade Level	Years Teaching
Jenny	4	4
Farrah	5	5
Alex	6	16
Kyle	8	6

Video Club-Style Professional Development

All video club sessions took place with the focus on video clips provided by the researcher or the participants (see Table 2). The initial video clip used in this study comes from the researcher's personal collection of classroom video, featuring an experienced middle grades mathematics teacher who has been recognized by his district for his excellence in the classroom. This video clip shows instances of student thinking and the teachers' responses to that thinking, as a way to introduce the participants to the goals of the study and set the tone for the video clips that they will collect of their own practice. Initially, the rest of the video clips used in the study were to come from either the researcher or the participants themselves, and were recorded in compliance with existing school-based media release permissions. Students whose parent/guardian has not signed a media release were not video recorded for this study. After some consideration, the researcher decided to share one additional non-participant video, taken from the IMAP video collection (Philipp et.al. 2011), as it offered some very clear instances of student thinking for participants to discuss at the September 2015 video club meeting.

TABLE 2: VIDEO CLIPS SHOWN IN THE VIDEO CLUB SESSIONS

Meeting #	Video Provider	Topic
1	Researcher	Creating equivalent fractions
2	Jenny	Investigating the properties of triangles using Geoboards
3	Kyle Alex	Finding the twelfth term; Investigating the relationships between the lengths of a triangle's sides
4	Farrah Researcher	Finding the area of an irregular/composite figure; Novice teachers discuss what they notice when watching video of classroom instruction
5	Researcher Kyle	Students share their solutions from a problem solving session; Exploration of volume

Data Collection Methods

The data sources for this study are teachers' responses to an initial demographic survey, teachers' video clips from their own instruction, teachers' responses to interview questions regarding their video selections, participants' individual responses to the video clips, the video and audio recordings of the video club sessions, and teachers' responses to a post-study survey.

Initial Survey

At the start of the study, teachers completed a brief demographic survey that tells their name, where they teach, what grade they teach, the number of years they have been teaching, their areas of certification and favorite math topics to teach, as well as what they hope to get out of participating in the study (see Appendix A). This background information from each teacher may provide context about their teaching experience and allow for some connections to be made as the study is conducted. For instance, the researcher might find that all of the teachers who are certified as secondary math teachers tend to have an easier time noticing and making use of students' mathematical thinking than their study counterparts who have Generalist (elementary) certifications. Or perhaps the teachers with more experience teaching younger students have a different set of strengths than those who have only taught older students. It is also possible that this demographic information will not yield any helpful context for study conclusions. It is worth collecting purely for context.

Classroom Instructional Video

Each teacher participating in the study agreed to provide video footage of his/her classroom mathematics instruction at least once during the study. All teachers teach in schools where students' parents/guardians have signed media release forms consenting to their being recorded. The participants video recorded their instruction, then watched the footage and were asked to select a time when they felt students' mathematical thinking was evident, and they believe that they made use of that thinking in some way. If possible, they also selected a time when they believed an opportunity to use students' thinking was missed. These video clips were shared with the study participants during the following month's video club session. The researcher watched these video clips in preparation for the video club sessions, and transcribed the clips so that all participants may have a transcript of the footage as they watch the clips. Due to the amount of time participants committed to this study, having the researcher handle the transcription was the most reasonable use of time. Prior to the video club session, the participating teacher who was sharing video approved the transcript for accuracy, and noted any errors for revision. These transcripts will also serve as data for the study, and can be found in Appendix B.

Participant Interviews

Each time a teacher submitted a video file to be shared with the group, he or she was interviewed about their choice of clip, their reason for including it, and any other helpful context they choose to offer (see Appendix C). Since teachers were asked to bring in video clips that share their instruction when student thinking is evident and is used in some way, as well as another clip where an opportunity to use students' mathematical thinking was missed, it was important to hear from the participants about why a particular clip was a good choice for sharing with the group. Participants discussed their clips with the researcher before the video club session, offering the researcher an opportunity to plan for potential interventions and consider any guidance the group's discussion may need in order to home in on the student thinking that is present in the video clips. Interviews were audio-recorded and transcribed for later analysis.

Individual Participant Notes About Video Clips

In a video club environment, group discussions are easy to capture. What is more challenging to understand are the individual thoughts of participants. In order to capture each participant's ability to notice students' mathematical thinking when they watch video clips of their peers' instruction, participants were asked to view the video clips independently and record what they notice about the students' mathematical thinking, and the teachers' response. Participants were asked to show a clear division between their individual thoughts and any notes they take once the group discussion begins. These notes were collected at the end of each video club session. Participants all chose to hand write their notes. It was intended that these notes would serve as data for the study, but analysis showed that there were no comments or other notes on them that wasn't clearly represented in the transcripts of group discussion of the video club sessions.

The Video Club Sessions – Video and Audio Files and Transcripts

Each video club session was video and audio recorded for later transcription. Given the social nature of a video club, it was felt that video recording would make it easier to ensure that all comments were attributed to the appropriate speaker, and all body language was clearly noted as applicable. Audio recording was done as a backup. Transcripts of the sessions will be found in Appendix D.

Post-Study Surveys

Following the study, post surveys were conducted with the participants to gather feedback about the sessions' format, effectiveness and impact on participants' thinking (see Appendix E). Participants were asked to complete the survey in writing within one week of the completion of the study, or may choose to do so via interview with the researcher if they prefer. This survey gave the researcher the opportunity to gather self-reporting data on participants' thinking about their own noticing abilities and the study's impact on their teaching, while also receiving feedback on the structure of the video club sessions as a model for professional development.

Data Analysis Methods

Video Club Analysis

There are two layers of video analysis in this study. First, the researcher analyzed the instructional videos that participants collect to share with the group, considering the choices they made when selecting a clip that they believe shows a time when they noticed and used students' mathematical thinking in their instruction, and another clip that shows a missed opportunity to do this. Aligned with research done by Elizabeth van Es on video clubs (van Es, 2011), participating teachers' levels of noticing (see Table 3) when reflecting on their own instruction were noted, based on the researcher's evaluation of the selected video clips and the comments made by the participant during the pre-video club session interview. Additionally, each participant's written and verbal comments during the video club sessions were examined and categorized into levels of noticing. Each teacher recorded their thoughts regarding the video clips they watched before any discussion took place. These responses were analyzed according to van Es' framework, and for emerging themes (Carspecken, 1996). Once individual thoughts were recorded, group discussion began. Careful transcription of this discussion will be done to note individual comments to be able to compare them to the initial thoughts each participant had about each clip. It was also possible to determine an overall session level of noticing for the group, aligned to the van Es framework, and compare this to individual levels found based on the pre-discussion notes. For instance, if teachers commented on students' confusion but then also made comments about specific mathematical thinking that took place, the session would be categorized as a Level 2, or Mixed level, of noticing (see table below). The research done by van Es used video clips of teachers and students in an instructional setting, and teachers in the video club were able to notice both teacher pedagogical moves as well as students' mathematical thinking. In this study, participants were able to do the same thing. (van Es, 2011, p. 139).

Please see the next page.

TABLE 3: LEVELS OF NOTICING (RECREATED FROM VAN ES, 2011, P.139)

	Level 1 *Baseline*	*Level 2* *Mixed*	*Level 3* *Focused*	*Level 4* *Extended*
What Teachers Notice	Attend to whole class environment, behavior, and learning and to teacher pedagogy	Primarily attend to teacher pedagogy Begin to attend to particular students' mathematical thinking and behaviors	Attend to particular students' mathematical thinking	Attend to the relationship between particular students' mathematical thinking and between teaching strategies and student mathematical thinking
How Teachers Notice	Form general impressions of what occurred Provide descriptive and evaluative comments Provide little or no evidence to support analysis	Form general impressions and highlight noteworthy events Provide primarily evaluative with some interpretive comments Begin to refer to specific events and interactions as evidence	Highlight noteworthy events Provide interpretive comments Refer to specific events and interactions as evidence Elaborate on events and interactions	Highlight noteworthy events Provide interpretive comments Refer to specific events and interactions as evidence Elaborate on events and interactions Make connections between events and principles of teaching and learning On the basis of interpretations, propose alternative pedagogical solutions

Additionally, in van Es and Sherin's work on teachers' learning to notice in a video club, the following framework is identified (2008):

> Noticing for teaching involves:
>
> (a) Identifying the significant events in a teaching situation
>
> (b) Using knowledge from one's context to reason about these events
>
> (c) Making connections between specific events and broader principles of teaching and learning (p. 245).

These elements of noticing align well with van Es' previously mentioned framework for levels of noticing, as they indicate a progression in sophistication in thinking about what is noticed. Table 4 shows a sample of how teachers' noticing might be categorized.

Please see the next page.

TABLE 4: LEVELS OF TEACHER NOTICING (ADAPTED FROM VAN ES, 2011)

	Level 1 *Baseline*	*Level 2* *Mixed*	*Level 3* *Focused*	*Level 4* *Extended*
What Teachers Notice	Attend to whole class environment, behavior, and learning and to teacher pedagogy	Primarily attend to teacher pedagogy Begin to attend to particular students' mathematical thinking and behaviors	Attend to particular students' mathematical thinking	Attend to the relationship between particular students' mathematical thinking and between teaching strategies and student mathematical thinking
Possible Teacher Comment	"The class seemed really focused."	"He asked her a follow-up question about her strategy for solving." "She grouped by tens and by ones."	"You can tell how flexible his understanding of tens and ones is by…"	"I wonder if she's had many opportunities to build the quantities with Base-10 blocks so she can see how the place value relationships work."

Finally, a recent study presented by Barnhart and van Es (2015) offer this set of guidelines for the sophistication of noticing skills when studying the abilities of pre-service teachers to notice students' thinking (see Table 5).

Please see the next page.

TABLE 5: LEVELS OF SOPHISTICATION FOR NOTICING SKILLS (RECREATED FROM BARNHART AND VAN ES, 2015, P.87)

Skill	Low sophistication	Medium Sophistication	High Sophistication
Attending	Highlights classroom events, teacher pedagogy, student behavior, and/or classroom climate. No attention to student thinking.	Highlights student thinking with respect to the collection of data from a scientific inquiry.	Highlights student thinking with respect to the collection, analysis, and interpretation of data from a scientific inquiry.
Analyzing	Little or no sensemaking of highlighted events; mostly descriptions. No elaboration or analysis of interactions and classroom events; little or no use of evidence to support claims.	Begins to make sense of highlighted events. Some use of evidence to support claims.	Consistently makes sense of highlighted events. Consistent use of evidence to support claims.
Responding	Does not identify or describe acting on specific student ideas as topics of discussion; offers disconnected or vague ideas of what to do differently next time.	Identifies and describes acting on a specific student idea during the lesson; offers ideas about what to do differently next time.	Identifies and describes acting on a specific student idea during the lesson and offers specific ideas of what to do differently net time in response to evidence; makes logical connections between teaching and learning.

Frameworks from both van Es (2011) and Barnhart and van Es (2015) are referenced during this study.

Interview and Survey Analysis

As previously indicated, critical qualitative research methodology (Carspecken, 1996) was used to analyze the transcribed audio recordings of the interviews for emerging themes. The questions in the interview were designed to examine the teacher's choice of video clip out of a larger segment of video collected, and determine the teacher's reasons for selecting that clip of their instruction. Looking at the teacher's complete video allowed the researcher to see if the teacher's clip selection is one of the better examples of student thinking in the lesson, and learning about the teacher's rationale will give insight into their motivation for sharing that clip. Perhaps they are looking for guidance from the group, or perhaps they are confident in the student thinking and teacher response that is shown, and are seeking praise. There are a number of possible reasons that the teacher may or may not directly voice in the interview. Careful analysis of the interview transcript shed light on participants' motivations for sharing their video, while also helping the researcher to determine if there were ongoing changes in practice taking place in the teacher's instruction.

Participants' responses to the pre- and post-study surveys were also collected and analyzed for emerging themes and connections to the rest of the study data. Information about the teachers' backgrounds and experience may inform the researcher about relationships between their responses in the video club sessions and their levels of noticing on Barnhart and van Es' frameworks (van Es, 2011; Barnhart and van Es, 2015). The researcher also learned about the teachers' perception of the impact of the video club sessions on their noticing of student thinking in their own classrooms, the types of video clips they found to be memorable, and the possible ways teachers suggest to adapt this video club study to a larger, more diverse group of participants. Each of the participating teachers were asked the same questions, and also completed a brief survey to gathered demographics data, including their entry path into teaching. Knowing which teachers entered the study with formalized study in the field of education, and how long they had been teaching provided background for teachers' responses to student thinking during the video club sessions.

Limitations of the Study

This small study group of four teachers limits the findings of the study. Working with a larger group of teachers could bring greater diversity of ideas to the discussion. While the presence of multiple grade levels helps provide diversity of experience and mathematics knowledge, the lack of several teachers on each grade level means that there is a still a limited view of teacher knowledge present. A larger group with several teachers per grade level would allow the researcher to examine trends in what teachers notice depending on the grade levels that they teach or which certifications they hold, while also attending to teachers' mathematical knowledge for teaching (Ball, 2003).

Additionally, because the teachers were responsible for capturing their own classroom video, guided by the request to share instances of students' mathematical thinking, the researcher had no control over the video clips' content. Teachers chose to video record a lesson at any time that worked for them, and may not used the same methods or selected the same content as the researcher might have. Depending on what participants chose to share with the group, student thinking may have been more difficult to notice in general.

Summary

This study proposed to investigate what mathematics teachers noticed when looking for students' mathematical thinking in a series of video club sessions, and how what they noticed changes over the course of the study. The researcher investigated teachers' noticing skills, the video clips that participants submitted to share, as well as the community of practice-based structure of a video club as a professional development environment. Four math teachers were presented with a series of video clips of whole class mathematics instruction, with instructions to reflect on them individually and then discuss them as a group. Video clips came from the researcher's personal collection, the participants' own classrooms, and the IMAP video collection, and their responses to the videos were analyzed for the teachers' levels of sophistication in noticing student thinking and teacher response, aligned with research by Barnhart and van Es (van Es, 2011; Barnhart and van Es, 2015). Additional analysis of the group's interactions as a Community of Practice was undertaken. Individual follow-up interviews were done with each teacher each time s/he submitted a video to be viewed by the group. Those interviews were audio-recorded and analyzed for emerging themes using Carspecken's (1996) methodology. Limitations of the study were examined. The study was completed in the Fall of 2015.

CHAPTER IV: RESULTS

As mentioned in chapter three, this study was conducted to investigate two questions: a) How does teachers' noticing of students' mathematical thinking change over time when participating in a video club style professional development? And b) What impact does the participants' selection of a video clip have on teachers' ability to notice students' mathematical thinking? The data from this study is presented here by examining the answers to the above research questions in order.

Question 1: How does teachers' noticing of students' mathematical thinking change over time when participating in a video club-style professional development?

In looking at the participants' noticing of student thinking, the researcher examined what the teachers noticed about student thinking during the video club sessions, determined if there were patterns to what was noticed, and checked for alignment to the van Es framework. Secondly, trends in what interested the participants as they discussed the videos were also analyzed. Following the video club sessions, participants completed brief interviews about the experience, and this data was examined as well. Finally, the researcher's assumptions about what the teachers would notice during the study are addressed.

When considering the participants' growth in their ability to notice students' mathematical thinking over the course of the study, the researcher did not find evidence of a substantial increase. At times when student thinking was evident in the video clips, participants were able to make comments that aligned with a Level 4, or Sophisticated level of noticing (van Es, 2011), but the majority of the video clips provided by the participants did not showcase student thinking in an observable manner. Throughout the sessions, participants tended to focus the bulk of their comments on proposing alternative pedagogical strategies to address something that they noticed while watching the video clips. According to van Es, this proposal of an alternative pedagogical solution is indicative of Level 4, or Extended Noticing, but this is also indicated by noticing a specific student's thinking. If the framework from Barnhart and van Es (2015) is applied here (see Figure 5), one would categorize most of the participants' comments as being Low in Sophistication in Attending, Analyzing and Responding to Student Thinking. In the case of the four participants in this study, noticing an individual student's thinking was not typically the impetus for their alternative proposals. In many cases, participants noted general confusion in the classroom, or picked up on the teacher's frustration with a lack of success in the lesson, and began to offer ideas about how to teach the content differently. Sometimes the recommendations were small – such as allowing students more time to record their thinking, or using guided notes to keep students on target. Other times the recommendations were for entirely different teaching approaches. The researcher wondered, **"When teachers offer an alternative pedagogical solution after watching a video of classroom instruction, what is the impetus?"** This question became an additional lens for analyzing the data collected during the study, and is examined further here.

Along with the help of a peer debriefer, the researcher examined all the participants' comments from all five video club sessions and categorized them by impetus. Of the 43 comments made that offered an alternative pedagogical solution, 4 were made in response to a particular student's thinking, 32 resulted from an impression of general student/class confusion, and 7 pushed for a clearer focus on the meaning of the mathematics that was being taught. This data can also be seen below in Figure 6.

TABLE 6: IMPETUS FOR ALTERNATIVE PEDAGOGICAL SOLUTIONS

Impetus for Alternative Pedagogical Solution	Number of Comments n = 43	Overall Percentage of Alternative Pedagogical Solution Comments
Responding to Individual Student Thinking	4	~9.3%
General Impression of Students' Confusion	32	~74.5%
Focusing on the Meaning of the Mathematics	7	~16.2%

Further detail of the participants' noticing is given here, with examples from each of the video club sessions, for clarity.

Noticing at the First Video Club Session

During the first video club session, norms for the study were established and the researcher shared a video from her own collection, wherein a fifth grade math teacher asked his students to create pictorial representations of equivalent fractions. This first clip served as a sample of the kind of video the participants would be bringing in to share – whole class instruction where students' voices can be heard clearly, with occasional close-ups on individuals or pairs of students, without concerns for perfect behavior or professional filming technique.

After watching the first video clip, the teachers were quick to start making suggestions about what the teacher might have done to improve his instruction and be better able to see what students were thinking during the lesson. They had recommendations for both the delivery of the instruction and its content. Farrah commented on her concern for everyone's engagement in the lesson, because the teacher had an extended conversation with a single student in front of the class. When asked if she saw evidence of student thinking, she said,

> "I mean, I'm hesitant because my video's going to be up there one day, but I think, no. Only because they don't talk very much, and how long he was on that little girl, like what we were talking about before, how much are the other kids really thinking?...Evidence of student thinking to me is when they're doing the heavy lifting, and just one kid was kind of doing that. And whether everyone else was doing the kind of thinking that she was, how can you measure that, you know?" (VC1, p.3, lines 2-12)

At first, this seems like it might be categorized like a Level 2 comment, due to its focus on the teacher's pedagogical moves, but she follows it with,

> "To me it would have been cool if he had ... When he was really pushing that one little girl, if instead he would have said, 'Okay, let's back up. Is multiplying by two over two the same as multiplying by two? Everyone think about that right now.' Don't let her say anything. 'Okay, whatever you're thinking write it down. Prove it in a picture or explain it in your own words.' Almost just stop right there and give them three or four minutes to get something on paper." (VC1, p.3, lines 31-36)

This immediate addition of an alternative pedagogical solution to help the students develop better understanding of what makes a fraction equivalent means her thinking is more along the lines of van Es' Level 4, or Extended Noticing. Farrah is responding to a couple of students featured in the video, who showed some confusion about how to create equivalent fractions, as well as her general impression of a lack of awareness of what other students in the class are thinking.

When thinking about a more effective way to help students understand what happens when you create equivalent fractions by multiplying the numerator and denominator, Kyle said,

> I wonder if he would have said, "Okay. Everyone draw another square that was, like put it into fourths now. Multiply that by two. How many fourths are [there]?" Bringing it back to the concrete or pictorial representation. That might have helped kids to see like multiplying by two doesn't give me the same as multiplying by two over two. (VC1, p.2, lines 19-23)

This comment was made as a general recommendation for the teacher, without mentioning a clear tie to an individual student's thinking.

Analysis of the full session transcript according to the van Es framework (see Figure 3) yields that the participants were consistently 'propos[ing] pedagogical solutions based on interpretations' (Level 4, van Es, 2011). However, not all of the recommendations came as a result of focusing on an individual student's thinking, which is typically what is outlined in van Es' framework in order to be operating at a Level 4 sophistication of Noticing. This was the first indication that van Es' framework might not align with the findings of this study.

Noticing at the Second Video Club Session

The second video club occurred three weeks after the first one. This session was the first where participants had their own video to share with the group. Jenny shared her lesson where students were using rubber bands and geoboards to create various triangles, including trying to create a triangle with two obtuse angles. The participants started their comments following the video with general supportive praise, like Kyle, who said, “That's freaking awesome.” (VC2, p.2, line 3), and then this longer comment from Alex,

> “One, that it seems like you want to be there, you want to teach, you're enthusiastic. Second, the kids are willing to learn, they're attentive, they're trying. The other thing is that you keep shooting them with questions left and right so that they're always thinking. You're straight forward, when someone's wrong they're wrong. It's not like, ‘Oh, everyone tried. Why tell you, Yeah, you can make a triangle with five sides?’" (VC2, p.2, lines 5-10)

As Kyle and Alex spoke, Farrah nodded and smiled. Jenny admitted being nervous, but was looking forward to getting some feedback (VC2, p.2). Moving away from the more general feedback, Alex offered some critique about Jenny’s quick insertion of the sum of any triangle’s angles being 180 degrees at the end of the lesson:

> “…if I were going to introduce the one hundred and eighty thing about triangles, I would have gone ahead and started with wonderful squares because they know right angles. Ask them to sum that up very quickly. They would ... hopefully some kid would've been very sharp and said, ‘Well, nine times four is thirty six, and it's three sixty,’ and then you slice it half ...then you can ask, ‘Well, if I had three sixty, what do you think I have now?’" (VC2, p.2, lines 23-30)

During this session, data analysis suggests that the participants may be engaging in Level 4, or Extended Noticing, because they are offering an alternative way to teach about the basic principles of triangles, having connected to what they saw in the video as a less effective brief mention of it as a fact that students might want to know. Whether this is truly a Level 4 example of Noticing is questionable, however, as it is an alternative solution proposed as a result of general impressions of the lesson, rather than a specific student's thinking. It was becoming clearer that the van Es framework was not the best fit for this study.

Noticing at the Third Video Club Session

Kyle's Video

At the third video club session, about three weeks later, two participants shared their videos. Kyle went first, sharing a clip where students were supposed to find the 12th term of a pattern, and the class was split about half and half between the correct and incorrect answer (up arrow vs. down arrow). He noted that doing a quick check for understanding and seeing the split in students' thoughts about the answer led him to stop and dig into the problem more than he originally planned to do, "I was like, 'Okay we need to take some time to talk about this.'" (VC3, p.2, line 28). This is a clear instance in the video club sessions where a video clip shows the teacher stopping to adjust instruction based on students' responses, and talking about it with the other participants.

Jenny notes that she saw one student as more of a visual learner based on her response,

> "The one girl, the one that was talking about the arrow going up and down. How she could kind of visualized it. You can tell she's more of a visual learner because I didn't see the arrow, I was thinking more mathematically. I don't know if that was something that you wanted to do when you were asking the different kids, but one way I was thinking about doing this was having the kids count it out. Right,

> down, left, up; right, down, left, up; so then they know that they're repeating 4s. Then we'll go, ‘Okay, well it's 1, 2, 3, 4. The 12th would be whatever the 4th is times 3.’ A different way to see it. She's a more visual learner, where some of your more math-y kids would have been like, ‘I don't see it.’ They're not used to drawing things out. They could have just seen the pattern and extrapolated that way.” (VC3, p.3, lines 18-26)

This allusion to pictorial vs. abstract ways of solving the problem indicates that there are multiple ways to solve it, and watching the video helped Jenny think about approaching it from a different direction than she might have herself. Her comment is focused on this student’s thinking and how it differed from her own, but isn’t linked to a teaching strategy, making it a Level 3 comment in terms of van Es’ framework.

This first part of the third video club session alternated wildly between comments that were totally off-topic in terms of noticing students’ thinking, where the participants were more focused on their own connections to Kyle’s struggles with his lesson and his students’ confusion, and then getting back on track to make comments that focus on students’ thinking or their impression of the lesson’s success, and what might be better pedagogical choices to drive the learning in the classroom. The researcher considered how to categorize these off-topic responses as anything other than unrelated to the van Es framework for levels of noticing, and will explore that further, later in this chapter. When they were focused on the content of the video, participants were able to notice student thinking, but they were easily distracted from the objective of the session.

Alex's Video

The second part of the third video club session concerned the group's discussion of Alex's video. Alex presented a video clip of instruction around the lengths of the sides of triangles. He shared that this class got different instruction than his first 2 classes, because the manipulative-based game he has planned didn't work out the way he expected – students weren't making the connection that he wanted (the sum of the length of two sides of a triangle must be greater than the length of the third side). His reflection had a tone of frustration – "they never made that connection so I just had to stop. It was a great game…" (VC3, p.18 lines 1-2). In thinking about the changes to the lesson that he made, he said that eliminating the game also meant getting rid of the notes packet he had made to go with it, impacting the way students took notes in class.

> "I need them to write more and I need them to interact more with each other, which I should have done in this case, had them turn to their partner, and each one explain, in their little groups, at least to explain and give each kid a chance in the group because you're right, not everyone did participate. That would have been a good time for them to participate." (VC3, p.17, lines 31-35)

It is important to note that Alex is talking about his overall impression of the lesson, not citing individual students' work or thinking, making this reflection a Level 2 comment on the van Es framework.

While the three teachers watching Alex's video with him were full of praise for his engaging delivery and humor, and had plenty of positive comments for him about what they felt worked well, they continued to offer alternative teaching approaches for him to consider, focusing on how to increase students' understanding of the content and create ways to make students' thinking more visible. Had they referred to student thinking in their comments, they would be representative of Level 4, or Extended Noticing on van Es' framework, but the lack of specific connection to student thinking makes this rating questionable.

Noticing at the Fourth Video Club Session

Introducing the van Es Noticing Framework

At the fourth video club, which took place about six weeks later, at the end of April, van Es' noticing framework was introduced. The participants were shown the tables in Figures 3, 4, and 5. They were told that this framework informed the work that the researcher was doing with them, and with the novice teachers she instructed in a math content course. They had a chance to read over the tables and ask questions, and then they watched a video clip as usual. Farrah shared a video from her classroom, in which her fifth grade students were working on finding the area of composite figures.

Farrah's Video

After the video clip concluded, the participants began by commenting on workspaces and student engagement, laughing, and saying "level 1, level 1…" before taking on a more serious demeanor. Kyle started with praise of Farrah's focus on vocabulary and her attempts to get students to figure out how to find the area on their own. He said, "…by continuing to prompt kids with those questions, you saw where their gaps were. You weren't expecting to teach them about regular polygons, but you had to cue their thinking about that to make sure that Paula's thoughts were the same thoughts as the rest of the thoughts." (VC4, p.1, lines 23-26) Jenny continued in this vein, saying,

> "My favorite part was when you said, 'I'll let you struggle for 2 minutes,' I just really, really liked that because I felt like you refused to give the kids the answers…it seemed like a lot of them were really engaged in trying to figure it out and you did a good job of actively monitoring and going around and making sure the kiddos were really thinking about it. It's like, 'You have the tools, so figure out how to use them,' which is really problem solving." (VC4, p.1, line 30 – p.2, line 6)

Alex followed with, "The best thing I think you did at the end was said, 'All right, if no one can get it then, put all your brains together and try to figure it out.' (VC4, p.2, lines 14-15) Then Kyle says, "I think what Alex said was exactly right, by shutting Paula off and saying, 'Everyone else work,' they'd be fine. We can't hear their thinking obviously. Clearly they were getting it and understanding. They learned from her, from Paula's errors in their way of thinking they figured out from Paula." (VC4, p.2, lines 26-30) Only this last comment is a Level 4 comment on the van Es framework, because it ties Farrah's pedagogical choices with students' thinking.

Noticing at the Fifth Video Club Session

The fifth video club session was postponed from its original date of mid-May when two of the participants weren't able to attend. Attempts to reschedule soon failed due to end of school year commitments and then summer travel, so it wasn't until September that the group was able to get together again. The fifth and final video club session featured two videos, one supplied by the researcher, and the other by a participant, Kyle.

Cathy's Class

The session started with the researcher sharing a video from the IMAP collection (Philipp, et al., 2011), featuring Cathy's Class. These 5th graders worked to solve a problem applying a pattern, and the video showcases how the teacher – Cathy – facilitates their discussion. The researcher chose to share this video as a warm-up for the participants to get back into the noticing work they had paused with the study almost 5 months previously. She began by asking the group, "What student thinking do you see?"

Farrah started by focusing on the students' disagreement on what it meant to be finished – reaching the top or climbing out of the hole – and how that determined whether a student said the answer was 11:00 or 12:20. Jenny agreed, and talked about the power of having students show their thinking by drawing out their solution on the board for the class to see – "…you could see that each of them had a totally different way of diagramming it, so just seeing how kids are organizing it because the problem wasn't super, super hard, but if you had a strategy that didn't let you organize it clearly, then you could make some simple mistakes." (VC5, p.2, lines 16-21) The group agreed that there was a classroom norm of showing your work and being comfortable to showing something different than your peers.

Alex brought up the idea that the teacher was at fault for the confusion in the room, and suggested that perhaps she chose to add controversy by not insisting that the class refocus on the question, "What time does the worm reach the top?" He thought she might have chosen to allow the discussion to develop by allowing for ambiguity in the question – some students solved for when the worm reached the top, while others solved for having time to get out of the hole, too. He said, "I wish we had the rest of what she says. Here is the answer, let’s have everyone vote. Let's see what would happen, but there is a definite answer and ready and unveil. Then ask the kids, where do you think you made your mistake? Have a kid say oh, I actually thought he had to get out…” (VC5, p.4, lines 12-15).

Kyle and Jenny agreed that they liked the teacher’s style – she gave almost no feedback on students’ work, only facilitating the discussion so that students continued doing the talking – “Maybe that's also part of their culture too. You're going to present a problem. It may or may not be right. We're going to talk about that, but I just want to see what you do. Having that delayed gratification.” (VC5, p.4, lines 24-27)

For this first ten minutes of the video club discussion, participants’ comments are focused on the culture of the classroom and how it facilitates student thinking, and the teacher’s choices in how she let the class discussion evolve. Because most of the participants’ comments about students’ thinking is general, this could be called a Level 2, or Mixed level of noticing, but it’s difficult to call, because there are 2 main camps of student thinking about the problem. It’s true that only Jenny focused on a specific student’s response in the video, noting how one student got to 12:20 by thinking about 20 minutes being a third of an hour. Otherwise, the comments were about the two possible answers, and how students’ work supported it. Once more it appears that the van Es framework is difficult to apply in this context.

Kyle’s Video

Shifting to Kyle’s video, the participants watched as Kyle taught a lesson on volume that reviewed where the volume formula comes from, having students stack transparent sheets to see the area of the sheet as the area of the base of the figure, and the number of sheets as a representation of the height. Reflecting on the result, Kyle notes that this concept should have been review for his students, but many didn't seem to have it down. During the lesson, he saw a range of student understanding, from struggling to figure out what the base is, to being able to figure out the area of any 3D figure presented.

Farrah keyed into the challenge of his activity of building with thin layers, and therefore not seeing the connection of the three dimensions as working with the same unit, the way you would if you worked with base ten blocks or unifix cubes – "I did it with actual unit cubes and I made them build the first layer, and we talk about layers. Whenever we speak about height, we first refer to it as layers." (VC5, p.7, lines 20-21) Jenny talked about teaching this idea to 4th graders at the end of the year using a dryer sheet box and base ten cubes to help students see how length, width and height all interact, building layers of boxes to fill it up, "Then they start seeing, no actually there would be stacks. They discover that on their own." (VC5, p.8, lines 1-2)

Alex said that it was likely Kyle struggled to get the participation that he wanted because of the high number of ESL students who just aren't that comfortable sharing their thinking in English. He pushed Kyle to think about how he might offer a context for exploring volume, like a fish tank, or an ant walking along a line as a representation of the first dimension. Kyle agreed that tying the concrete experience to a real world context might be helpful, and added, "there were kids who don't even get started because they don't feel like they know how to access it, [and so] what Farrah was saying, if I give them a few steps or give them the vocabulary reviews or the tactile experience, it's going to absorb more." (VC5, p.15, lines 8-11) All three of these comments focused on ways that Kyle's instruction might be improved so that students would have a clearer grasp of the concept of volume, aligning with Level 4, or Extended Noticing, except that the teachers are not referring to a specific student's thinking, as van Es' framework (2011) was intended to be used.

Responding to Individual Students' Thinking

One example of the participant giving an alternative pedagogical solution in response to student thinking is:

> "I think one kid really articulated multiplying by two gives me 6 points and multiplied by two over two gives me six eighths. Those are really different numbers. Really, that's like genius. Then the one girl that you asked, she was like, 'Multiply by fractions, it's like basically the same thing.' [but] couldn't really explain what the same thing meant. I wonder if he would have said, 'Okay. Everyone draw another square that was, like put it into fourths now. Multiply that by two. How many fourths are [there]?' Bringing it back to the concrete or pictorial representation. That might have helped kids to see like multiplying by two doesn't give me the same as multiplying by two over two." (VC1, p2, lines 15-23)

This is an example that clearly aligns to the van Es (2011) framework, because the participant notices the student's thinking and refers to it when offering an idea of another way to teach that might help with the student's confusion. It is easily classified as a Level 4, or Extended Noticing comment.

Responding to a General Impression of Confusion

Far more frequently, however, the participants offered alternatives that were general responses, not referring to a specific student in the video clip. When considering a lesson Alex shared, in which students struggled to come to understand that two sides of a triangle must sum to more than the third side, Farrah said, "I would make guided notes for this where I would say, 'Use this as your base. Try it when it's an isosceles triangle where the congruent sides are three inches, now the congruent sides are four inches, now they're five, now they're six.'" (VC3, p15, lines 7-9) This is an example of a participant offering some advice to a peer, but without a specific student's thinking as the impetus. Most likely, Farrah is using her own experience to refer to here, and her knowledge of teaching practices that have worked for her in the past, and she leverages them in her advice.

Focusing on the Meaning of the Mathematics

Other times, the participants chose to focus on the mathematics of the lesson, and how it might have been made clearer for students. Jenny says, "I would've liked to have had him talk more about did we change how many pieces are shaded? That's one of my favorite questions because you did change the number of pieces shaded however, when we look at the model as a whole, did the amount shaded change?" (VC1, p8, lines 8-11) Jenny highlights a likely misconception that students encounter when learning how to create equivalent fractions, and states her perception of the importance of the underlying concept of consistent value that equivalent fractions illustrate.

Summary

There are a variety of areas of research in the field of mathematics teacher noticing. This study was undertaken with a focus on how teachers can learn to notice and use students' mathematical thinking in their instruction. The analysis of the data from all five video club sessions showed a trend of participants making comments that resulted from a general impression from the video clips, rather than as a result of focusing on an individual student's thinking. Additionally, there was a clear difference in how participants spoke when a video was being shared by one of the other participants. They were sure to offer positive comments to each other, offering support and praise about what was working well in the classroom. They did not make these comments when viewing the clips provided by the researcher of teachers they did not know. As will be examined in research question two, there appears to be a relationship between the video clips that participants shared with the group and the participants' ability to notice students' mathematical thinking.

Question 2: What impact does the participants' selection of a video clip have on teachers' ability to notice students' mathematical thinking?

In the design of this study, the researcher chose to have participants provide their own video clips for the group to view. The intention was to give participants the freedom to film at any time that was convenient for them, and then choose a clip from their footage to share. The researcher intended to investigate each participant's motivation for selecting the clips as part of the analysis of this study.

All four of the participants supplied video clips to the researcher in advance of their video club sharing date, and all four submitted videos where the camera is set up at the back or side of the classroom, and left there for the duration of the clip. This whole class view affords a clear view of the teacher's whole class instruction, and sometimes allowed the participants to hear individual students responding to their teacher's questions. What it failed to do is provide the participants with a view of student work, or a chance to hear students speaking to each other about the lesson content. The "windows into student thinking" were not always present in the selected clips (Linsenmeier and Sherin, 2009), making it challenging for participants to notice individual student thinking. This challenge is examined further in chapter five.

What Did They Discuss?

The researcher noticed that the participants spent a good deal of time talking about topics indirectly related to the student thinking that they noticed. That is, the participants' comments were either typically a comment offering an alternative pedagogical solution, or were not really about noticing at all. Considering this, the researcher examined the substance of the participants' comments for emerging themes, and these were determined: Pedagogical Critique, Reflection, Examining the Mathematics, Community, and Reality of Teaching.

TABLE 7: NON-NOTICING COMMENT CATEGORIES

Comment Category	**Number of Comments (n = 44)**
Reflection	10
Examining the Mathematics	7
Community	14
Reality of Teaching	13

The researcher read through and coded session transcripts and participants' notes to identify these themes and pull representative samples. Pedagogical Critique comments were typically reflected in the noticing comments, where participants offered their perspective on what did or didn't work well in the video, and what pedagogical alternatives might be used instead. Samples of those comments precede this section, and are detailed under research question one. Reflection comments were made by the participant presenting the videos, and tended to focus on the planning or intention of the lesson, the implementation of that lesson, or the results of it. In comments coded as Examining the Mathematics, the participants focused on how the instruction highlighted vocabulary, misconceptions, or context of math applications. Community comments were typically praise, statements of support, participants finding common ground, or asking for and sharing advice. Finally, the Reality of Teaching comments were typically about common struggles like the pressures of limited time, student engagement, or using a prescribed curriculum. Further explanation and examples are shared here.

Reflection

Throughout the five sessions, participants used the video clubs as an opportunity to reflect on their practice. The participant sharing a clip often had something to say about their video, as in Jenny's comment here about quickly inserting the 180 degree rule about the sum of the angles of a triangle: "I'm definitely okay with [not everybody getting it] but I also don't know, should I even [bring it up]? I sometimes think it's good to push kids. Some kids are ... they got that, and they ran with it, and they're like, 'Oh, it's a hundred and eighty.' I don't know if I should do that or not." (VC2, p.3, lines 6-9) Similarly, Alex reflected on the implementation of his lesson, saying, "What some kids figured out, well if it's an equilateral triangle then I don't even have to do any addition because equilateral triangles will close. We went from that to numbers too quickly maybe." (VC3, p.5, lines 27-29) Watching the video with his peers seemed to help him consider his students' need for more of a bridge between pictorial representations and abstract thinking.

Farrah reflected on what she had noticed about her students' work while she was observing their small group problem solving time, as her students grappled with finding the area of composite figures.

> When I was walking around going table to table, it was pretty cool to see how some of the kids were going about it differently. At some tables the kids would

> draw a line horizontally, and they would see the 2 separate rectangles. Some of the kids were drawing the line vertically and seeing the 2 separate rectangles. Other kids were drawing it horizontally and vertically so they had to find the area of 3. Then there was that conversation, "What's easier, would you rather find the area of 2 rectangles, or 3 rectangles?" Getting them to understand that it was correct that they were doing that, what's the most efficient way? (VC4, p.5, lines 1-8)

Here, we see the Farrah is thinking about what she saw students do as they worked, and considered the implications for the different strategies that she noticed. By seeing a variety of methods, she was able to push students to share their ideas and determine a more efficient way to solve. This is an example of a Reflective comment that might also be categorized as a Level 4 noticing comment, because she is referring to specific work that she saw students doing, and considering how to act for the benefit of the class.

In thinking further about her lesson, Jenny shares, “I think I was trying to go more rapid fire, so there was a lot of kids that were shouting out answers. It was kind of hard to make sure I was really hearing individual student thinking and then following up with kids who didn't have it correct.” (VC2, p.5, lines 7-10) Here Jenny is making a connection between her ability to notice student thinking and the instructional choices that she made. The video club sessions gave the participants an opportunity to reflect on their practice in a way that they might not have otherwise.

Examining the Mathematics

The participants took a closer look at the mathematics present in the video clips mainly by looking at misconceptions and context. When examining misconceptions, participants noted that students were confused about the rules for forming a triangle –

“there's going to be a kid who’s still like, ‘I'm going to make a hundred-fifty degree angle, and then a hundred-forty degree angle, and it's going to be a triangle. I'm going to make it work.’” (VC2, p.7, lines 13-16) This notes the challenge that arises when trying to teach students about a geometric rule (in this case, the sum of all interior angles of a triangle is equivalent to 180 degrees) without sufficient time to internalize the concepts of angle measurements and relationships.

A related misconception was highlighted when Farrah’s class was working on finding the area of composite figures and the word ‘regular’ was used to talk about shapes, including rectangles. The participants discussed how students’ common use of the work ‘regular’ more likely means ‘typical,’ and how that can be misleading when thinking about the relationship between squares and rectangles. Later in the lesson, Farrah identified three students who thought they should find the area of the parts of a compound figure and then multiply them to get the total area. They had confounded the idea of multiplying to find area of a quadrilateral with combining the area of two adjacent figures.

When focusing on the power of teaching a lesson with the best possible context, Alex’s lesson on triangles brought to light the notion that an engaging story doesn’t necessarily make an effective teaching context. His use of the lines of a tent or house roof showed that one could form legitimate triangles without being aesthetically pleasing, leading students to think that their mathematically acceptable triangles were incorrect answers. “…the sixty [side length] was not actually too small to make a triangle, it just looked funny as a roof.” (VC3, p.17, lines 23-24)

A Community of Peers

In addition to the work participants did to examine the pedagogy and the mathematics taking place in their classrooms, the teachers served as a support system for each other, offering praise, commiserating over challenges, and sharing best practices. They were most likely to offer words of praise to the teacher whose video was being shared before giving critique or suggestions – “You're like so patient, when you're like ‘stack, stack, stack,’ I would have lost it. I don't have patience. I would have been like, ‘why aren't you stacking?’...Props on that in your patience.” (Farrah, VC5, p.6, lines 21-23) They also noted how engaged their students were during the lesson - “I feel like your engagement and the level of kids that were thinking in this high-level stuff was so increased because you have this expectation of calling out and making sure you're raising your hand and you're very engaged.” (Kyle, VC3, p.4, lines 7-9)

The participants also spent time talking about what they saw about each other’s classrooms that worked well, and sought advice on how to cultivate that. Alex shared:

> “I have to know who my kids are. I have to know what they like, what they don't like. I have to know, even what music they like. I ask them what's a famous quote from a movie they've seen or cartoons. They're giving me cartoons that are current and I haven't seen them, and I don't know…it's like oh my gosh I'm going to have to find out. It needs to be at their level when I'm talking to them.” (VC5, p.17, lines 31-38)

During a discussion about maintaining high expectations as a way to keep students going despite difficulty, Kyle told Farrah, “I think…you could tell the kids felt supported and also knew you were on their ass the whole time. Paula didn't get deflated, she figured out another way." (VC4, p.12, lines 17-19) In general, the participants saw each other as skilled teachers with ideas to share and techniques to emulate.

Reality of Teaching

Throughout the video club sessions, teachers talked about various elements of what the researcher termed the Reality of Teaching – time pressures, student engagement, and working with prescribed curriculum. All four participants were quick to empathize with each other about the challenges of being a classroom teacher in this day and age.

Time Pressures

In thinking about the time pressures that teachers face, particularly due to testing, there were several mentions of not having enough time to teach the way they would have liked, for instance: "…had time not been an issue, I think it also would've been cool to ... I wish I could've spent more times on all the different ways [to solve the problem]. (Farrah, VC4, p5, lines 22-23) and "…my thought is always like if I had this conversation with them in class, how long is it going to take for them, how quick are they going to make those realizations?" (Kyle, VC5, p.15, lines 17-19)

Student Engagement

When focusing on student engagement, participants thought about students who don't participate in discussions, whether due to language issues, lack of interest, or the ability to 'hide' within a larger group: "the kids, they may not be comfortable with their language so they're kind of timid to talk…When you have kids who have a much stronger grasp on the language, you won't be able to keep them quiet." (Alex, VC5, p.12, lines 35-37) Always concerned about knowing how all of her students are doing in their learning, Farrah said, "Conversations are really great to have. Especially math conversations. I just always, I'm just a control freak, and it's just like how many kids are really engaged in this conversation right now? How many kids are totally checked out and they're not thinking ever…[unless] we're writing something down?" (VC5, p.15, lines 22-25)

Working with Prescribed Curriculum

Farrah and Kyle both talked about the challenges of working with the curriculum that is prescribed for them at their schools, and figuring out how to create notes that students can build off of so they have something they can look back at later, or their parents can see to understand what's being learned in class. Farrah says, "If I'm doing it the way Eureka wants me to do it, they don't even have notes to go back and reference to say how do I do this type of problem." (VC5, p.9, lines 40-42) In response to this issue, she creates her own guided notes sheets instead of relying on individual white boards that the curriculum recommends:

> "In the notes there's 6 examples. I need to type that up for kids. Give them space, space to do things, space to take notes. The lower kids need steps…you give them three steps and they can do it. I think kids need notes. They need space and [for] the teacher…it's easier to walk around and I know I'm looking in this general area for this certain thing, versus a whiteboard, and I'm like, 'What do you mean you erased it? I haven't checked you yet.'" (VC5, p.10, lines 9-15)

She indicates the value she places in being able to see what students are thinking, and how they're doing their work to solve a problem by looking at their papers. Kyle wants to give his students something that is a digest of what they've learned in class – "The most important, most helpful page" (VC5, p.11, line 1) that they can refer to later. They both see creating note-taking supports like this for their students as a way that they facilitate student learning and can keep their fingers on the pulse of student thinking, while working within the confines of the prescribed curriculum.

Jenny spoke at length about what she has seen students doing in the classrooms at her school as a result of the curriculum that is in place – "…in third and fourth grade both, kids were just drawing and showing their thinking so much more because I think that's how the curriculum is designed. It's more like draw the array, draw the tape diagram, show your thinking." (VC5, p.12, lines 16-18) She felt that the curriculum and its demands on how students are supposed to show their work in problem solving was automatically making student thinking more visible for teachers.

Emerging Themes from Post-Study Interviews

Each participant was interviewed about their experience in the study's video club sessions upon its conclusion. Transcripts of their interviews were analyzed for emerging themes and the following were identified: benefits of participating, power of a transcript, opportunities to reflect, and perceptions of a change in practice. Some additional exploration of these topics is presented here.

Benefits of Participating

All of the participants stated that taking part in the study was beneficial. Jenny said, "it was great to really, really get specific feedback on my own practice and watch exemplary teachers teaching math, no matter what grade it was." (Jenny, Post-study interview, p.1, lines 10-12) Farrah talked about how little she gets to observe others at her school, and said, "it was nice to not only get to see other teachers, but also I really do believe that the group I was with, everybody was so great, I feel like I had a lot to learn from them. I really enjoyed it. (Farrah, post-study interview, p.1, lines 5-7) Alex, in his sixteenth year of teaching, seems to do little observation as well, as he said, “Well it was news, eye-opening to see how other people teach and what they think makes sense to a kid and to see how they spark new understanding in children's heads.” (Alex, post-study interview, p.1, lines 3-4) Kyle talked about the benefit of having someone from outside his school see his teaching, and how much he missed that – “I've been thinking about this year so much and I really miss talking to people that don't teach at my school about what to do. I think I'm learning. I'm always going to still be learning. I have to do this job at the best level because every kid is different. Every kid has his own unique situations. Every class of kids is different, every cohort within that class. I really liked somebody that wasn't [from my school] looking at what I was doing and saying, ‘It's good. Here's how you can make it better.’"(Kyle, post-study interview, p.8, lines 28-35) Having a community of peers to share their teaching with, in a group of shared respect and trust was something all four participants appreciated.

Power of a Transcript

When talking with participants after the study’s conclusion, there were several references to the transcripts of the shared videos to which participants referred during the sessions. Jenny talked about Alex’s ratio of student to teacher talk, saying, “I think when we looked at Alex's transcript, seeing that he just…it was like him, kids, him, kids, and it was always in the same ratio, that was crazy to me.” (Jenny, Post-study interview, p.5, lines 3-5) Kyle thought about the transcripts of his own shared videos and said, “I didn't think I was talking that much…I think you could watch a video of yourself teaching and just be like, ‘Dammit. Why am I only talking to this kid? Why is my decision to talk to this one kid about their behavior so much more important than everything else? I should just tell them please stop and get going.'" (Kyle, post-study interview, p.9, line 24-34) In general, the transcripts were seen as a helpful tool, and an additional lens on the video's contents. Jenny in particular recommended that any future studies of this kind include a transcript.

Opportunities to Reflect

Wang and Hartley (2003) wrote in support of video as a medium for teacher learning, and the study participants echoed this in the way they expressed an appreciation for the opportunities they had to reflect on their teaching. Alex said, "I think it's a good idea to look in the mirror more often. I think we look in the mirror too often for vanity reasons…but when it comes to what really matters, you're reflecting how you do your job, I think we need to do it on a more consistent basis." (Alex post-interview, p.1, lines 7-11) Jenny shared, "I thought it was really, really helpful. I think it was something that challenged me to really be a critical [observer of] what my kids were saying and instead of being like, 'That's not exactly what I need to say,' how do I keep asking better questions?" (Jenny, post-study interview, p.4, line 34 – p.5, line 2) Kyle said, "I was watching it [my video] again…with the help of Farrah, Alex, and Jenny. I was just like, 'Wow, I could have made that point a lot faster and gotten kids to practice a lot more.'… It's a very humbling experience and through it being humbling made me even more self-reflective than I already am about what I do with my students." (Kyle post-study interview, p.1, lines 5-16) Later, he said, "You can kind of look back and say, 'Was the time spent best to get kids to this level over here?' I didn't move in the moment. I didn't feel successful. Now looking back at the tape I can better analyze why it wasn't successful and what I need to do too fix that. (Kyle, post-study interview, p.3, lines 25-

28) Even if there was not a noticeable change in participants' ability to notice student thinking, there is a value placed on the experience itself.

Perceptions of a Change in Practice

The initial research question upon which this study was based sought to investigate how teachers' abilities to notice and use students' mathematical thinking in their instruction as a result of watching videos of their own (and their peers') teaching. Despite the findings that the study design didn't produce a change in teacher noticing, the participants themselves found the experience to be helpful, and in some cases, change-inducing. Jenny said, "Even just like saying, 'What are kids thinking?' Even just trying to make myself more aware of student thinking kind of changed my practice, as well, because sometimes, I feel like I would ask a question and then be like- I think I always was good at asking way, but then really, really listening, and then being like, 'A-ha.' Then, kind of really making sure I was paying attention to why and making sure all the other kids understood why that kid also thought that way." (Jenny, post-study interview, p.2, lines 1-6) The other participants did not share ways in which their practice had changed, but it was not a question that they were prompted to answer.

Summary

In this chapter, the data from the study was presented by examining the answers to the two research questions: a) How does teachers' noticing of students' mathematical thinking change over time when participating in a video club style professional development? And b) What impact does the participants' selection of a video clip have on teachers' ability to notice students' mathematical thinking? Additionally, themes extracted from the participants' post-study interviews were examined, exploring the ideas of: benefits of participating, power of a transcript, opportunities to reflect, and perceptions of a change in practice.

Analysis of the study data suggests a relationship between the video clips presented by the participants and their ability to notice student thinking. When, in the researcher's option, there were instances of student thinking clearly present, the participants noticed it. However, when student thinking was less obvious, typically masked by unclear sound, or the camera angle's focus on the teacher, participants' noticing of student thinking was much less likely. Conclusions about this phenomenon will be presented in chapter 5.

While a strong connection to students' mathematical thinking was not clear in most of the video club sessions' data, there were definite categories into which the participants' comments fell. In their conversations about the videos, participants focused on Pedagogical Critique, Reflection, Examining the Mathematics, Community, and Reality of Teaching. These categories support the researcher's conclusion that the van Es (2011) framework for noticing is not a good fit for the data collected in this study.

CHAPTER V: DISCUSSION

This study was conducted to determine the answers to two questions, a) *How does teachers' noticing of students' mathematical thinking change over time when participating in a video club style professional development?* And b) *What impact does the participants' selection of a video clip have on teachers' ability to notice students' mathematical thinking?* As indicated in the findings presented in the previous chapter, there was not a noticeable change in participants' ability to notice student thinking over the course of the video club sessions. The main reason for this lack of growth is proposed in this chapter, and some ideas for ways to address the issue are explored. Additional discussion regarding participants' choice of a video clip is also presented here.

Connecting Findings to Literature

The findings of the study connected to the literature in a few ways: examining how the participants followed the expectations of the study's design, considering who should collect video when it is to be used for teacher learning, and the ways in which this study aligned with community of practice research, and how it didn't, as well.

Expectation vs. Reality

The main issue faced in the execution of this study is that the participants were tasked with supplying video clips from their classrooms, but the clips were not of a similar content and style as those shared by the researcher. During the first video club session, the researcher shared a video clip from her own collection, modeling how the camera was sometimes set up to capture the entire class, and other times carried around the room to capture student discussion or zoom in on student work. It was emphasized that the video clips should show instances of students' mathematical thinking, or times when their thinking wasn't evident – a missed opportunity.

Each video submitted by the participants was filmed with the camera sitting at the back or side of the classroom, without any close ups on students or student work, meaning that the 'windows into student thinking' referred to by Linsenmeier and Sherin (2009) were not frequently present for viewers to observe. The researcher expected the participants to follow the examples of video capture that were modeled and discussed during the first session, but that did not happen.

This raises the question of ownership of learning. The researcher designed to the study to honor participants' abilities to choose any time they liked to record instruction, and focus on any content of their choosing, rather than adapt their schedule to the researcher's availability. In theory, it's an idea that conveys respect for the participating teachers. In practice, it is an additional task added to an already overbooked day of commitments on a teacher's schedule. Each teacher, when it was their turn to submit their video for pre-sharing transcription, told the researcher something along the lines of, 'I can just shoot one for you tomorrow. I apologize for not completing this yet! Thanks for the reminder.' (Jenny, personal communication, February 16, 2015). All four indicated the intention to record sooner and have more video clips from which to choose, but all four simply emailed a video from their classroom and three of the four said they were happy to have the researcher show whatever she'd like. At her pre-sharing interview, Farrah said, "I'm interested to see what I said in here," (Farrah, pre-sharing interview, p.2, line 17) indicating a lack of reflection over the video clip contents, and any exhibited student thinking. Alex sent his video in with a few notes and time stamps to discuss with the group, but this was not the norm for the participants.

The conclusion one drawn is that the researcher's intention – that participants spend time recording and reviewing the footage of their classroom as a way to reflect on their practice and prepare to share with the fellow teachers, delving more deeply into the notion of the importance of student thinking and how it appears in his or her classroom – is not something to which the participants were as committed. This is not unexpected – while all of the participants expressed an interest in the researcher's study and its focus on student thinking, preparing for the video club could not be expected to take top priority over all the other responsibilities a teacher must handle in a given day. The one teacher who DID follow through with the reflective part of the video capturing was the most experienced teacher, with 16 years of teaching experience and many years in 6th grade math. It is likely that his comfort with his content meant he was spending less time planning instruction, relative to the other three participants.

So Who Captures the Video?

In most of the literature around the use of a video club for the professional development of mathematics teachers, the researchers capture the video, select the clips, and share them with participants, potentially biasing the viewers towards a particular area of focus. Linsenmeier and Sherin's (2009) point about using video as a window into students' thinking only being possible if there are instances of student thinking present in the video in the first place is absolutely true. This researcher wanted to know if teachers who were prompted to search specifically for student thinking in their mathematics classrooms would be able to record and share such instances, and whether their participation in the video club would increase that ability over the course of the study. It was hoped that the tighter focus on the purpose of video recording would provide participants with the impetus to reflect on their instruction and share these reflections with their peers. While participants came to the video club sessions continually expressing interest in student thinking, the methods of their video collection made it challenging to notice. This researcher concludes that in order to guide teachers to notice student thinking in a classroom setting, either a third party (such as the researcher) needs to be the videographer, or the teachers themselves must truly own the idea that studying student thinking in their classrooms is of the utmost importance to student and teacher success in learning and teaching mathematics, and spend time determining how to do this well.

Ajayi (2016) studied interns in her teacher certification program who captured their own video to use for reflective purposes. Making use of instructional time with these interns, Ajayi trained the participants to identify critical events upon which to reflect, and to use a software program for time stamping and commenting. The participants recorded their own classroom video and used the software to share their reflections on a series of questions about what they noticed about their lessons, strengths and weaknesses, and their ideas for changes to future versions of these lessons. Participants had a clear set of goals going into their filming, and were completing the work as part of their certification program, which automatically increases buy-in to the video work's importance. Ajayi's context is not one this researcher would have been able to recreate, but it does show that self-collection of video can be effective for teacher development with the proper training and guidelines.

In a presentation at the NCTM Research Pre-Conference, Lischka and Sanchez (2015) shared the findings of a study they conducted to analyze the increase in critical analysis by preservice teachers (PSTs) when examining video of their own simulated classroom instruction. Lischka and Sanchez found that after they began to require their PSTs to transcribe a portion of their videos prior to writing their reflections, PSTs were more likely to write critical reflections that highlighted specific instances from the video, and give ways to improve either the lesson plan or the instructional delivery. It is possible that the researcher taking the burden of transcribing classroom videos off of this study's participants, the teachers were less likely to see that their videos were not as effective at showing student thinking as they thought.

In her dissertation study, the late Julie Orosco (2014) developed a professional development program for teachers in Northern California that focused on teachers being in charge of collecting video and selecting clips to share with each other at specific intervals. Similar to this researcher, Orosco had found the emphasis on researcher-collected and curated video clips. She wondered how to support teachers in using video to develop themselves as teachers, since having the ongoing support of a researcher can be expensive or unrealistic. A case study details the relationship that developed between three teachers who collaborated to plan a series of lessons, then video recorded the lesson execution and brought that video back to share with the small group. This occurred several times over the course of the school year, and two of the three participants began to assign more cognitively challenging tasks and put more of the thinking load on their students as a result of their work together.

Orosco's work offers some insight into the results of this study – none of the participants in this study were teaching a common lesson, nor, given their different grade levels, had the ability to plan common lessons. For Orosco's teachers, the collaboration seemed to drive adherence to the collection and curation of the video clips. Perhaps the participants in this study might have been more likely to film their students more carefully and worked to show more student thinking in their videos, even with the differing content, had there been more shared work by the participants to establish expectations for the videos that were to be shared, and norms for what it means to have evidence of student thinking on camera. It was not the researcher's original intention to lay out such stark lines of compliance for the video clips; after all one of the research questions asked, *What impact does the participants' selection of a video clip have on teachers' ability to notice students' mathematical thinking?* However, given the result of teachers' not being able to notice much student thinking in the participant-supplied videos, perhaps more guidelines would have resulted in participants better meeting the overall aim of having teachers focus on student thinking in their instruction, and the research question could have been adjusted.

Community of Practice…or Perhaps Not…

Initially, the researcher examined Community of Practice literature, considering if it applied to the group of teachers in this study. Some of the elements of a Community of Practice were a good fit; video clubs are indeed a construct where learning happens as a social activity, where relationships create a sense of trust and confidence among members (Kimble, Hildreth and Bourdon, 2008). In this group of four teachers, participants spoke of each other with high regard, for instance – "I have a lot of respect for the other teachers that were in that group, and I think I had a lot to learn from them…" (Farrah, post-study interview, p.1, lines 38-39) and, "I really liked our cohort of teachers because I love that it was specifically math…I felt like it was great to really, really get specific feedback on my own practice and watch exemplary teachers teaching math, no matter what grade it was." (Jenny, post-study interview, p.1, lines 6-11)

The researcher is aware, however, that the group is not a natural community of practice as typically defined; it's a constructed one. While all the participants already knew each other, and had worked together in some capacity in their graduate work, this particular group of four teachers had never gathered to share video from their classrooms, and likely wouldn't have without the study. As far as the researcher knows, there was no further video sharing once the study's sessions were complete, despite members saying they would be interested in continuing to do so during their post-study surveys (see Appendix F). The learning, as it was, was not 'driven by the learner.' (Yildirim, 2008, pp. 234-235), but by the researcher and her aims for the study.

The researcher aimed to cultivate a community of practice in this group of teachers, but it wasn't successful. There are a few likely reasons for this. First, the participants all taught different grade levels, and therefore didn't regularly have common content to share and discuss. Second, they all taught at different school campuses located across a large metropolitan area, making regular collaboration more challenging from a logistical standpoint. They had no common planning time during the school day during which to collaborate virtually either, nor did they all use the same curriculum. Continuing the sharing of their classroom video is the kind of investment in professional learning that occurs away from school and students, and is what Sandholtz (2002) and Lieberman

(1995) termed to be unrealistic for most teachers. While the design of the study was an attempt to help the participating teachers be less professionally isolated, as recommended by NCTM (2014), there were too many detractors to make continued, participant-driven collaboration reasonable.

Additionally, it's worth noting that most successful communities of practice operate with a group of participants which feature a blend of novices and experts. While none of the participants in this study would likely claim to be an expert, certainly none were true novices at teaching, or at paying attention to student thinking in their classrooms. They all had strong track records of student success (part of how they gained entrance to the graduate program from which they were selected for this study), and spoke about wanting to know what their students were thinking.

Moving forward, there is promise in continuing to work with one of the participants, Jenny, who has moved into a coaching role on her campus. In her post-study interview, which occurred in September 2015, Jenny talked about some of the work she has started doing with teachers on her campus:

> "I've definitely been trying to use the video more because I think that was something that I realized was awesome, in terms of what we did in our [video club] sessions together…Because sometimes, teachers don't remember a specific moment, but actually being like, "Let's watch this video. Let's pause it." I think it's something that it's worked better for me in one-on-one conversations versus a whole group because I don't know if our whole team trusts each other yet, or if they would get out the right things yet." (Jenny, post-study interview, p.3, lines 18-24)

At this point, Jenny is introducing the use of video with teachers, but hasn't yet fostered the relationships between the teachers on campus that are necessary for them to be comfortable sharing video of themselves with others. She can record a class and use the footage for feedback purposes, or share a clip of someone else's strong practice with an individual for his or her learning. She has also realized that her more novice teachers may not notice what is most worthwhile in a clip, harkening to the work of Star and Strickland (2008) and their use of video and classroom observations to help preservice teachers learn to see what is most important in a room – "Our younger teachers, our less experienced teachers are noticing things that I'm like, "That's not what I want you to pull out right now…That's all you got out of that amazing clip?" (Jenny, post-interview, p.2, lines 16-18)

There is great potential for following Jenny's journey as a coach who is committed to finding ways to foster a true community of practice at her school that is using video to help them all learn to be stronger teachers. Working at a single campus would eliminate many of the issues faced by the participants in this study, as schedules can be built to foster time for collaboration without worrying about travel time or a different curriculum being used across grade levels. Staff at a single school are already working together in a variety of ways to meet the needs of their students, and their work using video for learning would be one additional way of strengthening their common bonds.

Lessons Learned

Conducting research is an exercise in learning. From the initial stages of study design and literature review, through the execution of the study itself and analysis of the ensuing data, there are endless lessons to learn and revisions to plan for future work. This study is no exception. Given a fresh slate and bright-eyed participants, this research would focus on the following setup: 1) Recruit a group of teachers in a single grade level or 2-grade band who are located on a single school campus, with the cooperation of and a partner within the school administration; 2) Conduct professional development using a series of curated videos of classroom instruction, taken from the school's classrooms, offering transcripts, student work samples, and a clear set of guidelines about what made the videos effective examples of clips that show evidence of students' thinking; 3) Choose a volunteer to film him/herself following the guidelines and meet with them to make sure there is a clip, student work, and a transcript, then share with the group. Discuss what student thinking they can see in the clip, and whether there is any feedback for the teacher regarding video setup or other materials – does the video presented give windows into student thinking? Would any other materials be helpful to enable teachers to see that thinking? In what ways did the teacher leverage student thinking for the benefit of the class? What could be done to make student thinking more visible? What missed opportunities were there in capitalizing on student thinking? 4) Repeat with additional participants. 5) Over time, turn over the running of the sessions to a teacher in the group who seems interested in spearheading an ongoing team gathering like this, and support as needed.

By working with a group of teachers who are already collaborating for planning and are teaching the same community of children, there are existing common bonds and sense of purpose – teachers want to benefit the children and families they serve. This project could be the professional development program that these teachers follow for the semester or year, being released from other PD programming the school may be running for others, so there is no additional time commitment required. The deliberate instruction of what makes a strong video clip for seeing student thinking should help teachers see video that is helpful to them from the beginning, particularly since the videos would feature them and their students. The inclusion of additional materials to illustrate that thinking and outline effective video elements is also helpful. While facilitating the group and the beginning would be necessary to ensure a good start, the ability to grow the group into a true community of practice that provides its own leadership and collects its own materials means the teachers would have an ongoing ability to study themselves and their students in a way that should meaningfully drive instruction in a way that benefits students.

Summary

In its document *Principles to Actions,* NCTM reminded us of the isolation that teachers face, and the lack of opportunities to collaborate that leave them unable to engage in meaningful professional development that truly hones their craft (NCTM, 2014). The reality is that the job of teaching often gets in the way of the work of teaching. When faced with managing the canned food drive for home room, sponsoring a student club, helping with a bake sale, decorating the hallway for a special event, attending student sports events, and everything else that a teacher is asked to do on top of their regular teaching duties, it's not a surprise that without a deeply felt purpose, collecting video of student thinking is the last thing a teacher will make time to do. The participants in this study are full-time teachers with a more-than-full-time load, especially given their status as graduate students. If professional development is to be a valued and valuable experience for teachers, it must be embedded in the work they already do, supported by their school administration, and worked on with the team, so it becomes a priority for everyone who can benefit, most especially, the students in the classroom, whose voices should be heard, loud and clear.

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Appendix A

Initial Participant Questionnaire

Initial Questionnaire

Name	
School	
Grade level	
Years in teaching (including this year)	
Years teaching math (if different)	
Your certifications	
Favorite topics to teach	
What do you hope to get out of participating in this study?	
Top 5 snacks ☺	
Top 5 beverages ☺	

Appendix B

Participant Video Clip Transcripts

Jenny - 4^{th} grade math – February 2015

Students are using geoboards and rubber bands to try to build triangles as described on the PPT. They have attempted to *build a triangle with two right angles and 1 acute angle*.

J: Hold up your geoboards again…Hmm…I see some of you guys…let me see yours real quick. Does this one have two right angles?

Students: No.

J: Does this one have 2 right angles? No, Alize, this one doesn't have any right angles.

S1: That's an acute.

J: That's an acute triangle, it's got all acute. Let me see yours Carolyn. Carolyn you did something very similar to what I did. This is Carolyn's. Does Carolyn have 2 right angles?

Students: Yes.

J: (points to right angles) Bum, bum. Is this a triangle?

Students: No.

J: Why is this NOT a triangle? Why is this NOT a triangle? Amy?

Amy: It's not a triangle because it looks like it could be a square?

J: It looks like it could be a square if we put another rubber band here (gestures along the top of the shape). Why else is this not a triangle? Not because it looks like a square - Right now it's not actually a square either. But why is this NOT a triangle? Xavier?

Xavier: It's like this, and a triangle has to go like this.

J: So you're kind of showing me with your hands that a triangle has to go like this towards each other. What else do you notice about this, why is this not a triangle? That's another reason, let's keep building. Why else is this not a triangle? Brian.

Brian: It's not even a triangle because it's open.

J: Mmm! It's open! Everybody say open.

Students: Open.

J: When we think about polygons, that's one of our vocabulary words, when we think about polygons, they have to be closed. Right now I could walk into this shape. If I could walk into this shape, that means it's not a closed figure. A triangle has to be touching at three points. One, two, and up here it's not touching. So, what has to happen, Xavier you basically said this, is this rubber band has to come towards this rubber band. Or this rubber band has to come towards that rubber band. So these rubber bands have to come towards each other. When they do that, what happens to those angles? What happens to these angles here, when these rubber bands move towards each other? Do it. Make yours like this, make it into a U, and then notice, what happens to these angles when you have to bring the triangle, and close it? What happens to the angles? Everyone do it now, everyone should have an answer in like 10 seconds when you move it. Look at what's happening to that angle when you move it in. What's happening to those angles when you move it towards each other? When I go like this and I move him, what's happening to my angles? What's happening, Juan?

Juan: They're getting smaller.

J: The angles are getting smaller. Because they have to come towards each other to build that way. They have to come towards each other. Okay? 1, 2, 3, all eyes on me.

Students: 1, 2, all eyes on you.

J: I want to show you guys something very quickly, okay? What's happening here friends…if we have a right angle over here, and a right angle over here, then this line and this line are parallel. They're never gonna touch. But a triangle they have to come together to come to a point. So if they're like this, they're never gonna touch. So this line here has to come towards this one over here…it instead has to come towards him this way, making him a smaller angle. One thing that I want to tell you guys, just for kids that are really growing their brains, something that you're going to have to know for 5th grade and 6th grade, if you add up the angles, if this is 90 degrees 'cause it's a right angle and you add these up, the sum of the angles inside a triangle is going to be 180 degrees. So it can only be 180. If it's more than that, it's not going to work, because if it goes like this, they're never going to touch. So when you add this angle and this angle and this angle together, you're always going to get 180. We're gonna try one more…I want you guys to build a triangle with two obtuse angles and 1 acute angle. Go ahead. So build an obtuse angle, and then another obtuse angle, and then try to make an acute angle…build a triangle with two obtuse angles.

Students working…

J: Talk to your teams about what you're noticing. Talk to your teams about what you're noticing…3,2…

Students: And 1.

J: As we do this, friends, what do you notice when you're trying to make two obtuse angles? What do you notice as you're trying to make 2 obtuse angles? (gives students directions about putting materials down and paying attention) What did we notice when we try to make two obtuse <tri>angles? Only one kid noticed when they tried to do their work? Joshua, what did you notice? Everyone track Joshua.

Joshua: It's kinda hard in order to make 2 obtuse and one acute angle.

J: Why do you say it's hard?

Joshua: Because one, you only have 3 strings, and in order to get 2 obtuse you would need 4.

J: You said we would need 4 strings? Let me see…so, when I make an obtuse, you guys, some of you like to start with a right angle. So I start with a right angle, right Joshua? Got a right angle. Then I make these line segments farther away. So let's make them like this…so there's 2 obtuse angles, but what's the problem?

Students: It's not a triangle.

J: It's not a triangle. They're getting farther away from each other, kind of what you mean, Joshua. So I want you to think Joshua, it's not that you need 3, you would need 4 to connect them, but also this is just not a triangle. 'Cause with a triangle you need 3 sides. So with these three sides, can I make a triangle with this?

Students: No.

J: No, because these two sides, what's happening to these two sides?

S2: They're getting bigger.

J: Mmmm…

S3: They're getting smaller.

S4: They're opening.

J: They're kind of opening – what do you think about it? They're going like this, but they're not supposed to go like this if it's a triangle it's supposed to be getting closer together, so they can close it off. Right now are they going to get closed?

Students: No…

J: They're gonna keep going and going but for a triangle they're supposed to be getting closer to each other. So this does not work. So if you ever see a triangle with 2 obtuse angles, it's actually impossible.

Student tries to show an example, but it doesn't have 3 sides.

J: 3, 2,

Students: And 1.

J: Honey, is that a triangle? It's not a triangle. So I see some of your examples, guys, ask yourself, "Does it have three sides?" If it has 3 sides, let me see yours…let's look at Azul's. This angle right here it's very far apart, what kind of angle is that?

S5: Acute.

S6: Obtuse.

J: It's obtuse. It's obtuse, Azul, check! But I want 2 obtuse angles. If I look at this one, these are very very close together, what kind of angle is this?

Students: acute.

J: Acute. Now look at this one. These are also very close together. What type of angle is this?

Students: acute.

J: Acute. So Azul, you made a great obtuse triangle, but it's really hard and impossible, actually impossible, to make one with 2 obtuse angles. So one more thing, we're trying to be 5th grade ready, one thing I want you to know and friends if you can put this in your brain, if you ever sum up all the angles inside a triangle, it's gonna be 180. This angle might be big, like 150, and then these two over here might be 10 and 20, that's because a triangle, it has to come back toward each other, like Amy said, it has to close.

Kyle - 8th Grade Math

Students are working on their Do First.
K:…yesterday we talked about surface area. Today we're going to talk about volume. And so when we think about volume, we're going to read the definition…let's read the definition is a nice, unified voice…

All: The number of cubic units that fill a 3-dimensional shape.

K: So, this container represents…a rectangular prism, and each one of these little blocks is the shape of a…

All: square, cube…

K: Everybody, what shape is this? A cube, right. And when we take these cubes and will fill up this box, we find the volume, and how many cubic units, or how many cubes, can fit inside. What we're going to do is do a quick demonstration of how we get the formula for finding the volume of a rectangular prism, a cube, and a triangular prism…we're going to talk about how we're going to use these nice little rectangles on our paper, or on our tables, to solve this.

So every table should have a pile of rectangles. What I want everyone to do is take one rectangle, put it in your hand…on the top of your piece of paper…before we talk about volume, we need to talk about area. What I want you to do is take your rectangle, trace it on your paper, and then pay attention to how many squares it covers, I want you to redraw the squares and how it divides it up…you should have 6 columns, and you should have 3 rows. And I want you to answer this question…how many square units does this rectangle cover. I want you to think about what process did you use to figure out how many square units it covers.

(Walks around room, checking on students)

I see about half of us have an answer, some of us have blanks, so I'm going to ask the question, how can we find out how many squares are covered?

S1: (inaudible)

K: Why did you use that formula? (student response inaudible) Show me a thumbs up if you used length times width? Thumbs down if you used something different, or if you didn't get an answer. (name unclear) Do you want to explain to us how you used that?

S2: (inaudible)

K: How many is that? (student inaudible) Raise your hand if you solved this a different way. (name unclear) What did you do?

S3: I counted the squares.

K: Or you could just, or, count. If the squares are provided for you, you can use the area formula or you can count. If it's something that looks like this (draws rectangle, notes length and width on the sides, no squares inside), can we count the squares then?

S: No.

K: And then we would need to…

S: Do the formula.

K: Do the formula. All right. We're talking about area. What were the two dimensions that we had to multiply to find the area? You can just shout it out.

All: Length and width.

K: Length and width, right, so I want you to hold this in your hand. Hold the rectangle in your hand. When we lay this down flat it is a flat shape that covers space on the ground, and that is it. Just like when we laid the blanket down, it covered squares, the blanket was flat on the ground on the tiles. What we're going to do is see if there's a third dimension we can add by doing something to the rectangle. So I'm going to list 2 things. One, we have a flat shape, and we have two dimensions that were measured.

So all we're working with right now is a flat rectangle, and we did surface area yesterday and we unfolded our nets so it was a flat composite figure that covered squares on the ground. We have two dimensions that we're measuring, length and width. After you get this copied, I want you to start stacking all the rectangles your group has at the table. This should be copied in maybe the next 15 seconds…I want you to start stacking, and I want you to start thinking, are length and width the only dimensions that we have as we keep stacking our rectangles.

K: Stack stack stack…are length and width the only dimensions? Stack stack stack…

K: (asking a table) so, are length and width the only dimensions?

S: No.

K: What's the other dimension?

S: The height

K: So that means you can take the area of this base, the length times width…(inaudible)

K: (asking a 2^{nd} table) Are length and width the only dimensions?

S: No.

K: What's the other dimension?

S: The height

K: Height, perfect. So when we're finding volume, all we're doing is taking the area of the base, like the rectangle, and we just keep stacking it times the height…

K: All right, I'm pretty sure everyone's got this. When we start stacking our rectangles, are length and width the only dimensions that we have?

All: No.

K: What's the other dimension?

All: Height

K: Height. How many dimensions is that?

All: 3

K: 3. And…

S: that's why it's called three dimensional

K: Three dimensional. Dude. So because we have three dimensions when we stack the 2D object over and over, this is what I want us to record, and this is what we're going to practice today. When we're finding volume, what we're doing is taking a two dimensional base. And this is, you're going to draw a rectangle…we're gonna label this as the base. We have length, and we have width. So we only have 2 dimensions that we're dealing with. When we start stacking over and over again, when we start stacking that rectangular base over and over again, we create the third dimension of height, and that gives us a three dimensional object. So we're no longer covering space, just like the cubes in our container, we're not covering flat space, we're filling three dimensional space. And if you can imagine, do y'all remember those little orange cubes you used to count with in elementary school? These squares are based off of those, so you can imagine making a set of those little orange cubes that would have the same length, width and height as the rectangular prisms you made here.

So, if you want to find a volume for a shape…what we're going to do, is we're going to take the volume and we're going to write, "area of base, times the height of the prism." The way this looks on your STAAR chart, when you guys take the STAAR exam, is it's just going to say $V = B * h$. This is the area, and this is the height of the prism. Area of the base times the height. So if the base shape is a triangle, we stack the triangle a bunch of times. On Friday, we're going to do a base shape of a circle and stack the circle a bunch of times. So whatever the area of the base is, if it gets stacked repeatedly, that gives it height, which makes it fill up three dimensional space.

This is the formula we're going to use today to find the volume of prisms, or find the missing height or the missing area of the base. And instead of creating flat shapes, we have three dimensional shapes so they are solid, we have three dimensions, and those three dimensions are length, width, and everybody what's the third dimension?

All: height.

(Students have three independent problems to work on, where they tell the name of the shape and the name of the base. Move to the practice page once students show they have this down. “We are OG’s with volume. ☺)

22:10

K: Take a look at problem #1, I want you to trace around the base, shade it in…and then write down what shape the base is…Denise, what shape is the base?

Denise: It’s a rectangle.

K: All right, can everyone do this? Write the area formula for a rectangle, right underneath. Write the area formula for a rectangle…(name unclear), what did you write for the area formula for a rectangle?

S: base times height

K: Hmm…base times height could work, depending on the capitals of our B’s…

S: Length times width?

K: I’m going to say that for these, when we’re talking about volume, it’s length times width. ‘Cause already when we have triangles, with little b and little h, big B and big H, I just don’t want things to get confused. And, I did notice this. Some people in my first period class told me that my base was a square. Why would they be wrong? They said this base shape was a square. What’s true about a square?

S: Same sides…

K: All the sides are the same, yeah. So why would this one not be a square? Denise, or Freddy, why would this one not be a square?

Freddy: Because it says it’s a rectangle.

K: Well it tells you it’s a rectangular prism, that’s a good idea. And why, (name unclear)?

S: Because one side is 4, and then 6.

K: So again, sometimes in geometry, if it’s at an angle it might look like a square, but pay attention to the measurements and you’ll know if it’s a rectangle or not…all right, so, when we’re finding the volume, all we need to do is this. Volume is equal to the Base times the height, this B stands for the area of the base, so if our base is a rectangle we’re going to replace it with length times width, and then we’re going to multiply by the height. So then we knew that our length and our width are 6 times 4, the height of our prism is 4 units, so we multiply by 4. Everybody, 6 x 4?

All: 24.

K: and that times 4, you either use your calculator, you do it by hand, or you do mental math.

S: 96.

K: Am I going to put units, units squared, or units cubed?

All: Cubed.

K: Hands up, why are we going to put cubed? Jules, why are we going to put units cubed?

Jules: Because there's 3 dimensions.

K: 3 dimensions, yeah!

Alex – February 2015 – 6th grade math

A drawing on the board shows land divided by water, with a car on one side, and McDonald's on the other. Alex draws points where the bridge ends will be held, and proposes that the students figure out how to get the car across. Meanwhile, they are beckoned by the aroma of French fries…☺

3:14-4:20*

A: Let's pretend this is 40 feet. How long do those little bridges have to be, in order for it to connect?

S1: Um, they have to be like, long?

A: Yeah, but how long? Give me a number. Guess.

S1: Uh…I think uh…

A: Remember, all of this is 40, so how long do these red ones have to be? Guess.

S1: 5?

A: 5. Is that true, everybody? (erasing some of the lengths of the bridges)

All: No…

A: Who can tell us why it's not 5? Who can tell us why, "No, Mr. Martinez, it's not 5?!" Why not 5 feet? Why not 5 feet? Hmm…no one's helping me. Yes ma'am.

S2: Because it wouldn't connect.

A: What wouldn't connect?

S2: The bridge.

A: Okay, so back to you (crying noise). That's not good, that is not good. Help! Help! What must each one be?

S3: 20.

A: Is that true?

All: Yes!

A: What happens when it's 20?

Many: It connects…the bridge connects.

A: It makes the bridge. Is that true?

All: Yes.

A: Who can tell me what would happen if I made it, oooh, you know what, I've got extra material. Let me make them a little longer. Let me make them 30 feet long! Let me make them 30 feet long. What would happen?

S4: It would overlap.

A: Oh! Or else, what would happen when they come down at the same time?

Many students call out ideas.

A: Kenny.

Kenny: It won't go down anymore.

A: What do you see forming?

K: A triangle.

A: What if I make each length 60? I got more material! Let's make it 80 feet long! What happens if I make each of these, what?

All: 80 feet long

A: So it's going to be double of this (pointing to the base), so it's probably going to be (draws)…does that work?

All: No.

A: Why not? Yes sir.

S5: Because (not easy to understand – something about the ship trying to go through and getting cut off)…

A: But what happens to the car? Can the car make it?

S5: No.

A: So, here's what we discovered. Can these be less than 20?

All: No.

A: Can they be all the way up to 80?

All: No.

A: What if they're 60 – I mean, 30.

All: No.

A: What if they're 20?

All: Yes.

A: Interesting. So it looks like I'm forming a bunch of tri – what?

All: angles

A: A bunch of tri –what?

All: angles.

A: So today's lesson is, how does the length, go like this and say it with me, how does the length

All: How does the length…

A: of each side…

All: of each side…

A: of a triangle…

All: of a triangle…

A: Form a triangle?

All: form a triangle?

A: Repeat. Can any 3 sides…with any length…form a triangle?

All: Can any 3 sides…with any length…form a triangle?

A: Repeat. Yes or no?

All: Yes or no?

A: Let's try it out.

All: Let's try it out.

One team member gets 2 yellow strips and tries to create an isosceles triangle with a red piece, then with a pink piece. Then 2 blues and a pink. Then 2 blues and a yellow.

A: …Let's change colors. Instead of the 2 yellows, let's use 2 blues. Will it make a triangle? Yes or no? Yes or no?

All: No

A: Make sure you put it on the corners. Will it form a triangle?

All: No

A: Question - Why not? Yes ma'am.

S6: because they're too far, uh, they can't connect together. They have to be a little longer.

A: So tell me, what is the relationship between the length and a closed triangle?

S6: They have to have two that's bigger and one that's smaller.

A: (threats to show parents video of kids not doing the right thing are issued – perhaps a sale on eBay…☺) The two sides…have to be…bigger than the…base. (students repeat in sections) All you want is bass, you don't want treble…okay, repeat. The two sides…have to be bigger…than the base. Is that true?

All: Yes.

A: Let's look at the example of the bridge…what if they're equal to the base?

Students have mixed answers of yes and no.

A: Will it form a triangle? I don't know! Some kids are saying yes, some are saying no. Please pay attention. Repeat everybody, 24 inches.

All: 24 inches

A: (gets ruler sorted out, draws two 12-inch segments on the board) So this is how many inches, Kenny?

Kenny: 12.

A: Look at Kenny. He's doing a great job. And this one, Kenny?

K: 12.

A: Great. And look…oh, yes, I'm saved, saved by the bell. What is this?

Student: Paper.

A: Yes, I went to a party and they were shooting streamers all over. No. I went to IKEA. Believe it or not, this from here to here measures 24 what?

All: Inches

A: So I'm going to draw that in which color?

All: red.

A: You are not focused. In which color?

All: Red.

A: And this one measures how many?

Many: 24 inches

A: Question – did I draw a triangle?

All: No

A: I just drew two lines…next to each other…on top of what?

Students: another line/a base

A: Does that form a triangle?

All: no

A: So what must be true about these two green lines? What if I made this one 13 inches. Will I have a triangle?

All: No

A: My goodness, if this became 13 inches, I wouldn't have a triangle?

Students: mixed yes and no

A: This is what…13, and this is what…13. Question – why do they form a triangle? Why now but not before? Same kids…Tobar?

S7: They're…it's bigger than the base.

A: What do you mean, it's bigger than the base?

S7: When you add up both sides, it's more bigger.

A: Look out for the English. It's not 'more bigger' it's just, repeat, 'bigger.'

All: Bigger

A: We're going to say it again, repeat – when you add two sides…their sum…their sum…their total…put together…has to be…bigger than the…(holds up 3 fingers)

S8: When you add up two sides it has to be bigger than the third one. Also, I wanted to point out, I remember you put this on the morning work.

A: Ah! The morning work – stop! Good memory, though, because only two kids in S1 (a previous class) realized that, and no one in the last S group. That's genius sir. Yes sir.

S9: Well basically…

A: Hold on, I love that. I love it when one of the kids is like, "well basically…" Yes.

S9: So basically one of the sides has to be larger than the base.

A: No.

S9: At least one…

A: Oh no, tell him again…But I love it, darn it this class is so beautiful. I love it how kids are coming to other kids rescue. Because he made a what?

All: A mistake.

A: Hold on, hold on…thank you for asking. Now another student will clarify.

S10: <inaudible>

A: Fancy schmancy! Fancy schmancy! She said both of them have to be bigger than half…<something inaudible about how she knew that> Fancy schmancy! Fancy schmancy! So, both of them have to be bigger than half of the base or the third one, right? That's another way to say it. Do you understand, or not?

S9: yeah.

A: Here's my question for you, if you really understand it. Let's pretend you're going to make a tent, and normal tents look like, what?

All: A triangle

A: A triangle. So there's a kid and he's going to make a tent. He measures this and he discovers that it's 60 what?

All: inches

A: 60 divided by 12 is?

All: 5

A: How many feet?

All: 5

A: So a 5 foot tent. Not bad, not bad, for one person. Question – how long do you think each side should be to make this triangular tent? Estimate. Estimate. 3 kids participating, that's sad.

S1: Um, like, 31?

A: 31. Let's see what happens with 31 inches on each side…this is how big her tent would be. Because remember, what's half of here?

All: 30

A: So if I just made this 31, this is how big her tent would be. So, how would she get into this tent?

Student: she would have to crawl!

A: Thank you, so she would have to crawl in this tent. And someone would have to pull her legs out in the morning, too. So who thinks that 31 inches would be a good way to make the sides of this tent? No, not too many. Who has a better number? Yes ma'am.

S11: 60?

A: 60? No, that's cool, that's cool. So this one would go about here, and this one would go about here (drawing), wow, not bad! You could stand up in that one! In that tent, especially with her bow! Wow, I love it, that's a good answer! That is a good, what?

All: Answer.

A: That is a good answer. Pretend you're building a house, and then you put the roof on. Pretend this is 40 feet, no, we used 40. Let's pretend it's 100 feet – wow, that's a giant house – 100 feet long, and you're going to put a what?

Many: A roof on it

A: Can anybody tell me what one side of the roof could be? Not everyone participating, that's the sad part, sad part…yes, ma'am.

S12: Um, 60?

A: 60? Hmm…well I know 50/50 would be here, so here's 60…not too bad. Looks a little weird. It's a very wide house with a teeny roof. Anyone have a – ooh, look at that little girl, yes ma'am?

S1: Um, 25?

A: 25, oh no, then the roof would only be here and about here. That would be too what?

All: small!

A: And then the water would come in. And birds will fly in. So that's too small. So 60 was too small, 25 was too, too what?

All: small

A: Anyone else, same kids…finally, the little girl in comfort

S13: Um, 70?

A: Oooh, 70. Much more comfortable, 70. Look at that. Not bad. Who agrees with 70 feet? Okay, what I want you to do right now, please listen, yes?

S14: But the way you drew 60, compared to 70, it kind of looks like…

A: Sorry, sorry, you're right. 60 was here, 70 should have been there, and then what should this one have been?

All: 80

A: You kids! And what about this one?

All: 90

A: And what about this one?

All: 100

A: …raise your hand if it gets ridiculous after a point. So, at one point, should your roof be that pointed?

All: No.

A: Question – be normal and be good. Where have you seen roofs that are like that?

S15: Church

A: And here's a question that maybe you never thought of before. Why? Why do you think they make churches with roofs so steep (steep – students repeat a few times)?

S15: I don't know…to be communicating…to be connect to, up there…

A: Oooh! I never thought of that! Wow! Maybe you're trying to reach what?

Many: God! Heaven!

A: Heaven. I never thought of that. What's another reason the pitch would be so high, causing the roof to go so high in the sky? High in the sky, especially in the olden days?

S16: maybe to fit all the people that want to go?

A: No, are the people that tall? Would they have a room way up here? No. Good try, though, no one should be laughing.

Kids think it might be to catch lightning, connect to the term 'steeple', think it's a way to get electricity…

A: Listen, I'm going to give you a giant hint because I don't want to waste time. All the other houses weren't that steep. Only the church was that steep. What would you be able to do in the community because the steeple was so high?

S17: Um, you'd be able to see the church.

A: Thank you, say it again.

S17: You'd be able to see the church.

A: Okay, one last time.

S17: You'd be able to see the church.

A: So no matter where you are, you might be thinking of doing something (crazy, evil) evil, and then what would you do?

Many: Look at the steeple/the church…

Farrah - 5th Grade Math, April 2015 - Finding the area of an irregular shape

F: This shape, you counted the sides, how many sides were there?

SS: 6.

F: And you told me it was a…

SS: Hexagon

F: Does that look like a normal hexagon?

SS: No…

F: Is it a hexagon?

SS: No…Yes *(some sound unsure)*

F: Oh, it's not a hexagon because I made a funny face at you? Is it a hexagon?

SS: Yes.

F: Is it a regular hexagon?

SS: No.

F: With all sides and all angles congruent?

SS: No.

F: No, it's not. It's definitely irregular, but it is a hexagon. So I asked you to go to your STAAR chart. We need to find the area of this shape. So find the formula for the area of a hexagon on that chart…I don't think you're looking hard enough.

S: A = bh

F: What is b? Nope. We need to find the area of this shape, this is a hexagon, go to y'all's STAAR chart, go to area, find the formula for the area of a hexagon. Ayana.

Ayana: It says A = b*h

S: That's for a rectangle.

F: What is the length of this shape, Ayana? Ooh, it's a lot of numbers up there. Which one would you pick?

S: All of them.

F: All of them?

Students offer different numbers from the picture.

S: The formula isn't on this side.

F: You better find it!

Students keep looking at the chart and murmuring to each other.

F: Okay, so I heard A = s*s. What did y'all pick for s? What you wanna pick? You wanna pick 3? You could pick 8, 9, 5, 3, 6…

Students are calling out numbers, giggling

F: Look, this one doesn't even have a number but I maybe we can find it!

Students call out numbers, one suggests using a ruler

F: A ruler? This says 5 feet, girl, that's 5 rulers. That means this picture represents 5 of these. This picture is representing something a lot bigger. Girl…

Student says something I can't hear

F: You think you've figured out something? (*turns the camera so those girls are visible)* Okay, Paola, star of the show. You figured it out?

Students are calling out, claiming they've figured something out, too

Paola: The area formulas I think are only for regular polygons, so since…

F: Mmmmm, hold on, hold on. I think what you're about to say is really good. However, you just said that the area formulas are only for regular polygons. Let's be careful. Nobody else talk. Is a rectangle a regular polygon? (Student says no) Okay, so be careful with your language, right? Remember, we're like, oh, a rectangle looks regular, but is it regular (some students say 'no'). Regular means what?

SS: All sides congruent

F: All sides congruent. You better get the second part…she's saying it.

SS: All angles congruent.

F: All angles congruent. Okay, so let's think about a rectangle. Are all the angles congruent in a rectangle?

Students murmur, unsure, some yes and some no.

F: You heard what I said. Didn't I say what I said? Please, draw a rectangle on your paper. Lord, have mercy. Let me ask my question again. We're going to back it up. We were zooming in, let's zoom back out. A regular polygon has what? Raise your hand. Taylor, a regular polygon has what? Track Taylor…Hey, you're done drawing a rectangle, this isn't a second grade class. Quit drawing a rectangle, if you haven't drawn it by now, you can look at someone else's paper. Taylor, what do you know about a regular polygon?

Taylor: all congruent sides…and all congruent angles.

F: *repeats Taylor* And I asked you to draw a picture of a rectangle, please look at your rectangle. Listen to my question. You get so excited because you think you know what I'm going to say, and I always throw you off, don't I? So pump your brakes and listen. Look at your rectangle. Are all the angles congruent? Look at your shape, stop looking at me. Are all the angles congruent?

SS: Yes

F: What do all the angles equal in a rectangle?

SS: 90

F: So are all the angles congruent?

SS: Yes

F: Yes, child. But you said there were two parts, didn't you? All angles congruent and what?

SS: Sides.

F: Look at your rectangle. Are all the sides congruent?

SS: No.

F: How would you describe it? Almost heard it from Trinity…opposite sides congruent. Are all the sides congruent in a rectangle?

SS: No.

F: No. Okay, so I'm glad we reviewed that. Back to what we're trying to figure out. I asked you to find the formula. That's a hexagon, you told me it's a hexagon. Put your hands down, we're still with this girl. I said to you, that's a hexagon, it has 6 sides, we need the area. I said go to your STAAR chart and I said find the formula for the area of a hexagon, and you say there's no formula on here for the area of a hexagon. And I said you better find it. Track Paola, go ahead, sweetheart.

Paola: These formulas for area are only for quadrilaterals?

F: You're doing too much, honey, can you quit doing too much? You're doing too much. Now you're talking about all kinds of things. Do you see a formula there for every kind of quadrilateral that we've learned about?

Paola: No.

F: So please quit doing too much. Tell us what you came to.

Paola: *something like*, That um, since, it's not on here because it's not regular?

F: Now you're saying regular again. I can't pick you anymore Paola. I'm sorry, pick somebody else. You're doing too much. You're trying to use the vocabulary, but you're not using it correctly. Try someone else.

S: Um, I think she's trying to say that a hexagon is not on there because it seems like it's only shapes with right angles.

F: So on our chart, maybe there's only shapes with right angles? Okay. You're still not answering my question, though. I want to find the area of this shape. So you don't get to just say, "Well, we can't find the formula for the area of a hexagon, Ms. Springer, so give us a new shape!" No, that shape right there, we're going to find the area of it. Do you need time to talk at your table?

SS: Yes.

F: 'Cause I'm not gonna tell you. Okay.

Students start talking at their tables.

F: I'll let you struggle for 2 minutes, and then maybe I'll give you a hint.

Students talk and Sarah moves around the room, listening and talking to students. At one point, she says something like, "I get that the formula is not on here. What I care about, now find the solution. I still need the area of this shape." *Then someone mentions multiplying 9 by 8, and she can be heard saying that that's the area of a rectangle that's 9 by 8…*

(at 13:00)

F: If you think you've found the way, find the area. Of the whole shape, and not too much of the shape.

Appendix C

Pre-Sharing Interview Transcripts

Pre-Sharing Interview Questions

1) Tell me about the lesson that you recorded for our session.
2) Why did you choose this lesson to record?
3) You chose a clip that shows student thinking – what can you tell me about it?
4) You also chose a clip where student thinking isn't so obvious – tell me about that one.
5) Is there anything else you'd like to tell me about this lesson, your students, or your instruction in general?

Kyle, Pre-Sharing Interview

Researcher: All right. It looks like we're recording. All right, so just ell me about this lesson.

Kyle: The students had a series of very simple sequences to complete in the beginning, just as like a refresher, almost elementary school level.

Researcher: Mm-hmm (affirmative).

Kyle: Can you complete these terms...

Researcher: Right.

Kyle: To get thinking about patterns. Then, the idea was to progress to more complex sequences. I kind of got them thinking about is the amount of things increasing or decreasing, and starting to think about the function rules. Like, interpreting the input creates an output based on the terms and the visuals we see.

Researcher: Mm-hmm (affirmative).

Kyle: The goal was to get the very first part done in maybe like ten minutes and have a very quick discussion. Or, not even that, like five minutes, everyone has the same answers, good we know how to do this. Then move on to the one were there's the toothpicks.

Researcher: Mm-hmm (affirmative).

Kyle: Then get kids to read through that, build their own toothpicks, talk about those, and then be able to do like two more on their own.

Researcher: Right.

Kyle: The student that went up there, who's one of my higher students, did not complete the sequences correctly, just went to the next arrow.

Researcher: Mm-hmm (affirmative).

Kyle: As opposed to reading and seeing the word twelve and writing that. I decided I was like, oh, let's take some time to talk about this, and why it was confusing. Some strategies to help. I kind of like dominated a lot of the conversation and that put like a light bulb in my head, oh, reading is hard, even if it's just a sentence that's a word that we don't understand.

Researcher: Mm-hmm (affirmative).

Kyle: When we move to the toothpicks, I kind of, I decided to read everything out loud. I decided to kind of get them set up with a table to get them to help start thinking. [inaudible 00:01:48].

Researcher: The word adjoining.

Kyle: Yeah. Exactly.

Researcher: Mm-hmm (affirmative).

Kyle: Even if diorama was a word. It's one I edited out, because it wasn't necessary.

Researcher: Yeah.

Kyle: I felt like efficiency twelve, there are some other words, here that I know that they're gonna see that they're not going to be comfortable with.

Researcher: Mm-hmm (affirmative).

Kyle: They eventually, throughout the end of the lesson were fine with completing the toothpicks ... But that took the whole time.

Researcher: Mm-hmm (affirmative).

Kyle: That's been just kind of like a source of frustration this year. We need to do these explore activities to really understand what an input and an output make.

Researcher: Mm-hmm (affirmative)

Kyle: Where, as I would assume it would taken us maybe twenty minutes to do all that, and then start practicing independently.

Researcher: Mm-hmm (affirmative)

Kyle: It seems like most of that class needs some scaffolding.

Researcher: Mm-hmm (affirmative).

Kyle: Not like total hand holding, watch Mr. Ritz do it and don't think for yourself. Like, let me set this part up for you, now let's go.

Researcher: Yeah ... I think they also got caught up on, the pattern had five arrows.

Kyle: Yeah.

Researcher: To show them, I think the authors were thinking I'm going to show them this fifth term, to show them that it's starting over, but instead it was like they wanted to make the sixth term.

Kyle: Mm-hmm (affirmative).

Researcher: Then be like, oh two, sixes is twelve.

Kyle: Oh yeah.

Researcher: I wondered if there was some of that going on.

Kyle: Yeah. Maybe.

Researcher: Right. Maybe that's the twelfth term.

Kyle: Because it's, instead of, doubling instead of going by fours, yeah.

Researcher: ... Because six ... Right.

Kyle: Yeah, I really hadn't [inaudible 00:03:15].

Researcher: Right, and didn't think about this is a set a four, and then another set of four would get me to eight, and then another set of four would get me to twelve.

Kyle: Our, one of the other girls that teach eighth grade math on another campus, she taught kindergarten. Did all that concrete manipulative stuff that you've gotta do.

Researcher: Mm-hmm (affirmative). Yeah.

Kyle: She was saying that in kindergarten, students learn that, someone has to repeat three times before it becomes a pattern.

Researcher: Right, in order to be considered a pattern, yeah.

Kyle: This only repeated ... It showed the pattern then went back to the first sequence.

Researcher: Yeah, you have to extrapolate that it's going to ... Yeah, yeah.

Kyle: I thought that, I was like, that makes so much sense.

Researcher: Yeah.

Kyle: It's still a while, and kids may be unable to recognize that stuff.

Researcher: Yeah, because if you're told it's a sequence, I think that's the other vocabulary piece, right, that they need to work on.

Kyle: Yeah.

Researcher: They need to understand that if I tell you this is a sequence, then you should be able to isolate ...

Kyle: What you see is ... Yeah.

Researcher: The section that is repeating term of the sequence when you look at it.

Kyle: Yeah, yeah.

Researcher: Where did you feel like you saw some good, from the teacher perspective, of being able to observe it. Not necessarily good as in correct student thinking.

Kyle: I really just, I was very impressed with the way ... Even though [inaudible 00:04:30] was thinking was correct to him, but incorrect overall, it was good to hear him do that, because he doesn't ever talk. Then, most [inaudible 00:04:39], I thought just did a fabulous job of explaining their thought process. Mostly it was just like, I kept drawing the pattern out, and repeated it.

Researcher: Mm-hmm (affirmative).

Kyle: Then [inaudible 00:04:48] said, when they pointed in, it went up, and when they pointed away, it went down. They just saw that visual pattern, and that helped me connect it. I just really ... All three of those students I taught last year, in various capacities of success. Just to be able to see them articulate their thoughts confidently, when last year, they just would be like, I don't want to talk to you at all.

Researcher: Mm-hmm (affirmative) ... Right, right.

Kyle: And even someone like Freddy, who's a new student to our campus, just at least feeling confident to say, the next term should be this ... But he couldn't explain why.

Researcher: Mm-hmm (affirmative).

Kyle: I think that kind of revealed here's a student that hasn't been with us for the past two years, he's new to our system and structure.

Researcher: Right.

Kyle: There's some pushing to be done. When we got to the toothpick part ... I don't know if the video went all the way through that. It might have stopped.

Researcher: It stop ... It went a good way through it, and you edited some out, I think, in between when they were working on their own ... But, go ahead.

Kyle: I think that even then, it was like hard for kids to explain. I drew this number of toothpicks because every time you draw another house, you're adding five toothpicks, or something.

Researcher: Mm-hmm (affirmative).

Kyle: It's just that articulation of their thinking, I think, is something that was interesting just to see how hard it was for them to explain, or define their answer. Like they could visually draw it to you, and just be like, I did the work. This isn't explaining it, and then to explain that process verbally.

Researcher: Do you think anybody needed the toothpicks, like the actual toothpicks?

Kyle: I absolutely did. I think that was a tough moment, too, where I was like, we're cramped for time. I think, also ... I think there were times where I over estimated my students and there were times when I under estimated them. I felt like that was a moment where I like ... I looked at all of these and was like this is easy, it's pictures, you draw them it's fine. We could get a lot-

Researcher: Right, they're basic pictures. Every kid can draw a house, mm-hmm (affirmative).

Kyle: Yeah, exactly, like we should be able to get this done super easily.

Researcher: ... Just like everybody can count eleven.

Kyle: Yeah, exactly, everybody should be able to read the word twelve and be fine. I think that, if they would have had the manipulatives for that. Maybe if I would have chosen ... Maybe if I'd started with that one instead of the basic sequences, we would have gotten to some more meaty stuff I think all the kids could have done with the toothpicks in their hand. That would have made me afraid that some of them would start stabbing each other, but okay.

Researcher: Yeah, you always have to practice that. 'I'm going to give you these, but you have to promise not to stab each other.' Yeah, yeah.

Do you feel like there were points where you missed some student thinking? Like where student thinking was kind of hidden?

Kyle: I think so. I think, one of the things that I wish I had started doing was giving kids maybe just their own little notebook to write down their responses. There's not a lot of room in the notes that Carnegie gives us, and a lot of times there's not a lot of room in the notes that I make.

Researcher: Mm-hmm (affirmative).

Kyle: I think having a capture tool for them, like I'm asking a question. For the next blank line in your capture rule, write down what you're thinking about this. I think every kid-

Researcher: Yeah ... Yeah, learning how to take your own notes is an important skill.

Kyle: Yeah, so I think every kid being accountable to writing something down, make sure everybody's thinking about it. And it allows me a chance to, as they're writing, I can kind of like look around and see their ideas.

Researcher: Yeah.

Kyle: I think that was a part. I think it's also hard because, obviously you're cold calling on the kids, and trying to be [inaudible 00:08:12]. You can't call on all like 23 of them. I'll call ... Being able to cold call on some random kids, gave a good flavor of ...

Researcher: ... Because you chose who you were calling on.

Kyle: Yeah, well it was sort of randomized, but it was like I flipped and I was like, hm, Freddy. He probably knows some of what he needs to know, not all of it. We'll see what he has to say.

Researcher: Right, right.

Kyle: Then that kind of encouraged, I think in the arrow discussion encouraged a lot of the kids to be like, oh let's do this.

Researcher: Right.

Kyle: I think Kendra, who was doing the toothpick stuff, maybe like, for time's sake I could have ... Kendra usually gets it, but has struggles with explaining it. Maybe I should have called on a kid who could get it, and explain it. I don't know, I think that's the hard thing, too.

Researcher: It's a challenge, right? Yeah.

Kyle: It's like, do I call on the kid who doesn't get it to expose different thinking, and then have all the kids talk about it. Or do I just say like, does everybody agree with he kid that understands it? Then, if they don't, then they can ...

Researcher: Right, right, yeah ... I always think it's interesting when kids basically refuse to engage in a tool that you've given them.

Kyle: Yeah.

Researcher: Like draw the toothpicks.

Kyle: Yeah, that was insane to me. I was like-

Researcher: Like these are the kids who probably actually really needed the physical toothpicks.

Kyle: Yeah, because they didn't even draw-

Researcher: ... And they were refusing to engage in the pictorial version of the support, for whatever reason.

Kyle: I don't, and that's crazy. I'm doing a lesson on Monday, where we're going to have like a box of m&m's, a box of Toblerones, I need to find some sort of cubic thing.

Researcher: Mm-hmm (affirmative).

Kyle: They're gonna draw the nets. They're going to make all the measurements, draw the nets, find the surface area, and they're gonna come up with the rules for like these particular shapes. Then I found, my friend, Jonathon and Solen have a four-year-old and a one and a half year old. They have these magna-tiles.

Researcher: Yeah, those are so cool. I just ordered some for myself.

Kyle: They're like hollow, and so I was like, I need to teach that perimeter times height gives you the surface area, the lateral surface area. I was at the Galleria yesterday, like running into Lego Land.

Researcher: ... And those are not, no those are not cheap.

Kyle: I texted Solen, I was like, how much are these. She was like, dude you can borrow these from us. It's just awesome, so I'm excited about those manipulatives, and being in kids' hands so they can really see that the rules for geometry have a basis in what we see in the real world. Those kids that are refusing to draw ... That would have been a good thing to ask. Like, why did you decide not to draw?

Researcher: Right.

Kyle: You know, and some kids might have just said, I don't know how, or I already figured out the pattern.

Researcher: Yeah, or like, I can look at the picture that's up there and count it, and just visualize what's ... You would want them to communicate that to you.

Kyle: Yeah, exactly ... And that's the other thing that's starting to get frustrating. Is, you know, kids have these [inaudible 00:10:57], which is a really helpful tool for them to be able to do a lot of their math homework efficiently ... But I have so many kids that are just refusing to like, whatever they put in the calculator, just write it down ... So I know what's going on.

Researcher: Mm-hmm (affirmative).

Kyle: I have this argument every time, where they're just like, hey, whatever you put in the calculator, make you sure write it down because I'm not going to be able to give you credit, because I don't know what you did. They're just like, but it's in the calculator, why does it matter? It's like, because it looks like you just circled an answer. I know you didn't, but I need to know like-

Researcher: Right, because it's important to me that your thinking is visible, and I can't find out whether you really understand what you're doing or not, unless I can see your work in some way.

Kyle: Yeah ... Yeah, exactly.

Researcher: Yeah.

Kyle: That's always fun, too, stubborn ...

Researcher: It seems like you generally had kids who were reluctant to talk in that class. Is that just that class, or is that all of your eighth graders?

Kyle: That, I think it's that class in particular. My morning class is awesome. Like my lowest students are like the most vocal.

Researcher: On it.

Kyle: Then I have some, I have a few kids who I think are ... I think the kids that are reluctant to talk are kids that are still on the ELL spectrum.

Researcher: Mm-hmm (affirmative), sure.

Kyle: Like every kid that we had a TELPAS writing sample from, I was like ... Half of them are the ones that don't talk about anything. I don't know if it's that they're not comfortable with the language, or they don't feel like they've been successful in math.

Researcher: Yeah.

Kyle: In my morning class, when I call on the kids that are typically silent, they'll give a response.

Researcher: Mm-hmm (affirmative).

Kyle: In this class, when I call on the kids who are typically silent, they're just kind of like, I don't know what to do.

Researcher: I wasn't raising my hand for a reason.

Kyle: Yeah, exactly, why are you calling on me ...

Researcher: I don't have anything to tell you, yeah, yeah.

Kyle: Mean, bearded man. Then I've also seen some success with, like this one girl Jennifer Guerrero who ... When I would cold call on her last year she would just refuse to do anything. This year, she like shouts out answers, and I'm almost just like, I don't care. Like I want to know what you have to say, because she's usually engaged in thinking about it.

Researcher: Yeah ... Right.

Kyle: It's good to see that there's growth, but I wonder if they had that capture tool to write, then I could be ... I wouldn't have to worry about calling on them, be like, you're thinking's good, or like, mm ... You know, I want you to [inaudible 00:13:09].

Researcher: Yeah, and I think the more you do that from the very beginning of the year, the more it becomes a habit and a system in your class.

Kyle: Yeah.

Researcher: If you give them credit for it, or if you do some sort of notebook check every couple weeks ... Right?

Kyle: Every time there's a quiz or a test. Man, yeah, they need to ... I use to be bale to give a quiz or a test and just like, chill, observe, answer emails ... And I'm like on duty the whole time. I used to be able to like check paychecks and folders, and things like that. Now it's like this kid needs me to read something out loud, this kid needs a quick translation of what this means.

Researcher: Wow, yeah.

Kyle: Even after modifying the tests so that it's not like a block, it's just the three most important sentences.

Researcher: Right. It's not that they aren't trustworthy in taking the test, that they genuinely need assistance.

Kyle: They just need the support because so much stuff is new.

Researcher: Uh-huh ... Yeah.

Kyle: I think that's kind of scary.

Researcher: Yeah, well and so then, I would think for this in particular, the more you can give them a concrete tool, the better.

Kyle: Absolutely.

Researcher: You know ... So when you look at a lesson and you see that it's about toothpicks, even if you don't supply toothpicks to every class, this class is gonna get toothpicks.

Kyle: Yeah ... They need the toothpicks, yeah.

Researcher: You know, like you're gonna need ... Just to like sort of make them a little more comfortable, so that they can say, I did the thing, look it's right ... You know, so that's it's not as intimidating to process the words on the page, and the drawings. I don't know if that'll help or not, but I feel like it might.

Kyle: Yeah, no I think that makes a lot of sense ... And I think that my morning class would appreciate that too.

Researcher: I think all, I think kids, in general, would get a kick out of doing something like that.

Kyle: They'd love it.

Researcher: It's the kind of thing, like once you hit fourth grade, there are unfortunately teachers who say like, oh those are for babies, you don't need those anymore. Manipulatives, oh ... And they don't say, these are learning tools that are appropriate at a variety of grade levels. The tools change as the kids get older.

Kyle: Yeah ... Exactly.

Researcher: They say, oh you should just know your facts, so you don't need to use base ten blocks anymore, or you should already know how place value. Or you should ... Yeah.

Kyle: I waned to bring in my tool box, you know, and like pop it on. These are my tools. I treat them respectfully with care, and they help me to do a lot of different stuff.

Researcher: Yeah.

Kyle: The stuff I'm going to give today, and the stuff that we used in class are like tools, too. We need to treat them respectfully and use them to help us build our own knowledge and extend-

Researcher: Yeah ... Yeah ... I had a friend who had like a pencil case, like those plastic pencil box. She got them somewhere cheap, gave one to each kid, and they would make a paper set of fraction bars, and different steps.

Kyle: Oh ... That's so awesome.

Researcher: They would have little Ziploc baggies in their kit. Then they would also have a list that they would add to, of different problem solving strategies that they used. They had a physical tool kit. It's something else for kids to carry around, but it was really cool.

Kyle: That's like, Yeah ... No, I think that's awesome, and that's what ... Teaching something for the first year and trying to figure it out is so frustrating.

Researcher: Yeah, you figure out a lot.

Kyle: It's like, these are things that I thought about doing in the first six weeks of school. Then it was like, oh I need to work through the book to see if the book is what I need to do. I need to make my own notes. Then I was like, crap, now I need to make my own notes. It's like, I used to have a lot of ... Last year, in seventh grade, I had all the key point, all the word wall stuff made, and so I'm just kind of like ...

Researcher: Yeah, next year is your year.

Kyle: Yeah.

Researcher: Yeah.

Kyle: ... But it's good. I feel like I'm back in year three, where just it's, I'm figuring out curriculum, and how to improve it. I'm exited about building all that stuff.

Researcher: Yeah.

Kyle: I also think, we did an exercise yesterday in our content, where we went to the Algebra one TEKs from this year, to the new ones that I'm going to have them figure out which ones. The new TEKs, I assume, have been learned already.

Researcher: Mm-hmm (affirmative).

Kyle: That's what we're going to focus on after our STAAR, which are all objectives that we already taught, we just need to redo them. I think it'll be a cool opportunity to use manipulatives to do it, to take our time, and to not feel rushed to get through a lot of curriculum before a certain date.

Researcher: Yeah.

Kyle: I'm going to figure out how I can use those re-takes to bring back grades on track.

Researcher: Yeah, yeah.

Kyle: Yeah, I just, I also told our course people for YES. I was like, you need to find returning teachers to six, seventh, and eighth grade math, like give them a stipend. Let them go through what the standards are, let them go through what the book does. Figure out what book lessons are good, what lessons aren't, and build those materials so that teachers have that tool kit ... And it's all shared resources, and you can print them out, or put them in the buy stuff for each campus. They have that taken care of, because, you know, a first year teacher that's doing what I'm doing probably is not at a place where they think about how to use all those resources.

Researcher: Yeah, and like having to run around on the weekend, trying to find the right materials.

Kyle: Yeah, that's what I did all afternoon.

Researcher: Like hoping, hm, can I find some at Home Depot, and Target, and Lakeshore. Like where do I get this stuff that I need?

Kyle: Yeah, exactly, and having people that have already figured that out, and done it for you. Then can show you how to use them.

Researcher: Right.

Kyle: I just remember my ... In my junior year on college, our special in math course was like the best thing in the world. It was all concrete, pictorial, abstract. We had to write every lesson. We wrote like 20 page lessons, where we explained how to do it concretely, explain how to do it pictorially, and then how to do it abstractly.

Researcher: Mm-hmm (affirmative).

Kyle: We went through counting, all the way to Algebra.

Researcher: Yeah.

Kyle: It was just awesome, because I was like ... I love math, and I was always a year ahead, and it just clicked. It was awesome to go back and say like, oh these are why these rules work in the real world.

Researcher: Right.

Kyle: That really influenced what I was doing in the last four years of teaching.

Researcher: Yeah.

Kyle: That's what I'm trying to do.

Researcher: Well, yeah and ... You know, this is a way to think about things for kids who are not a year ahead, and for whom it doesn't click, right?

Kyle: No ... Yeah.

Researcher: I was a kid who always, I mean I got A's, but starting about eighth grade, I had to work really hard for an A in Math.

Kyle: Yeah.

Researcher: Midway through high school, I started becoming happy with a B, you know.

Kyle: Yeah.

Researcher: It helped me that I had weighted classes elsewhere, so I could say like, oh well this A in English and this B in Math are gonna you know ... It's going to be okay, because I was that nerdy kid. I still, like when I started taking graduate level courses, I did all the course work for Secondary Master's Math teacher. Which means you take graduate level math, and graduate level pedagogical course. It was great, but it was challenging for me.

Kyle: Yeah.

Researcher: It brought back, the math itself wasn't really that challenging, once I dug into it. I had taught math for long enough that I had deepened my basic, foundational understanding of a lot of concepts. That all of a sudden, stuff that I struggled with in high school was no longer as confusing to me.

Kyle: That makes sense, yeah.

Researcher: ... But, I was definitely somebody who did not do well in calculus. I had to work my butt off for a B in calculus. I've never been so glad for a B- in my entire life. With lots of tutoring from 40 different people, right ... But I think that's part of what made me a good math teacher, because I get what it's like to be the kid who sits at the back of the room and is like, I do not know what's going on.

Kyle: Yeah.

Researcher: I felt that coming back when we hit challenging stuff in my grad classes, where I would be like ... I would feel like the nervousness kick in. I would go to ask a question and my voice would be shaking, and I would kind of feel like I wanted to cry. Oh my God, this is what the kids feel like, and sometimes they're only ten.

Kyle: Yeah.

Researcher: ... And they feel this way. All those strategies you're talking about are super valuable.

Kyle: Yeah.

Researcher: Nobody should feel like that when they're in a classroom.

Kyle: No ... Well, and I told, like when I was in sixth grade, that was my first, that was my second year of being here at…

Alex, Pre-sharing Interview

Speaker 1: Can you tell me just basics about this lesson? Where were kids coming from? What were you ...

Speaker 2: The kids were coming from no where because ... No those are brand new to that, I didn't mean it that way. This is a brand new TX that I have never taught before, that I didn't know anything about and I had to research it and when I read what they were supposed to know, it was just too foreign for anyone to really grasp.

I could have done it 2 ways. I could have either told the kids straight up what the property was and have them regurgitate it and repeat it ...

Speaker 1: Right.

Speaker 2: ... Draw it out and then look at the evidence that I've drawn on the board and have them copy it over again. I decided to try to have them figure it out on their own and I didn't want to give them the name of the property itself because the name itself is like speaking in martian. What I wanted to do was try to figure out the situation when they have 3 legs and can any 3 legs form a triangle.

Before I taught this lesson I thought sure and 3 legs form a triangle, what are you talking about. Put 3 sticks together and bam. You can get 3 toothpicks but little did I realize that of course 3 toothpicks would be the same size ...

Speaker 1: The equilateral triangle.

Speaker 2: Equilateral triangle. It doesn't matter the size if it's an equilateral, which a kid figured out later. Which I could not believe he did because I had not figured it out yet. Then they were to put these pieces of paper that were measured from 1 inch to, I think, 6 inches, together.

Speaker 1: The different colored strips.

Speaker 2: The different colored strips and try to see times when they couldn't because the measurements ... 1 was way to long and 2 were way to short. Before doing that ... I tried that with a class and it went horribly wrong. Horribly bad, it was scripted out, everything there, you had dies, everything was wonderful.

With these other kids, I decided to go in a different direction. I said, "Look, let us talk about something that's real not strips of paper. Let's pretend we had a bridge and you need to cross this bridge" ...

Speaker 1: To get to McDonald's.

Speaker 2: To get to McDonald's. At that point these kids were able to see it and understand it. It was almost like they were feeling that wow, these 2 draw bridges or the 2 halves of the draw bridges have to be a specific length in order for it to close evenly. Now at some point they are going to close and then touch and in that case they're not going to form a good draw bridge but they will form a triangle.

That's where they figured out 2 of the legs that your talking about, have to add up to more than the third 1. Then at that point it was like, "oh my gosh this is ... Yes you figured it out." Now did they figure out the math, no. I don't think anyone said, "Oh yes, the length of 2 sides of the triangle must be greater than the sum of the third."

Did they say it that way, no. They figured out that the 2 had to be longer than the third. Then of course, I told them there is a rule or a property for that. That's when I told them, that's what it's called. Why is it called that, I don't know. They could have called it Bill's Law or something else. That's when they said, "We figured it out." Then we tried other legs afterwards and they were able to test it out.

Speaker 1: Great. It seemed like they were ... You could definitely see there were some that were just totally like, "What?" Great, so if the distance across the water is 40, how long could these be? 5? What?

Speaker 2: You know what that little girl was ... She's different. Anyway, yeah she's right.

Speaker 1: Still she was not the only 1.

Speaker 2: Exactly, in that case for her, I should have given her maybe 2 blocks and then a long block and let her put that block there and then I take that block off and add 2 more blocks, let's see which blocks would actually ... For her, even though it was on the board, drawn. For her that was still way to abstract.

Speaker 1: Was not enough, she needed the whole concrete experience.

Speaker 2: Way, way too abstract.

Speaker 1: Were you focusing only on isosceles triangles?

Speaker 2: No, the example with that led itself better to using an isosceles triangle. Afterwards, kids came to the conclusion about the equilateral triangle. Then, afterwards the one that I guess was most abstract was a scalene. Some kids actually thought afterwards, the next day, "well what is scalene?" Now there all different, so why do any really have to match up. That's when they came to an even deeper understanding. It's not no.

We saw the isosceles, obviously it worked and when it doesn't work. The equilateral 1 that they come up with the idea that it doesn't really matter. You don't even have to do the calculations because there is some rules ... Some steps that you have to follow to be able to ask yourself if 2 strips equal ... What the third 1 has to be in order for it to be a triangle.

Some of the problems that I've seen in books or on worksheets are where they give you the 3 dimensions and the math is: add these 2 to make sure it equals, then add the next 2, then add the next 2. You have 3 different steps to find out whether they can form the triangle. At some point, kids figure out, hey wait a second, once you have an equilateral triangle, you really don't have to do the math, once you see those 3 numbers there, there's like check, it will.

Then some kids came up with ... These were for the scalene. They actually figured out ... They didn't even do the math, they just said "If the 2 lengths are very from the long length then you can't. I'm like what do you mean very far? They were trying to say that when the 2 small distances are way smaller than the long distance, then just visually these 2 numbers ... Like 3, 3, and a 10. Visually they figured out that it wouldn't work. I wish they had done the math but they went with visual and said you don't even have to do it. Thank you kids.

They were able to figure out ways around doing the 3 addition ... The 3 sums to check it off that it does equal a triangle.

Speaker 1: Awesome. That you had notices several instances, which I'm curious to see what the rest of the group sees, as we start talking. Can you think about a moment that you thought really stood out in that lesson.

Speaker 2: Gosh, I even have seen this video ... (speaking Spanish)

Speaker 1: It's okay.

Speaker 2: I think the only one that I do remember is just when we're talking about the draw bridge. I like the part when the kid said, "Make it into a draw bridge." The kid had that connection about what it should look like. I like when the kids kept telling me, when I was asking ridiculous questions. For example, can it be this long? The answer was yes.

What if it were longer and longer and longer. Then they came to the realization that they stop, we see what's going on. We see with like ... Come on give me a break.

Speaker 1: As we watch, you won't give them that much context. You'll just have to tell them what the objective was for the lesson. Then we'll see what ... If they have any thoughts about where they they really saw a student thinking, where maybe kids thinking is a little bit masked and any other general comments.

Do you have anything you want to add?

Speaker 2: I think the only thing that I want to add is that, I want anyone to give me feedback when I do give an answer. My philosophy in teaching is never to give an answer. My clue is too close to the answer then I will push back and say "No. You're practically giving them the answer." I just want to know where maybe I crossed the line and give the answer or when I got too close and let them think it up.

Speaker 1: That's good. Thank you.

Farrah, Pre-sharing Interview

Speaker 1: Tell me what, where if you can remember, where does this lesson sit in terms of what your students had worked on with area and shapes.

Speaker 2: Before this they did do the area of rectangles. They did the area of rectangles and squares. We had a lesson where we actually went into the hallway and I had the tiles lined out and they were actually counting tiles. Then eventually understood, oh it can multiply because there's this many rows and this many columns. I regret not doing irregular shapes like this outside in the hallway, but it was a time thing with [star 00:00:55] coming up and everything else, it was just kind of like, here's an irregular shape imagine it in the hallway because we don't have time to go out there. That probably would have helped a lot more. I don't know, does that answer your question?

Pretty much they've just done area.

Speaker 1: So eventually, you had them struggle with it for a bit and you'd stress things like what does it mean when something's regular? We're talking about both congruent sides and congruent [angles 00:01:28]. Eventually you turn them loose, just work on it, try to figure it out. Some of them were still trying to figure out where the formula was on the chart. And you were like, no just tell me how do I find the area of this figure. Were they eventually successful? What did they do?

Speaker 2: Most of the kids were. Most of the kids had one or two kids at their table that were kind of on to it and then the other kids would be like, oh what if we do this? And I had some kids, it was interesting, I thought is that some of the kids want to cut it horizontally and vertically to make three different rectangles and I let them do that but then we also had the conversation of what would be easier, finding the area of these three rectangles or maybe just finding the area of two? What would make this easier?

The hardest part for them, even once they make those cuts, if the sides are not given, that's very difficult for them. Or even if the sides are given, collecting the correct numbers. It's always a very simple outlining. I'm like, with your pencil touch the side of the shape and they'll just rub their pencil along the edge of it and I'll be like, oh so that's six? And they'll be like, no that's nine. For them to actually have to touch it to see, oh that's not what I said it was.

Getting them to slow down in that because they're so used to being so automatic. I guess that comes from when they were finding the area of rectangles and squares, the only numbers they saw, they just picked and understanding in these shapes you have to slow down and pick the correct sides. They were pretty successful with it, like I said, I had some kids cutting it into three and some kids only cutting it vertically and some kids cutting it only horizontally. I had maybe a pocket of kids that wanted to do the length times the width, like the longest length and the longest width and say that's what it is and I tried not to just tell them no. I tried to extend the lines of that shape and be like, okay you found the area of this. Extending those lines to see, and then I would circle that part that they didn't have and there was one kid that was like, oh we can subtract that away.

Speaker 1: Yes!

Speaker 2: I was like whoa.

Speaker 1: Because to me, that's even easier, just find the whole thing and then subtract

Speaker 2: Take away that little part, yeah. That one kid got that and I probably could've shared that with class but I just didn't.

Speaker 1: Well and just because it's easier for us doesn't mean that it's an easier way for them to think about it.

Speaker 2: Yeah, and for that kid maybe it was easy to subtract it away.

Speaker 1: So when we watch today, I'll have you just kind of like we've done with everyone else, let the others kind of say what they see and what they're thinking about the clip, and then if you want to chime in after that, if you want to add any context to it or whatever, just so they're ideas are as unbiased as possible. Yeah, I think it's, I think it should be pretty straight forward.

Any questions?

Speaker 2: No, I don't think so. I'm interested to see what I said in here.

Speaker 1: You were funny.

Speaker 2: Was I? I like to be funny.

Appendix D

Video Club Transcripts

Video Club 1 – 01.31.15

Speaker 1: Slash engagement, slash thinking question for now. We'll come back to it. When I say "student thinking, evidence to student thinking." Student thinking and somehow was noticed and used or made some sort of impact on how this lesson went. What did you note?

Speaker 2: I feel like a lot of it was ... The way that he was questioning was a lot of abstract student thinking. Which I think might have contributed to the fact that it was just a Mister ... What's his name?

Speaker 1: Huro.

Speaker 2: What?

Speaker 1: Huro.

Speaker 3: Huro?

Speaker 1: With an H, but yeah.

Speaker 2: Sounds like a [bomb 00:00:55]. I feel like that's what maybe constricted it between being [inaudible 00:01:01]. I think one kid really articulated multiplying by two gives me 6 points and multiplied by two over two gives me six eighths. Those are really different numbers. Really, that's like genius. Then the one girl that you asked, she was like, "Multiply by fractions, it's like basically the same thing." I couldn't really explain what the same thing meant. I wonder if he would have said, "Okay. Everyone draw another square that was, like put it into fourths now. Multiply that by two. How many fourths are [inaudible 00:01:33]?"

Bringing it back to the concrete or pictorial representation. That might have helped kids to see like multiplying by two doesn't give me the same as multiplying by two over two.

Speaker 1: Mm-hmm (affirmative).

Speaker 3: I think when I first heard it he was like really trying to drive that point home like times two over two is different than times-ing it by two. Then I had to like draw it myself, kind of like you did. I had to think, because I did three fourths times two and I was like oh it's like ¾ plus ¾ because you're doing it double," so I feel like it would have helped a little bit if he had shown that. Because I felt like he just kept talking about it, yeah, very abstractly, and some of the kids were getting it, and some of the kids were like, "What's the point, what's the nuance here? I don't even understand why you're asking this question."

Speaker 1: [crosstalk 00:02:18] hoping a kid was going to say that-

Speaker 3: Yeah.

Speaker 1: Yeah.

Speaker 4: What are we supposed to be saying right now?

Speaker 1: When you watch this video, can you see evidence of students thinking?

Speaker 4: I am hesitant because my video is going to be up there one day, but I think no. Only because they don't talk very much. There wasn't so much ... How long he was on that one little girl. Like what we were talking about before like how much are the other kids really thinking? I can sit up straight and I can look at her but

I'm still thinking about what is in the cafeteria for lunch today and I hope I get in line first, otherwise they're going to run out of pizza and I'm going to get a ham sandwich. That's what my students do, I know. I was thinking like, "Oh, it's three fourths plus three fourths because you're doing it double." I feel like it would've helped if he would've shown that a little bit. I felt like he kept talking about the idea, very abstract like you were saying. I felt like some of the kids were kind of getting it and then some of the kids were like, "What's the point? What's the new ones here? I don't understand why you're asking this question."

Speaker 1: You felt like the whole class, no idea?

Speaker 4: We don't know because we don't know what they're thinking. When I hear the word "evidence," to me it's almost like guilty until proven innocent. Prove that the kids were thinking. You really can't. You don't know what's in their heads.

Speaker 2: That was something like his behavior management, I know we're not talking about that, but his push, I remember he was tracking her was good because the rationale was, "You need to be thinking about this." Then there wasn't like a scaffold and instructional follow up to ... The conversation was there but even then kids weren't writing down. Kids weren't doing the model on their paper to show what something meant. I think that would have strengthened their ability to communicate with their partner and they would have participated.

Speaker 4: It's hard because even in group work, are both of the kids doing heavy lifting? I know with some of my table groups, often there's one kids that's kind of pushing everyone else and hopefully they get it from Carla.

Speaker 2: Carla's always the one.

Speaker 4: Yeah. Carla. To me it would have been cool if he had ... When he was really pushing that one little girl, if instead he would have said, "Okay, let's back up. Is multiplying by two over two the same as multiplying by two? Everyone think about that right now." Don't let her say anything. "Okay, whatever you're thinking write it down. Prove it in a picture or explain it in your own words." Almost just stop right there and give them three or four minutes to get something on paper. Maybe we're not supposed to talk about this, but I'm finding that in my own classroom that if I give them a little independent before the group work, and then we go back and go over it, they don't carry all those crazy misconceptions and things into their group work. It's almost like it gets weeded out. I just discovered that. I've always done group and then independent. I'm just excited because I've just realized that this week. That [inaudible 00:05:35]. Getting them to do some independent work to me would show, prove that they're student thinking.

Speaker 1: That they're more engaged.

Speaker 4: Mm-hmm (affirmative). Then even he could be circulating at that time and pick up two papers like, this kid way off but we could talk about it. You don't have to show the kids name. Then this kid we're on the right track. Then that engages them even more then twenty-eight of us need to be thinking about this. It's good, I get what he's trying to do. It's also more engaging if I pick up Gabby's work and you all want to see what was Gabby thinking?

Speaker 2: When I do that in class, kids are on it and stuff is good. When I'm just like, "Okay. Talk with your partner and work through this," nothing gets done. Like ten minutes is wasted on a problem or on the problems.

Speaker 5: I think there was evidence of thinking, but unfortunately it was those two children. Believe it or not those two children were correct in what they were saying. I think the first little girl, I wrote down that she was actually unfortunately, mislead by the teacher because she never said that it was multiplying by two but because he said to her, "Oh, so you're multiplying by two." Maybe the little girl at that moment was like, "Wow, he's actually ... Maybe I'm on the right track." I think, for me, she just accepted that, "Oh, yes, I guess I am." [I know 00:06:56] push her into a corner. I think he should of let her say that instead of him telling her, “Is that what you were saying?" It's also unfortunate that he didn't stop at one point and then just have everyone give their opinion about each section that each of the children were saying, whether they were sure or not. Just by a show of hands he could've quickly see whether the kids were thinking correctly or not thinking correctly.

Speaker 4: It's not that point yet. Never mind.

Speaker 1: That's okay.

Speaker 4: The part about missed opportunities?

Speaker 1: Yeah.

Speaker 4: Can we go?

Speaker 1: We can go to missed opportunities. We've kind of been talking about it already.

Speaker 4: Yeah we have. I have two things. One is just very simple and I think Kevin was touching on it. How abstract it was. It would be very simple for him to have just, "Here is a sheet of paper. I tear it in half. Gabby is going to get half. Oh wait, Gabby. Here's Gabby's half. Oh, here you go Gabby. Oh, wait, actually," but I still give her both the pieces. "No, no Gabby, I'm going to give you two now. You have more." Talk about that. Like, "Now you have two. You have more, right?" All the kids are like, "No, she has the same, it's just split. It's the same." There's that. I would have been more concrete. Like just pick up a piece of paper Mr. Huro. The only other thing that I would say ... Well I had another but one thing is when the student said ... This is on the second page, the bottom quarter and the top quarter where it says, "When you are multiplying, or adding fractions, you can't change the denominator."

That is very concerning to me. I'm discovering because it's a [problem] for me [in 5th grade], they multiply and they divide but only by unit fractions so therefore the denominator will be one. There's going to be a huge misconception going into sixth grade that when you multiply fractions the denominator doesn't change. We've already touched on that. When they said that, he kind of got more to it like down at the bottom when he was like, "Oh two. You're multiplying by two over one." I would have liked to hear him say, "Well, the denominator doesn't change because we're multiplying by one." I immediately showed my kids like, "In sixth grade you're going to multiply not by three over one. What about three over two?" Understanding that they are multiplying top and bottom. I wouldn't let a student say, "You can't change the denominator when you multiply or add fractions" because you do. I guess it's like a small thing. You know that a sixth grade teacher could quick undo. Like, "No, actually now that you're in sixth grade." I don't know. When I heard that I kind of cringed a little.

Then he tries to correct them. He's like, "When you multiply the number of pieces then the whole fraction doesn't change." I don't know. I wish he would have slowed down to explain like, "When we multiply fraction," but I don't know what he's taught previously, about multiplying the fraction. Then he eventually did say the two over one.

Speaker 1: Right. What else?

Speaker 3: He has like a gift and a curse in here. I feel like he had very high expectations where he was trying to say ... At this point in the lesson if I felt like only one or two kids was kind of really getting it, I would've jumped ship and done something really serious. I would have gone back to the concrete, I would've had them draw something, or we would've done something a little bit different. Part of me says, "Good for you man. You knew what you wanted them to say and you kept pushing, pushing and pushing." Other parts of me are like, "Did he waste more time and how many kids do you sacrifice in doing that, that still are like, "I don't really know what you're trying to do?"

Speaker 4: You don't realize it when you're in the moment but he was talking a lot. He was talking a lot. Even when he was talking a lot only a couple of other kids spoke then it's kind of like they talked a lot. There wasn't like a lot of doing. The touching, feeling, writing.

Speaker 3: When we had that module about rigorous instruction, it made me think there was one question we had on the little anchor charts that was like, "When do you do this? When do you start doing the heavy lifting in your class?" I really thought about that because I was like, "It's always when it's the most important thing that I start doing that." This is a really crucial point. It's probably one of the most important things that he's trying to say and you can tell a lot of kids didn't get it.

That was probably the key crux of his kids' understanding and moving forward and that's exactly when he started doing more of the talking and he started losing the kids. Just kind of stinks ... He's trying to do it.

Speaker 4: Maybe even going back like when we were talking about multiplying a fraction by two. You know how Gabby was talking about the repeated addition, I would almost say, "You know what? Let's forget about fractions. Let's talk about whole numbers." Just go back to their background knowledge, what they already know and what they're super comfortable with. "I have two apples. Multiply it by two. What happens? I have two apples and I have two more apples." Okay, do it with a fraction. "We have three fourths, let's multiply it by two, what really happens." We would draw two separate models and we would count the fourths and we would have six fourths. We wouldn't have ... Or six-

Speaker 2: Or even doing the whole number apples times two over two.

Speaker 4: Right.

Speaker 2: Right? We're going to multiply it by the two numerator, the two in the denominator means we divide. Or we just say, "Two over two. What is two divided by two? It's one."

Speaker 4: That's something else. When was he going to talk about ... Maybe he got to it later. We don't know. When they say, "Multiplying by two over two, that's the same thing by multiplying by two?" I like that he tries to play devil's advocate ... Or not even that but tries to mislead the kids to see if they really know their stuff. I think you saw that as a mistake where I saw it as like a good thing. I always try to trick my kids. I always try to trick them. They learned now.

Speaker 2: Even in that trickery like giving your kids, "Multiplying by two over two is the same thing as multiplying by two." Take five seconds, what is two over two really equal to?

Speaker 4: Right.

Speaker 2: Just give me like that one quick five second shift to be like, "Aw crap, it's not two, it's actually one."

Speaker 4: That's why it's equivalent. When is anything times one? We spent weeks on that. You know? What is two out of two?

Speaker 5: The problem is at the very beginning also because when he was talking to the girl the question he says is, "How did you cut your one whole to make that happen?" She said, "I chose six eights because if you multiply." At that point he should have stopped her and said, "No, no. How did you cut it?" Now they're on a tangent and people are going to get lost. Now he tries to fix this one child at the expense of the other twenty-seven. With just a one on one conversation while everyone just watching an accident happening. What do you want me to do when there's an accident? I'm not a paramedic, I can't get off the bus, I didn't help. All I could do is watch. Now all I'm doing is watching and now I can't even slouch. I understand how the other kids are. They're bored and it's normal for the kids to not pay attention. It's not about me anymore. It's not about the class, it's just about you and the kid.

Speaker 2: How do ask that question, "Mr. Huro, you're a great teacher." I feel bad that [crosstalk 00:14:58]-

Speaker 1: It's fine. It's cool.

Speaker 2: I think this has all happened to us.

Speaker 1: We talked after this lesson. He was like, "Oh my God, what a mess." He's not under the mistaken impression that this went beautifully.

Speaker 2: If she would've answered the question, she would've said, "I took the fourth and I split each part into two separate pieces." Then his next question would be, "How many pieces are there total? How many pieces are shaded? Does it take up the same amount of space?" That steers the question-

Speaker 5: If he then goes back to planning. Instead of him being up there on the board with what he has, give them a sheet of paper, cut it into fourths. Put one fourth away. Okay. Now with exactly what you have, now create another common fraction. Whatever you're going to do is going to be only using that material. They just cut each of those again in half. Ta-da! They would have seen it for themselves. Some of them have cut their fingers like, "You are the ones that doesn't understand. Let me help you." Or something. Cut it into octagons like, "You're the one who doesn't" ... It's clear evidence of not really learning [inaudible 00:15:59].

Speaker 1: Go ahead Gabby.

Speaker 3: You're saying like completely have three fourths, like they had a fourth taken away. I think the only problem with that is then they're going to get into what he was saying, times-ing it by a two. They're only going to be multiplying the numerator and not the denominator because you took out of the denominator.

Speaker 2: You can only keep the square that was three fourths shade and then the one fourth was blank. You just have to split it into-

Speaker 3: You said you cut it. It would be like you cut it-

Speaker 2: Yeah, yeah.

Speaker 3: You cut to have like an L shaped block piece and you take out that other one, fourth the missing three fourths. Now you're just cutting the other pieces in half. Now you just have six pieces.

Speaker 5: No, no. It's long strips.

Speaker 3: Oh. Yeah.

Speaker 5: Looking at what he had drawn, he drew it well. He drew it, it was a whole squares like here. He had cut it into three and he shaded three and he left the fourth one blank on that video right there. Then he went across and he did that. There was still two pieces of the eight now were there. Again, why does he have to [inaudible 00:16:58] very quick evidence of whether someone is learning it.

Speaker 2: There's a lot of empty boxes up there.

Speaker 4: I think we probably have already touched on this but I would've liked to have had him talk more about did we change how many pieces are shaded? That's one of my favorite questions because you did change the number of pieces shaded however, when we look at the model as a whole, did the amount shaded change? That's the best conversation is the amount of pieces changed. Oh my gosh! We have more pieces but it's just like if I have a large pepperoni pizza and I cut it into four slices or if I cut it into ten slices, I still have one whole large pepperoni pizza. The amount that I'm eating doesn't change. Maybe I eat several small pieces or maybe I eat one larger piece but the amount shaded is not changing the pieces.

Speaker 5: He should have gone back and talked on that because that's part of what kids will understand is that using the area model. Did the amount of area that we slice, did that actually change? The answer the kid would say, "No." He could have asked, "What number did you get?" She would have said, "This and that." Then of course, I like how she did say, she did double this, and you did double that. She really doesn't understand it. She doesn't. That other boy does. He's, "Hey, no. You multiply this and that. It's not the same." He had a good [inaudible 00:18:33]. She didn't. He's strong in the area of multiplying fractions, she is not. That's not what this was about. This was about, "Is the area of this fraction the same if I just rearrange it into more little pieces?"

Speaker 2: As a teacher this has happened to me more times than I can count. The question is, when you're leading that discussion or that moment, you have to be, like you said, just very mindful of the objectives of this. When you said, she didn't answer the question, I wrote that here. I was like, "Answer the question?" [crosstalk 00:19:13] or whatever. If you're not clear on what you want kids to have at the end. Maybe she made a mistake in her reasoning but he could've been like, "You know what? Crap. I got to reteach this." What she said wrong, that doesn't have to do with what I really want the kids to do today.

Speaker 4: Yeah. The main key [inaudible 00:19:36] fractions using the number line area models and numbers. Really, are they equivalent? How do you know? You really wouldn't even have to get into, I mean not necessarily yet, get into like what they're multiplying and dividing by. You know, the numerator and the denominator, almost like that, but we don't know what he did before this. We do, that one half example I mean. Is this maybe the day that they only do it ...

Speaker 3: This is more the number lines.

Speaker 4: Yeah. And numbers. Maybe today he could have just done number lines and area models because that seems to be what he has here. Then tomorrow go to the numbers and make the [crosstalk 00:20:15]. Sorry. The next day come into, what do you notice about these? I don't know what he did leading up. You know? It can almost be like all these models. Like, "Oh, look, these have the same amount shaded. These have the same amount shaded." And putting them next to each other and finding a pattern. Did they do that? It seemed like they already knew, I multiply by two. I multiply by two.

Speaker 1: What they had done before that as I recall was they had a one half example, so kids figured out two fourths, four eights. They already have this number pattern idea in there. It sounded like some of them had figured out something about multiplying by two. Something with two. You know? The were trying to use that pattern to follow. I think you're right in that, the conversation got off point. Right?

Speaker 2: Interesting. I wonder if there had been like a way, they're maybe using tables right now, to like with that and just would say, "How many pieces are shaded? How many pieces are there total?" Then be able to write that as a fraction for the three fourths. Ten keep doing that as they split so then that's how they can generalize the rule that equals to the next thing which is like, I don't multiply by two. I have to multiply the shaded number by two and the total number by two for this to make sense. It's not that there's six pieces of shaded, not four pieces, so there's six shaded pieces there.

Speaker 3: [Brandon 00:21:48] just looks at a hundreds chart and you look at ... I don't do [inaudible 00:21:51] two and four and how they increase that way, you should've seen like ... You could have those kids extract that pattern.

Speaker 4: Do they know that fractions represent division and can they get a decimal? Right? They can do three divided by four. My kids understand three divided by four. You can make a division box. Three divided by four, put a decimal, fill in some zeros. Doesn't change the value. Get a decimal. We would get the same decimal.

Speaker 2: One of the things that we did when kids have never added ...

Speaker 4: Dividing decimals? We didn't used to.

Speaker 2: We've never done adding and subtracting positive and negative fractions? We had to like teach that as they would do first but then some people really ... One of the things they did is said, "Three fourths and negative five fourths." You had to write each fourth separately. Going back to what you're saying, if they could divide, you could say, "You're telling me that multiplying it by two, is six fourths or six eights." Draw that out. What does that look, six fourths really means six quarters. Three fourths means three quarters.

Speaker 4: You know what? He knew that this was the misconception. He knew that. This is not a surprise. Maybe even instead of what he has here, maybe initially he had, "What happens if I take three fourths times two in the numerator, times two in the denominator?" Versus, just starting out with that. Then after that say, "So what do we know? Is it the same? Do we get the same thing when we do this?" Almost starting with that versus looking ... For me time is so precious. I would just be so frustrated if I was him.

Speaker 1: They have seven minutes on this.

Speaker 4: Seven minutes is like an eternity. If I was him I'd be beyond frustrated. Maybe frustrated watching it for him. That's the importance of identifying those misconceptions. Right? If you knew that was a misconception, maybe instead of leaning her into it, like you're saying, starting with that, on the paper. Three fourths times two over one. Three fourths times two over two. Draw a picture. No I don't want to see the algorithm. Draw a model. Show me what it means. Then, are they the same? They're all in the same L. Yeah. Then they would be, student thinking. Then student thinking would be obvious.

Speaker 2: It all would be a different model on the paper.

Speaker 4: You can even have several. There can be several examples. Like this one times two over one. This one times two over two. This one times eight over eight. This one times eight over one. Drawing, discovering the difference.

Speaker 2: It would've been better.

Speaker 4: "Oh, it's not the same. What do you know about eight out of eight? What do you know about" ... And drawing the original model of course. Draw the original, you got to draw it, times two over two.

Speaker 2: It could be five minutes.

Speaker 4: Don't get me started. I have a hard time with that. I'm sorry.

Speaker 2: No, you're going to kill it.

Speaker 3: No. [inaudible 00:25:05].

Speaker 4: I've been conditioned not to [inaudible 00:25:08]. We won't get into that. It's a tough thing.

Speaker 1: It seems to me like a lot of the things you guys brought up, the main thing I heard you bring up was he wasn't concrete or [inaudible 00:25:22] enough. He went too abstract. The kids jumped to, "I just multiply the top and the bottom by two and I got this answer. There's a pattern I can follow and that's how I'll get equivalent fractions." Because they couldn't explain it, then they didn't really get what it meant. Right? You were pushing, if he had done that [inaudible 00:25:43] go back. I think the other thing it seems like you started talking about management, engagement issue anyway. Right? If the original question was, "What do I do when I start engaging with one kid and then now everybody else is not paying attention?" If I want to back up and get everybody's attention, then the thinking this as high. Do you feel like you addressed that or no?

Speaker 4: Do we feel like we addressed?

Speaker 1: That issue.

Speaker 4: In the video or [crosstalk 00:26:16].

Speaker 2: I think so. I think what Sarah just said of even changing the leading question to be, "Are these two things true?"

Speaker 4: I think if you're in the moment. I think that's what. You're him, minute two, minute two, what are we doing? When that little girl is saying, "Yeah. Yeah. It's like multiplying by two." I think right then I would have stopped and said, "Draw it right now." I would have been frustrated.

Speaker 2: Not just her draw it but everybody draw it.

Speaker 4: Yeah. Everybody draw it.

Speaker 2: I think that's the-

Speaker 4: Again, I really discovered this week like that independent before group or before singling out one kid who's explaining. When I say, "Everybody draw it." I would let everybody draw it. Even if they were drawing it wrong, I would let them draw it wrong. Then we would come back together and I would say, "Okay, what are some of the things that you drew?" Explore that. We could talk about, "Is this correct or is that correct? Are they equal?" He could just even for time. I'm a time person. Time just stresses me out. Even after the independent I would say, "Okay. Here's what you should've drawn. If it's times two, this is what it is." Almost like inside me, there's a point where you got to get to explain. You can only let them trouble with it for so long.

Speaker 1: Explain to the students [inaudible 00:27:32] these.

Speaker 4: It's not what we learned today.

Speaker 2: It's supposed to be students explaining but then the teacher filters. It's just [crosstalk 00:27:42].

Speaker 4: It was teacher led. That is what I learned today, it's wrong, and it made me upset because I'm already going to be terrible at 5E.

Speaker 5: Did you read the readings?

Speaker 4: Yes, I read the readings. Don't you ever ask me that. I am the ultimate overachiever. Do you want to see my notes I took? I had like four pages of notes.

Speaker 5: No. That's what I thought. That's what I thought I had her notes on. That the students are the center of [inaudible 00:28:06].

Speaker 4: That's what I thought too but then we came today ... Didn't he say teacher led?

Speaker 2: He did. Yeah. I think that-

Speaker 1: Did he mean teacher facilitating at the students?

Speaker 2: Maybe that's what.

Speaker 4: If that's what he meant, that's not what I got.

Speaker 1: The main teacher tells.

Speaker 4: Yeah. Pretty much. He was like, basically, that's when you go over what they engaged. Right? Engaged. Explore. After explore you explain. Basically, "You explored this. You explored this. You explored this, here's what it really is." That's what we ... Well I'm not going to do real good on that.

Speaker 1: [crosstalk 00:28:38].

Speaker 2: Now you know. I think that what you needed to explain was [crosstalk 00:28:44].

Speaker 4: I put it on silent, I don't know what's happening. I think my phone sets an alarm [inaudible 00:28:50]

Speaker 2: I think that in the explore, explain, it's almost like this situation here. Had he done the picture thing and everyone had drawn it, that's more explore ... I just dropped a pen. He could if it was purely teacher led he would've just popped up the picture and said, "This is what you should've drawn. If you didn't draw it the right way, this is the reason why." If he did like the 5E to the best of his ability, he would do what you said, which is grab three or four papers, some that were right, some that were wrong, put it up and say, "Who did this? Explain what it means. Who did this? Explain what it means." Then the kids that were incorrect be like ... That's where the teacher could say, "These three students are accurate. Students that were inaccurate, what do you notice about yours that's not the same?" That way he's still filtering and saying, "This is really what's true," but he's allowing the students to be like the work samples that lead to that.

Speaker 5: The kids are still the ones who are coming up and saying, "This is why I got it right." One thing I like to do is stop and say, "Who got it right?" They raise their hand. At the beginning of the year kids, sometimes they go all [inaudible

00:29:58]. Then who got it wrong? They're like, "What? You want us to raise our hands? We already know who we are." Then I ask them, "Why did you get it wrong?" Even the kids who got it wrong have a chance to explain their thinking. Then there's evidence of thinking. Unfortunately, if it's true you try to guide it back to-

Speaker 1: Or they are explaining where they went wrong because they figured out what their missed step was which is really beautiful.

Speaker 4: When we go over something, if it's graded work or something, as we're going over it I'm like, "Follow your work. You have to circle your mistake as we go." Especially if it's an algorithm. Like long division. We're redoing it all together. Then they find their mistake and they circle it. That's one of the most ... I tell them erasers in math class, we actually don't really need them because I love ... I tell them I want to see your mistakes. Don't mark it out, just keep on writing. Then find your mistake. I think they multiply and they get the wrong answer. You don't get to erase it and start over. You get to go step by step, what did I do wrong? Then they find it and change it. Why do you want to start all over when you can just tweak a little part? Then, you're more likely not to make that mistake again.

Getting back to having the kids stop and draw a model or something of times two or times two over two, you're worried ... My worry is that they're all drawing it wrong. That's more wasted time. I'm a time person. Right before you know how we were talking about like connect what they already know? Right before I have them draw that model, I would say, "What is it with whole numbers? If we multiply it by two, how would you actually draw two times two with whole numbers?" Giving them like there's two here and there's two here. Two times two. What is three fourths times two? I need that three fourths, I need a three fourths. Then tell them that part but hopefully they would connect that from ... Instead of, "Is it the same? Draw it." Reminding them.

Speaker 1: [crosstalk 00:31:56]. Right.

Speaker 4: Reminding them that the whole number and whole number.

Speaker 1: This is what we're going to be doing.

Video Club 2 – 2.21.15, Jenny shares

Speaker 1: All right. Five good things.

Speaker 2: That's freaking awesome.

Speaker 3: Thirty seven [crosstalk 00:00:11].

Speaker 1: One that it seems like you want to be there, you want to teach, you're enthusiastic. Second, the kids are willing to learn, they're attentive, they're trying. The other thing is that you keep shooting them with questions left and right so that they're always thinking. You're straight forward, when someone's wrong they're wrong. It's not like, "Oh, everyone tried. Why tell you, Yeah, you can make a triangle with five sides." You shut them down when it's not there, then you quickly ask them what their reasoning was behind that. I think the only one that is a little ... I don't know. Have they talked about measuring angles before? Have they used the protractors before?

Speaker 3: Yeah, we used a protractor previously in ... [Windon 00:01:02] and I talked about that, but yeah. They've used a protractor, but that's like a new skill to fourth grade. I feel like some kids got it, but the way that it's on the test is that actually the protractor's already set up. You can very easily see how the angles ... [crosstalk 00:01:14]

Speaker 1: Do they get to physically hold a protractor?

Speaker 3: No. We did it one day, but I felt like they were really really baffled.

Speaker 4: On the test it's an image of a protractor over the angle?

Speaker 3: Within the ... yup.

Speaker 1: The only thing I would ... if you're going to introduce, or if I were going to introduce the one hundred and eighty thing about triangles, I would have gone ahead and started with wonderful squares because they know right angles. Ask them to sum that up very quickly. They would ... hopefully some kid would've been very sharp and said, "Well, nine times four is thirty six, and it's three sixty," and then you slice it half ... you tear a paper in half, and in the geo-board, I don't know, what do you smash it in half, but then you can ask, "Well, if I had three sixty, what do you think I have now?"

Speaker 3: Oh.

Speaker 1: And they would like, "Oh, you cut it in half ..." What kid would say one hundred ... because they way these kids are answering. I'm kidding ... anyway, then only they would have figured out, "Oh, that's where the one eighty comes from."

Speaker 4: Yeah. That's one of those things that I think when I was writing that down I was ... That's one of those things where it's not in the fourth grade standards at all and I was just thinking some of my higher kids are ready for more information. That's why I kind of decided to do it briefly. It wasn't like a big exploratory thing, but I ... question for you guys. Do you think I should do things like that? Sometimes I'm like, "Okay. For all my kids that are really growing their brain," I'll say something that I feel like ... I just told them the fact. Maybe that's not a ... [crosstalk 00:02:34]

Speaker 3: You're okay if not everybody gets it ...

Speaker 4: Right. [crosstalk 00:02:38] I'm definitely okay with that but I also don't know, should I even do that? I sometimes think it's good to push kids. Some kids are ... they got that, and they ran with it, and their like, "Oh, it's a hundred and eighty." I don't know if I should do that or not. Like you said, it wasn't very exploratory, it's very much like, "Just to let you guys know, it's one eighty." For them to remember it.

Speaker 1: I think you can do it, but you just have to [crosstalk 00:02:55] make it, you just have to make it super duper simple. For example, if you wanted to break it down into it's lowest possible segment, then I would have gotten a piece of paper that was nice and big. Then I would have already drawn the corners, or the little boxes in red and then label them with nineties, and nineties and nineties. Then I would have asked the kids, "Anyone want to shoot, tell me what all these angles would add up to?" Hopefully someone would come up with the right. I'm sure you would have wrong answers but that someone would come up with the right answer.

Then you might have the answer in the bag. Show them how ninety plus ninety plus ninety plus ninety equals three sixty. Then you would say, "All right. I'm going to go ahead and fold this right down the center." Have a kid hold this end, and this end and someone cut it right down the middle. "All right. Sit down kids," and then over lap them to show them that both triangles were exactly the same. Then take one, throw it in the trash and say, "How much do I have now?"

I think some kid would have been sharp enough ... not ... again, not all of them, but one kid would have said, "Hold on," and then of course done the division and found out. You could have cheered him on, carried him on your shoulders around the classroom and sit him back there.

Speaker 4: No, that would be really cool. I was just thinking you could do some cool things with [inaudible 00:04:02] fractions because when you have that triangle ... I was thinking my kids know forty five, forty five, ninety right away for the triangle, but at least they could see that that's half of the original angle inside there and they would say, "If that's a half, then this is a half. Together they'd be a whole, which would be ninety and ninety." That would be another way for them to think through it. I just know three sixty ... [inaudible 00:04:19]

Speaker 3: Mm-hmm (affirmative).

Speaker 2: Do you all learn about straight angles?

Speaker 4: Yeah, a little bit.

Speaker 2: You can do the same thing where you have ... you could ...

Speaker 4: Rip off the corners. [crosstalk 00:04:26]

Speaker 2: ... do it Arturo's way and then show them mathematically why it makes one eighty and then you can rip off the angles, arrange them together and it makes a straight line.

Speaker 1: Oh! [crosstalk 00:04:35]

Speaker 4: Yeah, you rip all the corners off the triangle.

Speaker 3: Dang!

Speaker 2: Have you ever mentioned that?

Speaker 3: No.

Speaker 2: I do that. When we ... when I taught seventh grade we did that. We had to explain why all the angles made one eighty. I didn't do ...

Speaker 4: You rip off the angles of the triangle?

Speaker 2: Yeah, and then ... once you cut them and then you put them all together. You could just ...

Speaker 3: You go ... arc them around basically and they ...

Speaker 2: ... yeah.

Speaker 4: ... make a straight line.

Speaker 3: Oh, that's amazing.

Speaker 1: Make sure you have a straight line already drawn.

Speaker 4: I think I did know that, but I just ... wow, that's cool.

Speaker 2: I want to say you just, there's all questions. It was so rapid fire and kids were engaged the whole time. It's like, "This is one of two right angles. No, it's acute. What about ..." It was just so energetic and fast paced though. You could tell the kids were processing. One of the directions were like, "Make this with two obtuse angles." They were like, "Oh, yeah." You could visibly hear the oh's in the classroom of that discovery and I think ... Thinking about concrete, pictorial, abstract. The concrete stuff that's happening right now which is really, every kid can access and every kid can respond to it, which is really awesome. I was wondering if, when you ask questions in class, do you just wait for kids to raise their hands, or do you just call on whoever you want to?

Speaker 4: Yeah. That's something I noticed. I was like, "Jeez, because a lot of kids were just shouting out incorrect answers." I think because this was more, this activity was more like a review. Let's work in quadrilaterals. [inaudible 00:05:57] make sure they got it. You could tell from the previous day that some kids were still confused about the angle measurements. I wanted them to kind of build it so they could go a little bit deeper with triangles.

Yeah. That was something that, I think I was trying to go more rapid fire, so there was a lot of kids that were shouting out answers. It was kind of hard to make sure I was really hearing individual student thinking and then following up with kids who didn't have it correct. Yeah, it's something that I noticed as well. There were some kids that were shouting out for random things.

Speaker 2: Yeah.

Speaker 4: I was like, "Oh, that didn't make sense there."

Speaker 3: Bigger! Then if you don't react, "Okay, smaller!"

Speaker 4: Yeah! [crosstalk 00:06:27] I was like, "Oh no."

Speaker 2: Just kidding! They're open. They're open.

Speaker 4: Then some parts I was like, "Oh, that's not okay. I should have checked in." That's what I said.

Speaker 2: That's what ... yeah. It seemed like from the pace in which you were going, it was like, "We should all know this. Let's make sure we're all on the same page."

Speaker 4: Yeah.

Speaker 2: I think that if it was moving into introducing new material, you would not be going at that pace.

Speaker 4: Yeah, right.

Speaker 2: You would, there's times where I ... when I was, yeah, the context. I just was annotating give ten seconds for kids to write down why they think it's not a triangle. What do they notice about the angles? Are they getting bigger, smaller, [inaudible 00:07:10]. I think that it was new stuff, then you would obviously take that time, but if it's stuff that they should know, and that they've reviewed before ...

Speaker 4: Did you have the math notebooks that the kids just write it down on?

Speaker 2: No, we ... I'm just starting to do that this year. I noticed after the first twelve weeks, I was like, "Wow. I'm asking a lot of everybody questions." I used to do that where I'd be like, "Everybody, what's the area formula for a triangle?" One kid would be like, "[inaudible 00:07:39]. Now, I've started to say find some space [inaudible 00:07:46] your response. I think they're getting it. I was doing this, I was thinking about [inaudible 00:07:50].

Speaker 4: Yeah.

Speaker 2: Where kids can just ask random questions, and you have to write it down and think about it.

Speaker 4: Mm-hmm (affirmative)-

Speaker 2: That way they can capture their thoughts. The instructional coach at school said she keeps one for her own job, she keeps another for herself. She said you might want to have that kind of drill, you know the one for kids. That way they can access their own notes which are meaningful to them.

Speaker 3: I wonder about, I felt like where you really, didn't know whether they got it or not was the one eighty party.

Speaker 4: Mm-hmm (affirmative)-

Speaker 3: I totally get that this is not necessarily fourth grade.

Speaker 4: Right. That's what I was wondering--

Speaker 3: [crosstalk 00:08:40] .

Speaker 4: Yep.

Speaker 3: One of the things that I think is so helpful about knowing that is that then kids know they can't have a triangle with two right angles or two obtuse angles. Those two angles already total one eighty or more.

Speaker 2: Yeah.

Speaker 3: There's no room left in the one eighty for a third angle. Right?

Speaker 4: Yep.

Speaker 3: I think they didn't make that connection. There wasn't a point where you said, "How many degrees is a right angle? Okay, that's one. Then what if we had a second right, how many degrees would that be?"

Speaker 4: Mm-hmm (affirmative)-

Speaker 3: "Okay so if we got a ninety and ninety, and the total of our triangle is one eighty. How many degrees are left over for the third angle?"

Speaker 4: Right.

Speaker 1: Zero.

Speaker 2: [crosstalk 00:09:27].

Speaker 3: Oh. You know, and like that sort of process.

Speaker 4: That's a bit of the part of the reason why I did that. In the planning, I think that's what we thought. I feel like it didn't come across. [crosstalk 00:09:36]. I knew I felt like I should say one eighty because to me that makes sense. Oh, ninety and ninety, you're already one eighty. You're already at your goal.

Speaker 3: Right.

Speaker 4: Yeah-

Speaker 3: You said it sort of later on, you said...

Speaker 2: The one fifty has to be ten or twenty.

Speaker 3: Yeah. Yeah. You're like maybe this one's one fifty and this one or this one of these two over here might be ten and twenty. Cool. You got a triangle but there's going to be a kid whose still like, "I'm going to make a hundred fifty degree angle, and then a hundred forty degree angle, and it's going to be a triangle. I'm going to make it work."

Speaker 4: Yeah.

Speaker 3: They're still missing that idea like dude, if you are over one eighty it's just-

Speaker 2: You're jacked.

Speaker 3: It's just not going to happen.

Speaker 4: Mm-hmm (affirmative)-

Speaker 3: It's totally your call whether you do something with them like that. It's not actually something you they need to know for fourth grade.

Speaker 4: Right. Right.

Speaker 3: If you're going to introduce the idea, then you want to make sure there's something for them to hang on, I think.

Speaker 4: Mm-hmm (affirmative)-

Speaker 2: Yeah.

Speaker 4: Mm-hmm (affirmative)-

Speaker 3: We talked earlier about like, you want some kid to be like, "Dude, you know, it's impossible." Right?

Speaker 4: Mm-hmm (affirmative)-

Speaker 3: Nobody seems to be making that connection. That it's impossible. They were just like, "Well, the angles have to get smaller." They weren't connecting the degree measurements to the angles getting smaller, I think.

Speaker 4: Mm-hmm (affirmative)-

Speaker 1: I think the reason that happened is because she challenged the kids to create-

Speaker 4: Another one.

Speaker 1: -a triangle that had two obtuse angles.

Speaker 4: Yeah.

Speaker 1: The kids are saying, "Well, the teacher says I need to do this. I'm going to do my darnedest to [crosstalk 00:11:07].

Speaker 3: I love this tape. I'm going to make [crosstalk 00:11:11].

Speaker 1: I love the part where they just keep laughing and they can't stop. Eighty four says they're going to keep going and going for a triangle. They're supposed to be getting closer to each other. This does not work. Then you say, "Have you ever seen a triangle with two obtuse angles? It's actually possible." [crosstalk 00:11:32] . It's not possible. Like you see a ghost. It's not possible.

Speaker 3: If you see a triangle with two obtuse angles, you're actually in a parallel universe where that's possible.

Speaker 4: [crosstalk 00:11:42].

Speaker 3: You know, like you were saying until you actually see what you say, right?

Speaker 4: Yeah, I know. That's why I'm glad- [crosstalk 00:11:55] when you read it, it's like, did you ever see that? You actually did not see that.

Speaker 2: That's awesome.

Speaker 3: Right. Do not trust your eyes. You might see things. Yeah.

Speaker 2: That's great.

Speaker 3: I feel like I love the geo-boards though in many ways didn't make their thinking visible.

Speaker 4: Mm-hmm (affirmative)-

Speaker 3: Right? We couldn't see that on camera because we couldn't see it.

Speaker 4: Right.

Speaker 3: You were able to go around-

Speaker 4: This is where the helmet cam, that I forgot it did-

Speaker 3: Yeah. No GoPro this time. [crosstalk 00:12:17]. I think this is a good example of how actually you are able to access kid's thinking.

Speaker 4: Mm-hmm (affirmative)- Through the geo-board. When you have kids stop and jot, it's like you're really seeing it or-

Speaker 2: Yeah. I feel like that's so important when I think about... thinking about my students, they're in math eight because they can't take algebra. Right? I don't know what I was thinking, thinking that they could think that quickly on their feet and respond. When probably three fourths of the time I'm talking to them, they're [inaudible 00:12:57]. When someone in there answers the question, I didn't tell them to think about that.

Speaker 3: Mm-hmm (affirmative)-

Speaker 4: Yep.

Speaker 2: Being able to use the geo-boards to see what students are thinking, and even see them struggle with making the triangles. That's just really invaluable.

Speaker 3: Mm-hmm (affirmative) there was a point when I didn't have geo-boards. We just didn't have those. I certainly didn't have all this other technology. I just took three long pieces of strips of paper with brads.

Speaker 4: Oh, okay.

Speaker 3: That the kids could make the different triangle shapes. Right? They could make them different lengths. It's okay if you have some hanging out on the other side depending upon how you do it.

Speaker 4: Yeah.

Speaker 3: It was helpful for them to be like, here are my two right angles. I guess, I have to bring them together if I... Either this comes here or this comes here or they both come together but there has to be something. I think the fact that you're using the geo-boards is helping them...

Speaker 4: Mm-hmm (affirmative)-

Speaker 3: -see that. They definitely need more connections really, I think.

Speaker 4: Mm-hmm (affirmative)- Mm-hmm (affirmative)- More concrete. That is the answer I keep getting, more concrete. It's evident that we're so soon to get rid of concrete because we're like, we have to get them to this. I feel like everything I've learned so far through [inaudible 00:14:08] just should be more concrete.

Speaker 3: Mm-hmm (affirmative)- Well, and figuring out how to bridge the concrete [crosstalk 00:14:16].

Speaker 2: There's ways in which... I think when I first learned about it... I think even in college, I had to write lots of plans where I was how do you teach concrete? How do you teach pictorial? How do you teach in to abstract? I was literally writing three lesson plans in a row.

Speaker 4: Yeah.

Speaker 2: They were twenty pages long. Never said that would actually happen [inaudible 00:14:37]. If I did it on my own, you kind of do all three at the same time.

Speaker 4: Mm-hmm (affirmative)-

Speaker 2: Or you do two of them at the same time. Where you can introduce your pictorial and abstract.

Speaker 3: Mm-hmm (affirmative)-

Speaker 2: I think in this example, one thing you could do is whatever they're making on the geo-board, they're drawing on paper as a record. Here's where I made two obtuse angles with three line segments.

Speaker 3: Right, this is what it looked like.

Speaker 2: This is what it looks like. Is it a triangle? No, write down why it's not a triangle. The kids write their reasons. Then they have their thought in a box, and they have the class thought that they all came up with.

Speaker 3: Mm-hmm (affirmative)-

Speaker 2: Then when they do, what's one of those things. Clair was just doing a lesson for... something we're learning about in math content but one of the things she was trying to do is saying no triangles can have... Two sides of one triangle have to be greater than the other side.

Speaker 3: Mm-hmm (affirmative)-

Speaker 2: What do you have?

Speaker 3: You've been working on that too?

Speaker 2: Yeah.

Speaker 4: That two sides of one triangle have to be greater than the other.

Speaker 2: Yeah. She was saying, "How do I do that where kids are discovering this concretely without showing them examples?"

Speaker 3: Mm-hmm (affirmative)-

Speaker 2: She came up with a way of, kind of like a, what do you call it? Pipe cleaner. I had several of them where it was two three seven but you could never make a triangle with that.

Speaker 4: Mm-hmm (affirmative)-

Speaker 2: I mean, kids do a bunch of those where it's impossible to make it. Then record their thoughts, and then present that to another group, who all their triangles worked. They noticed this makes circles or...

Speaker 1: Yeah. One thing I was just thinking about was; for example, having a circle like this, and every kid has a circle. Then that circle you can go ahead and put three dots, and then create some pre-made triangles before hand.

Speaker 2: Mm-hmm (affirmative)-

Speaker 1: Then cut them up. Then for example, you can make something of all those angles. Then all right, let's put our angles on this circle, and when will these angles that you had, these three random angles that you got, create a triangle? Of course, as they get a ninety, a ninety, and a ninety, they'll try to fix them and they'll never work. If they do get a ninety and a forty five, hopefully they'll figure out, "Oh, I need another forty five to make it work." So they can actually figure out on their own that you may have a gazillion angles but there's only a correct three combinations that will equal some magic number. After trial and error, all the numbers, whatever the mixture they are will only happen when they're all one eighty.

Speaker 2: Yeah.

Speaker 4: Mm-hmm (affirmative)- Yeah, I thought so.

Speaker 2: I think that doing concrete and pictorial and recording. Then doing pictorial abstract and recording. Then doing abstract, the kids have to draw their own conclusion.

Speaker 3: Mm-hmm (affirmative)-

Speaker 2: I think that that's-

Speaker 3: Mm-hmm (affirmative)-

Speaker 2: -seems to be the magic ticket.

Speaker 3: Mm-hmm (affirmative)-

Speaker 2: I think, unfortunately, takes longer [inaudible 00:17:38].

Speaker 3: Right.

Speaker 4: Mm-hmm (affirmative)-

Speaker 2: I don't know about you all but I don't have all day to teach the rest of these.

Speaker 3: Mm-hmm (affirmative)-

Speaker 4: That's what I was [crosstalk 00:17:49]. That's why I asked you earlier about the teets and how you were doing with that.

Speaker 3: Well, if you think about with the challenge is always to figure out how everything that we're teaching is related.

Speaker 4: Mm-hmm (affirmative)-

Speaker 3: If you take more than a day it's because you're getting at king of a bigger idea [crosstalk 00:18:07].

Speaker 2: Yeah.

Speaker 3: Smaller things, you know? We have this temptation to break everything down into bite size pieces. Then you don't realize that you, the ridiculous analogy I use is, you spend all year eating a bite here and eating a bite there and not realize that you ate an entire chicken.

Speaker 2: Yeah.

Speaker 3: Right? You just know you ate a bunch of stuff. Right?

Speaker 4: Mm-hmm (affirmative)-

Speaker 3: Oh yeah. I spent all this, I can check all of these boxes of these different skills that I have but I don't understand that actually there are these big over origin ideas. I think that's the beauty of planning and stuff we talked about last summer. There's a way to help kids connect to all the different ideas around the triangle stuff that you're working on. You don't lose as much time as you think you might.

Speaker 2: Yeah.

Speaker 3: If that makes sense.

Speaker 2: The other thing too is that, I think the more kids are more for visible refined than a year ago in math, when I didn't even teach it. When they would create common assessments, the application for response part would be left utterly blank. Kids wouldn't know what to do. Kids would write down in a sentence that because as an entire district, we've moved to a different type of curriculum. We're really forcing our kids to put their thoughts down. Write down their reasons and rational and just their [crosstalk 00:19:29]. I think we're getting stuff back where it's just like... even if it's not right. Kids are at least saying this is why I think this is true.

Speaker 3: Mm-hmm (affirmative)-

Speaker 2: The more, now that they're primed to do that, it's much more efficient. It's like those moments where it's stop and drop in class it's not like I'm pulling teeth to do that. Kids are like [inaudible 00:19:49] real quick.

Speaker 4: Mm-hmm (affirmative)-

Speaker 2: Right? Maybe-

Speaker 4: Because it's more of a habit in your class.

Speaker 2: This ones a habit. Once it becomes a habit, maybe it's not going to take as much time to do something like this because kids are more used to it.

Speaker 3: Right. Do you have a guided notes packet for your week with all the ideas from that big topic?

Speaker 2: Yeah.

Speaker 3: You're hitting what you need to hit for the week but the connection is a little more obvious or-

Speaker 2: Yeah.

Speaker 3: -the systems are in place and there's no alliance or anything?

Speaker 2: Yeah.

Speaker 4: Yeah.

Speaker 2: Requires such a general idea.

Speaker 3: I definitely- [crosstalk 00:20:28].

Speaker 4: I think, yeah. I think there's huge benefits to it but...

Speaker 3: Yeah. I think you got to be careful right? If you always do guided notes then kids never learn to takes notes of their own. Right?

Speaker 2: Yeah.

Speaker 3: If you think about something like this where I do this a lot. I use so many [inaudible 00:20:47] in my class, I wanted them to have a record of what manipulative showed.

Speaker 2: Yeah.

Speaker 3: We would build something based on blocks and they would draw what they built, and then they would represent it with numbers. They had to do all those things. If we can think about ways to build that connection piece in... Maybe some of them were getting confused about obtuse and acute just because they haven't labeled them enough. Written the word enough next to a small angle, you know? Not because they really don't know it. Not because you haven't taught it but because they just need to practice like anyone else, you know?

Speaker 2: Yeah. That's the other thing. I feel like... When I think about what you need to do concretely, manipulative wise, pictorially to make the concept very real. Even the practice in that tends to take a class period or a little bit more.

Speaker 3: Mm-hmm (affirmative)-

Speaker 2: Then you have to also just have to give them time to practice. Yes, they have homework but maybe that's not always done to the best of their ability. You also need thirty minutes the next day for them just to do whatever they need to to process.

Speaker 4: Yep. Mm-hmm (affirmative)-

Speaker 2: That's for me, the past four weeks with construction. We did simple and compound interest and loans and financial planning. It was never finished in a day. It was always like, I did this in a day, and then I took like twenty minutes in the next class, and then I went into the lesson for that day. We didn't really get to practice a lot.

Speaker 3: You did it the following day.

Speaker 2: Yeah, the following day, and then the next. Nothing I've made for homework ever was what I gave for homework. I was like, "I'm just kidding. Circle these problems, and I don't want you to answer those. I just want you to do this one part of it."

Speaker 3: Mm-hmm (affirmative)-

Speaker 2: It sucked because I really hold them accountable to their homework so I forgot what I told them. That idea of it needs to be fluid. It's hard. You feel like you need to check off five boxes...

Speaker 3: Right.

Speaker 4: Mm-hmm (affirmative)-

Speaker 2: It can happen.

Speaker 4: Balancing the buck straightening this.

Speaker 3: Right.

Speaker 4: I think especially in this profession, I think everyone feels like they can only do so much. Especially with grad school and other... I feel like I want to say, "Kids did this and this and this," and then she's like yeah. Then I worry that sometimes our kids have a very speckled picture of what math is. Math should be a very beautiful thing of how everything is interlaced.

Speaker 2: [crosstalk 00:23:03]

Speaker 4: I feel like a lot of times I don't teach that way because I'm like, "Oh, dang it. We have to do this and this." Yeah.

Speaker 3: Well, that's-

Video Club 3 – 3.09.15, Kyle shares

Speaker 1: Kyle, at the beginning Asio was telling you the next term. Thinking that it's the 12th. Not understanding the 12th term concept.

Kyle: Doing what you were saying which is, the pattern is that and then repeating.

Speaker 1: Although, maybe not.

Kyle: Maybe not.

Speaker 1: Maybe I'll give [crosstalk 00:00:19].

Kyle: Might be here [inaudible 00:00:21], but I think you can do it.

Speaker 1: He gave the answer ... Asio said that it's down because he was like, "Here's the 6th one." He basically listened to the next shape in the pattern and said, "That one. It's down." For whatever reason didn't get the 12th term, he got the next term.

Jenny: Oh, he just got to the next one. I see what you're saying.

Kyle: When I did a quick poll it was half the kids said it was down and half the kids said it was up.

Farrah: Were any saying side to side?

Kyle: No.

Farrah: Okay, that's how you know, because you could check.

Kyle: Then I was like, "Okay we need to take some time to talk about this."

Jenny: You identified the misconception in the moment?

Kyle: Right.

Speaker 1: One of my thoughts was, did a kid ... This is probably not what they did, but I wondered if the kid looked at it, said "The next term is ... It would be down, right? That's the 6th one and 6 times 2 is 12"

Jenny: That's what I was wondering, doubling.

Speaker 1: "Is it also the 12th one?" Did they just find the next one and stop? I think it's more likely that they just found the next one.

Kyle: That's my assumption.

Speaker 1: It's possible. We don't know.

Farrah: When you said "This is 1st, 2nd, 3rd, 4th, 5th, 6th, is that the 12th?" You could have had the students actually say, "You all think that the 12th term is down? Okay, so everyone," and not giving away who's right or wrong. Down here when you were like, "If you thought it was this then you better be drawing it out." Having them say, "Now that you have your answer, number your terms and then go back and read the problem again." Something like ... I do the same thing, "1st, 2nd, 3rd, 4th, 6th, is that the 12th?"

Speaker 1: It's hard not to do that.

Farrah: It's really hard, especially when you're pressed for time.

Speaker 1: Points where you felt like you could see what kids were thinking?

Jenny: The one girl, the one that was talking about the arrow going up and down. How she could kind of visualized it. You can tell she's more of a visual learner because I didn't see the arrow, I was thinking more mathematically. I don't know if that was something that you wanted to do when you were asking the different kids, but one way I was thinking about doing this was having the kids count it out. Right, down, left, up, right, down, left, up so then they know that they're repeating 4s. Then we'll go, "Okay, well it's 1, 2, 3, 4. The 12th would be whatever the 4th is times 3." A different ways to see it. She's a more visual learner, where some of your more math-y kids would have been like, "I don't see it." They're not used to drawing things out. They could have just seen the pattern and extrapolated that way.

Farrah: I thought that was really cool that she saw that. If the arrows are pointing out, it's going up. If they're pointing in, it's going down. Smarty pants.

Speaker 1: Well that's interesting because similar to what you said Jenny, I saw this as a group of 4 that repeats, but if you go by what Farrah said then it's a group of 3 then a shared group of 3. The second ... The left facing arrows gets shared.

Jenny: Kind of like the toothpick problem.

Speaker 1: It overlaps.

Farrah: An extension could have been clockwise counter clockwise and if you did counter would it have changed? Where would it have changed? Where would it have not changed the term? Then whenever the girl was like, you already know this. Whenever the girl was like, "You said the arrow is up, why is the arrow up?" Because it's the 12th term. It is because it is. Pushing her and saying, "You're telling me that the 12th term is up. You're telling me that when it's up, that's the 12th term. I get that, but how do you know?" Pushing her to explain her thinking.

Speaker 1: You're talking about Freddy?

Farrah: I think Melissa. Freddy, Melissa. Freddy [inaudible 00:04:35]. Oh, it is Freddy. Right before Melissa.

Kyle: I thought that was the moment where he typically usually explains a little bit further and so when he didn't I was like, "We don't have time." I think this was all supposed to be a really quick intro.

Speaker 1: Took a lot longer than you expected.

Kyle: It look way longer.

Farrah: You were probably really thrown off when half of them had their thumb down and their pen down. [crosstalk 00:04:58] You were probably like "What?"

Jenny: That's the worst.

Farrah: Way to keep your cool because even if my 5th graders had done that I would have just been like ... I just have these moments where I'm just like, "Half of you have this wrong. We spent so much time on this.."

Kyle: You should know this.

Farrah: I take it personally.

Jenny: I do too. I'm so glad we're having this conversation because I'm like, "Oh, okay. I'm not going crazy."

Kyle: If we were watching [crosstalk 00:05:22] video, you would have felt my frustration with some students. I didn't go off on anybody.

Farrah: What time of day is this?

Kyle: This is 6th, 7th. It's right after lunch, right after homeroom. It's also the class that last time we met we watched this, Alex knows, we've had like 7 kids who've been retained before. It's a ton of kids who are Ell, still doing [inaudible 00:05:46] writing samples. We have 2 kids who are ... This is their first year at Yes. It's really-

Jenny: Tough class.

Kyle: It's a lot of ... I've noticed that too when I flip to the N word pages like the 2nd and 3rd. Ash was like, "Crap, I didn't even think I was talking that much." When you compare the chunk ... I feel like that's what we saw with [crosstalk 00:06:13]. I didn't realize. When I got evaluated on this by Kieth. The feedback was the ratio wasn't actually a tie. It was half of student thinking to my thinking as I thought.

Farrah: I just commend you for keeping your cool because I would have been extremely frustrated by that. That's why I'm having trouble sending my videos to Whitney because I need to have a day where I don't yell because I get frustrated.

Kyle: I think that's valuable.

Jenny: I think that's better because-

Kyle: That's why I was actually really frustrated how my video on Thursday was like. I wanted to see when you are frustrated and you still need to get through stuff. How do we do the things teachers ... How do we [inaudible 00:07:02] contrasting. How do we stop and just say, "One of my kids [inaudible 00:07:06] my kids are continuing to disrupt." What am I going to do instead?

Jenny: What's my plan B?

Farrah: I've had moments where I'm like, "You know what? Put your hands down and I'm going to show you." I hate that.

Kyle: I hate that too.

Farrah: The clock is ticking, the test is coming and I'm like, "That's it put your hands down." Then I try to model a few more before asking them questions because sometimes I think when that happens it's because my modeling wasn't either good enough or it wasn't long enough, but I don't want my modeling that long. [crosstalk 00:07:41] find that balance.

Kyle: I also I thought if I'm thinking about my Thursday lesson which was ... We did some composite numbers and we found the area ... I'd give them 1 and they were going to do it, I brought a kid up to explain it and we wanted to derive the process of look for the shapes, write the formulas, find the [inaudible 00:07:58] points and just go.

That took a long time to get to and I felt like what I should have done is ... A lot of people are interrupting me, I'm just going to give the exit ticket out now. You're going to give it to me, I'll grade it. Once I've graded everybody's, you can work on the homework pages. If everyone is getting 100% then we'll just work on homework. Even if 1 of us fails it that means that we haven't mastered this yet.

I don't know if that's a good way of just exposing the kids to, "If this is the way you're telling me that you don't me to give you any support or you don't need any practice because you've been interrupting me. Then you're going to prove to me that I'm just [inaudible 00:08:35]."

Speaker 1: Right, I need to find out, are you acting this way because you're so frustrated with the material that you're totally disengaged or are you acting this way because you totally get it and you really need to stop talking about it. Now may be the time [inaudible 00:08:48] every now and then you may need to do that right?

Kyle: What's interesting is I think that for 2/3rds of that class that are quieter ones that just work hard.

Farrah: They're nice?

Kyle: Yeah, they're nice.

Farrah: You're a kipster and you didn't even know it.

Kyle: They probably would have done fine and the kids that were frustrated and kept disrupting were probably the ones that needed it the most. That could have been real easy to have been like "You 5, you failed this. Why? Let's do a lot of practice problems. Everybody else, work independently if you don't have homework."

Speaker 5: Can I make a quick comment?

Speaker 1: Please.

Speaker 5: One of the DOIs, Katy Washburn, at east end was facilitating a PD session on managing your emotional wake. Part of it was knowing your trigger. Really she was pushing teachers to be like, "What is your trigger? What is the thing that when it happens you know that you're lesson is going down hill, you're going down hill."

Farrah: [inaudible 00:09:41] trigger and I still pull it.

Speaker 5: It's good to get pulled. Either you're going to pull it or they're going to pull it, but when it gets pulled, what is your go to for that?

Speaker 1: Do you have an escape plan?

Speaker 5: You feel it, that you have your escape plan and you're like, "Okay for the next 30 seconds I want everyone to stop and write about blah." It has been pulled, I've pulled it, they've pulled it. Something is going on. To have that backup plan, it's like your breaking case for emergency, but this is what you're going to do for 30 seconds while you inwardly want to get out of my system.

Speaker 5: [crosstalk 00:10:21]. Planning for it.

Kyle: It's different in this moment because it didn't feel like I needed to lose my cool because it was cognitive. We either [inaudible 00:10:29] reading comprehensions part, there was a thinking processing part and I'm find with coaching that. What pulls my trigger is people are just blatantly disrupting that [crosstalk 00:10:39] kindly ask you to be a good person and you're just continually bothering everyone else.

Farrah: The reason that would have pulled my trigger because I have these moments where I'm like, "How do you not know this?" There are things that I have re-looped, I have reviewed, it has been in the do now, it has been in the homework. You've demonstrated success on it before and then it's just like the short term memory or the long term memory rather is just-

Kyle: Why wasn't it sticking? I thought I did the conceptual, concrete, explore, explain and it still isn't there.

Jenny: I sometimes feel like ... In the past I've been more like, "I do, we do, you do." Maybe more like a mix of all that. This year I've been trying way more to do more 5V or a lot more exploratory, conceptual kid building stuff. I feel like it doesn't seem as sticky to me for some reason and maybe just because I'm not the great facilitator that I need to be and I can keep working on that. I feel like sometimes here how you were wanting the kids to talk more.

I feel like you eventually do just as much talking as you would have done if you would have been, "This is how we should do it." Which I'm not saying that's the right answer, but I too worry sometimes when I have the kids talking more. Sometimes I feel that they're not the best at listening to each other. I feel like that one kid that had that really great point [inaudible 00:11:59]. Did anyone even hear that and understand what she said. Maybe the people at her table did, but is that wasted learning time for the other 20 kids just sitting there.

The kid that doesn't understand all these cool amazing things about math, the nerd about math and be like, "Guys there are 6 different ways to multiple 2 by 2." I will show them all these ways and by the 5th time they're like ... I'm like this is awesome.

Farrah: It's 4 right?

Jenny: Exactly, and I'm like, "Oh my god. I literally just did all that for them."

Kyle: What's been interesting is that other times I have, like that last semester when I put kids in front to explain, it's really like fruit falling [inaudible 00:12:33].

Jenny: Right, sometimes it's beautiful.

Kyle: This was an instance where it was decent. One of the things we saw when Denny showed us his video is that he had developed some structures where it was just at your table. Actually when I did my character strength lesson it was just partners. It was work on this for 5 minutes, stop, you got 1 minute to explain your work, you got 1 minute to explain your work. You got a minute to make sure all the work is the same and you agree. Shut up, work for another 5 minutes then explain.

Jenny: Instead of it all being a whole group.

Kyle: Yeah, instead of it all being a whole group. Then I got a chance to check on the groups and circulate. At any point in time, whether they were working independently or they were talking, I could just interrupt them and say, "Have you thought about this? Have you thought about this? Check over here." Which I think actually worked really well for this particular class of students.

Jenny: Interesting. Probably more processing time which is good.

Kyle: Alex hasn't said anything yet.

Farrah: I've been noticing that too.

Speaker 1: Do you have anything you want to add?

Alex: How many, 5 things we are supposed to say about our group-

Speaker 1: No, you can just talk about-

Kyle: You can tell me 5 things you think sucked.

Speaker 1: It's not feedback per say, it's just what did you-

Alex: No, I wanted to hear everything that Kyle had to say before I said something. I just wanted to hear his justification. That was his class, what happened before, what happened afterwards. I learned a lot of points that I really did like. When you were asking the kids if they didn't know any words and obviously they didn't know, but they just didn't want to say anything. At least you said, "Hey let me know." They didn't want to.

Speaker 1: Well you actually edited some out where you did [crosstalk 00:14:08].

Kyle: One of them was diorama and I was like, "This is the word for the problem, but it's not an important word for the math." I think that's even a good conversation to have them like-

Farrah: We've had those conversations. My kiddos had to do ... It was before we had touched on geometry and it was where they had to figure out ... Okay, the problem says, "A pentagon has 5 sides." There's a chart and it says, "One pentagon would be this many sides, two pentagons would be that many sides."

They have to find the pattern and they have to say, "If there's 9 pentagons, how many sides is that?"

I had a little girl raise her hand and call me over. She was really trying to persist. She was really trying hard, she struggled and she was like, "Mrs. Brenner, I'm really trying, but I just don't know what a pentagon is." She wanted me to tell her what a pentagon was and I caught myself and I didn't want to tell her. I wanted to say, "You know Emily, sometimes there's words that you won't know in a math problem and you have to find your way around those words." What if she take the Star test and there's a word she doesn't know, she's going to give up. I told her, "Sometimes you have to find your way around those words to see if you can pull out the math and still solve the problem. I want you to sit there and I want you to keep trying. I'm going to come back and check on you."

I came back and checked on her and she had figured it out. A pentagon has 5 sides, you don't need to know what it looks like, honey, but it has 5 sides. How many sides 2 of them got? 10. She ended up figuring it out. Even them understanding the vocabulary, there's always going to be a word that you don't know, there just is.

Alex: I liked the other part where he had also mentioned that I guess he had it ingrained in a couple kids to speak complete sentences. I like how that came back [crosstalk 00:15:48] and saw that kid trying to interrupt and he was like, "Hey you have to speak in complete." The best thing about speaking in complete sentences is because once the human brain has let out some sounds or sentences then it better understands when it's correct and if it's wrong and someone tells you that that's wrong then you're complete idea ... it's broken down. You're like, "Wow." You're actually reforming a complete idea when someone corrects you. That was the thing I liked about that.

The other one is like you were mentioning also, and I'm glad you said that. There's this gigantic chunk in the back of the first page of you explain everything and then you tell the kids, "All right now you have 10 seconds to do it." There was no process time at all and the kids are like inhaling all this information. You have 10 seconds to give it back to me and a little wait time would have been good there. The other thing I mentioned before is this lesson, was it the first time they saw patterns?

Kyle: I would say in their entire math lives, definitely not, but it was the first time that we had done any pattern work because this was kind of the first day.

Alex: This is like I told you before, it would have been a cool to have those manipulative out there, the real toothpicks.

Jenny: The clock would have been awesome too.

Alex: The real beads, the real cord. To stand back and say, "Anybody make the prettiest necklace with the most beautiful pattern." Let them make their own pattern, their own necklace. Then explain what you're pattern is or if you like, you can pick a kid to explain what your pattern is. Here's some toothpicks. Instead of making houses like this picture, I challenge you to make something else that repeats itself. Questions, I have a pair of scissors. I'm going to fold this paper in half and I'm going to start cutting, cutting and watch magical presto. I got about 7 dolls and they're like [crosstalk 00:17:46].

Speaker 1: I think part of why they struggle with that 10 second piece is that if you had said, before you read the instructions, "How many houses are there?"

Kyle: Exactly.

Speaker 1: Right? They were trying to apply everything you just read and you set up the table.

Farrah: Did you see me when I was like "What?" [crosstalk 00:18:06].

Speaker 1: You were ready to fill in the table [crosstalk 00:18:09], but then they were asked to go back up.

Farrah: He was just like, "How many houses?"

Jenny: Can I give you some general feedback about that too, because I was reading that too. I was reading that too. It's really funny because ... This is great because I feel like I'm learning all these things that I didn't know like, "Oh my God, why did I do that, but everyone does that. It's okay." I feel like the question you're asking, how many houses do you see, obviously that's very low level ... Look at the picture, it's 3.

I feel like I often times ask that question just as a little pulse check, but if you look at the time, the actual amount of time you took to make them say 3, it was a long time. No math is really being present, that's a recall, let's make sure we understand. Even if you wanted to you could be like, "1, 2, 3." Takes 3 seconds. Then taking 10 seconds, then say 3, and they all argue about the complete sentences it's just like jeez. You just got to get them to say it's 3.

Kyle: Can you just count 3 squares [crosstalk 00:19:02].

Jenny: When I ask them the easiest question it's actually when we take the longest time. It's almost like I have ... "I'm about to say 3," and they're like ... and I'm like, "Just say 3." Then I'm like, "Oh my God. Why did I even ask that question if I already knew everyone knows it?" That's very common [inaudible 00:19:19] something all of us.

I think sometimes when we look at our lesson plans, just we be like, "What's the foundational thing that we have to make sure everyone knows?" Yes, 3 houses is really important. Do I really need to ask this many kids to make sure they get it? No, class let's just count, 1, 2, 3 done. Now let's take more time.

Kyle: Not letting that derail from the actual application.

Jenny: The actual application of the patterns.

Farrah: Just one last super important point.

Kyle: How important?

Jenny: Super important.

Farrah: It's super important. Go to line 64, you see where he says, "I just want you to look at the picture and somewhere in the blank space." That would have a perfect opportunity or a Taylor Swift reference.

Kyle: That's really true. No, because her album wasn't out yet.

Farrah: Oh no.

Speaker 1: This was before then.

Kyle: I actually did reference Taylor Swift when we talked about blank spaces last week.

Farrah: Every time I'm like, "See this blank space? I'll write your name." The girls are like "Mrs. Brenner, that's getting old."

Jenny: Oh my God, I'm going to use that on Monday.

Farrah: 4th graders you think…

Video Club 3 – 3.09.15, Alex shares

Speaker 1: Just a little bit about this lesson. This was what, last week? Two weeks ago? A couple weeks ago?

Speaker 2: I think about two weeks ago. We were doing the geometry and area and volume units, and one of the [inaudible 00:00:12] says that students should know that the number of degrees in a triangle, which is one hundred eighty, and that lesson was going to be easy. They figured that out very quickly. Then the next part about the triangles they had to figure out were the names of those triangles, they knew those from last year so that wasn't difficult at all. The other part was to know a property called a triangular inequality property. What it states is that the sum of two sides have to be larger than the length of the third side in order for a triangle to be formed. I didn't want to tell them that, I wanted them to figure that out. I didn't mention the name of the property, I just wanted to see if they could come to that understanding.

In the first two groups if you notice that there's manipulatives on the table. I created a wonderful little game that had dice and had scores and had boxes and charts and questions. After that my blood pressure went up because they couldn't figure it out. They were able to make the triangles, but they didn't come up with the property itself which I would have wanted them to say that the sum of two sides has to be bigger than the third. It didn't work so I threw that out the window and I said let me just do something that I normally do which is just ask questions and let them figure it out.

Speaker 1: Can we pause one second? What was the manipulative? Can you explain a little more about the manipulative?

Speaker 2: They had to get in groups and they roll the die, there's three die, and each die will tell you the length of the side that you would get from your packet so it was one inch, two inch, three inch, four inch, five inch and six inches. If you rolled the three dice and then pushed in with three sixes you were able to put them together in a triangle that had six, six and six is an equilateral triangle. Every time they did that they were like "yeah we could form a triangle," but what happens when they got one, one and six. Then those two little ends wouldn't be able to connect to the long line.

Speaker 1: Did you make pieces that were six, five-

Speaker 2: Yes, and they were all color-coded.

Speaker 1: Where could you see kids were thinking something, whether it was right or wrong? Where was it evident?

Speaker 2: Just one thing. The little girl who answered those two questions completely wrong, the little girl on the right-hand-side of the class. She's a special ed kid and-

Speaker 3: The one in the corner?

Speaker 2: No, the little girl who said, remember-

Speaker 1: Five and then twenty-five

Speaker 2: She's special ed and the great thing about the kids is that no one laughed at her. They know she participates a lot and a lot of the time she gets the answer wrong so just kudos to the kids for not laughing at her.

Speaker 4: I think that speaks to the culture you have in your class where every kid is shouting out, or when they know it's not time to shout out the answer there all raising their hands, I mean at least two-thirds or three-fourths of the kids are ready and processing. I think what I really liked was how visual you made it, it wasn't- I mean if you're thinking about doing the Five E thing, this is the exploration part. You did a little activity and it didn't work so you just flipped to how I'd share this usually. This is exploring, it's thinking about if we're forty feet across and we have to five feet bridges they're not going to make it. You kept adding and so you made the numbers really concrete and simple for them to access and so the kids were able to say this isn't going to work, this isn't going to work, and then once it hit the magic number it was like, okay cool.

What I also really liked about this is that both of them being twenty is fine for the bridge, but it's not fine for the triangle. You kind of allowed them to think incorrectly first so then when it became a triangle part the bridge thing no longer worked, we had to think about more geometric mathematical reasoning, which I liked.

Speaker 1: What else?

Speaker 3: I think your real world example that you used was an awesome [inaudible 00:04:31] I think you made it very concrete and it was very much like this draw-bridge example. Kids had a concrete goal, they wanted to get to McDonald's and you kind of made it more fun and engaging. I think if you just had the kind you first started with which was the triangles that was awesome too because it was concrete, but then actually thinking about this has to connect and then knowing that. It was just a really awesome example to make sure you're getting more student thinking because if it was- it was something very concrete so I feel like that helped them make more connections.

Speaker 4: Yeah I thought that switch from lets imagine the draw-bridge to lets create a bunch of isosceles triangles, that connect was just like they saw it in their heads, they saw it on the board and then they were like lets just make a bunch of bridges, but now we don't have the triangles, and starting to make that. I like how you even [inaudible 00:05:14] that to say the two lengths have to be bigger than the base and then that started to draw it out to what if they're not all isosceles. What if it's a different type of triangle. Scalene I think is the word I'm ...

Speaker 1: Looking at the transcript where can you see like, oh I see what that kid's thinking.

Speaker 3: That's one thing I thought was interesting because I don't know. You do obviously had a few students that you could hear their thinking, like the one kid that was like "oh I remember this from the morning work" and he was kind of saying that. What I think is different between the way that we saw with my classroom and Kevin's classroom I feel like you and I would focus in on really one student and making sure that one student could explain it. Where I feel like Arturo has this very good call and response system that works really well for him. I sometimes think what I do- everyone's calling out it gets a little crazy and the management isn't where it needs to be, but I feel like you got a lot of feedback right away from all your kids because the way your classroom is set up.

I don't know if there's going to be a few kids that probably don't know this topic because we couldn't hear their thinking exactly, but I feel like your engagement and the level of kids that were thinking in this high-level stuff was so increased because you have this expectation of calling out and making sure you're raising your hand and you're very engaged. I'll find an exact moment, but I think because it was so me, you, me, you, like all of us, because there was a lot of alls alls alls there wasn't a lot of this one student's going to stop and explain. I think just because your pace was so quick, bouncing from example to example, which I thought was a cool way to do it.

Speaker 4: I think given your time-frame, what you said to us earlier, you tried having them explore and get the point, and it's fast-paced because you really have this last twenty minutes when they should have had the rule and been figuring it out.

Speaker 1: Was this the third class who didn't get to try the game, right?

Speaker 2: Also, another teacher had seen this video and their comment was you don't give kids time to write and that's what I threw out the window because it was a nice packet, three pages, a lot of questions after each step. They had to answer the questions and even after they answered the questions the two classes didn't make the connections. I'm like, I need them to write more and I need them to interact more with each other, which I should have done in this case, had them turn to their partner, and each one explain, in their little groups, at least to explain and give each kid a chance in the group because you're right, not everyone did participate. That would have been a good time for them to participate.

Speaker 4: Was the packet you made based on what they would have done for the game?

Speaker 2: It was very exploratory where they roll the dice and they keep score and if they cannot create a triangle with the numbers they get, then they get a zero. The first kid to fifty wins and then the question is why did the kid win. Then the kid is supposed to go back and try to figure out oh, because everything I got connected. Then the question is well then what were the numbers, cause they were supposed to report the numbers also for each length, and then to see when it would not happen, but they never made that connection so I just had to stop. It was a great game-

Speaker 5: I think if you, and I guess it was so in the moment because you shifted from the game to just okay quick try to make the triangles see if connect, see if they don't connect. Looking back how you might do it next year. I would make guided notes and not necessarily the game with the dice and the sides, but I would make guided notes for this where I would say use this as your base. Try it when it's an isosceles triangle with the congruent sides are three inches, now the congruent sides are four inches, now their five, now their six. At what point, you know what I mean, it would almost be like they would be keeping a record and then they would be like oh, if the base is ten when I use five and five as my sides that isn't working, but what about when I use six and six. Having the pattern there to see okay it didn't work and then another example, now your base is twenty and how that actually-

Speaker 2: I like that and then maybe the third one is okay I'm using [inaudible 00:09:32] the base quickly without even doing any work, any more experiments.

Speaker 1: What could the sides be?

Speaker 2: Quickly, what would it have to be?

Speaker 5: I think they just needed more time. Even when you're like okay grab this piece and do this are they connecting? I just think it went, even for me, I felt like it just went fast, so having more time.

Speaker 1: There's a bit more, there's like another maybe ten, fifteen minutes probably of this section of class? Because there was the second part that you gave me that we don't have for today? Did they at some point get to go back and use the papers and build triangles with the numbers one to six.

Speaker 2: No.

Speaker 1: That might be something I would do now that they've done the draw-bridging. Now can they make the connections themselves.

Speaker 2: Yeah, from there we went on to the next thing, just to numbers so lets say if you had six feet, three feet, two feet would it form, then at that point that's when the kids figured out ... The trick in order for them to answer a question is to show me their three steps, these two sides because you give them three numbers and they have to add the three different combinations to see. What some kids figured out well if it's an equilateral triangle then I don't even have to do any addition because equilateral triangles will close. We went from that to numbers too quickly maybe.

Speaker 4: I think if I was you doing this lesson again I would do what Springer said, or even if they had a piece of paper to draw the bridge. The other thing you could do at school is you could even draw the bridges using the little strips that you use: draw-bridge and try to use the two short ones, try to use a shorter one and a longer one, and figure out how to make the bridge work. What are the ways? I think the other thing that's hard about this lesson is the goal is to ask them if you add these two sides what do you notice about comparing them to the third side, and even just having that question. I like what you just said about it sometimes being isosceles or equilateral and sometimes being scalene and having that mix is important for the rule to be derived.

Speaker 1: I think what wasn't explicit was, the tent, right, it's sixty inch base, thirty-one inch sides. That's not a good tent, but it is a triangle right? I think there were a couple of times when kids thought oh maybe I'm wrong and my numbers are not acceptable because they don't serve the purpose of making a good tent or making an attractive roof for the house, but they still successfully made a triangle. I still came up with two sides that are more than the third side, but it sounds like you got there the next day.

Speaker 3: You kind of said that, I remember you were like you're going to crawl under the tent or you'd have like the boat. You kind of made the connection, but I see what you're saying. If the kids were like oh no it's not a triangle, am I right or wrong.

Speaker 1: Right, because there's a point on page lets see, like around one hundred seventy-ish, oh at the bottom, one hundred eighty-one. Sixty was too small, twenty-five was really too small, the sixty was not actually too small to make a triangle, it just looked funny as a roof. Does that make sense Martinez?

Speaker 3: I remember when you said sixty, I was like why didn't sixty work? Because I was just thinking-

Speaker 1: Because sixty did work it just looked funny on a big white house to have this roof that was very low. That would be the point that I probably would have wanted just to hone in on a little bit there, but it sounds like they got it eventually so it's one of those things that as long as it eventually comes through it doesn't matter, but in the moment I was like "no but it does work it just doesn't look good, but it's still a triangle." I would have been the nerdy kid in the back going "but I don't [crosstalk 00:13:34].

Speaker 2: What about modern architecture?

Speaker 5: Oh my gosh stop it.

Speaker 1: In our last couple of minutes and other things you wanted to mention, any feedback you want to give Martinez because he's hungry for pushes.

Speaker 2: Oh, I thought hungry for dinner.

Speaker 3: No, I mean I loved it I really loved it.

Speaker 5: I just loved, maybe this is off, but I love how funny you are.

Speaker 4: Yeah, it's just great.

Speaker 5: I just love, like I would love to be in your class so much. The only question I've already said it is-

Speaker 4: Would you put your daughter in his class?

Speaker 5: -the kids, yeah of course, the only push is you were doing so much writing on the board. Writing and erasing and writing and erasing and I think the kids who don't find you as funny as I do, cause I just want to stare at you the whole time, I was super engaged, but I think those kids that maybe weren't engaged or weren't participating even if a spiral notebook just having them like "all right write this, what do you notice." Just them doing something besides the call and response.

Speaker 1: Even the kids who were really engaged, but might not remember all the points that you hit during the lesson. [crosstalk 00:14:44] Some sort of reporting.

Speaker 4: I think that would be my biggest push too is that it seems like all of your kids have incredible eyesight to be able to see the whiteboard, but they don't- I think if they would have drawn the stuff out, which sucks because giving all these notes that you didn't end up using for them, but I'm even have a stack of construction paper and white paper in my room and in those moments where I'm just like I don't have enough time to do what we were going to do, I'm going to do something totally different and just guide them through some processes.

Speaker 1: Take out a piece of paper and-

Speaker 4: I just take out a piece of paper and I'm like "guess what you're going to be in high school in a year you should be able to take your own notes," and so we write little things and they keep those sheets of paper in their binder and then that way it's something they can refer to.

Speaker 2: Don't they have math journals?

Speaker 4: Yeah.

Speaker 2: Should have used them.

Speaker 1: Hindsight's always 20/20 right?

Speaker 3: Or even because your classroom is so quickly even if you want to do them, since it looks like your classroom is more setup, you do a lot of whiteboard works I'm assuming.

Speaker 2: That's all I have.

Speaker 5: What about the Smart Board that's in a box. I was super jealous.

Speaker 2: That was delivered in October and it was installed a week ago.

Speaker 5: My gosh how frustrating.

Speaker 3: You might just want to do little whiteboards and then have them show it up because you did so much drawing. I feel like, because I was drawing it too and I was like, me drawing it really helped understanding what you were doing. If the kids could draw then they could show it really quick and then draw me another non-example. Let that be another check, because like we said earlier because you use so much call and response which is awesome and that's really engaging there might be a few kids that are kind of-

Speaker 4: You know what I just thought of that was really good, like when Gabby and I were talking about ... When we were talking about getting hung up on that first video we watched, getting hung up on the small questions where I was like how many houses and are you going to say it in a complete sentence. You asked all those quick questions and just got numbers that were fine, when you needed the kids to really explain more important stuff, that's when you pushed them to-

Speaker 3: Slow down.

Speaker 4: -speak in complete sentences and then I think the push would be then to, that is what we need to know. Everyone write this down.

Speaker 3: Everyone stop now this is really important. Stop. Because you had them repeat it back to you a couple times-

Speaker 5: Fancy smanczy.

Speaker 3: My main take-away was fancy-smanczy.

Speaker 1: If there were just those couple of points where one particular kid said something really insightful and you were like let's do this. That would have been a perfect point to write it down in the journal, absolutely.

Speaker 3: You have two sides and you drew a third one, like he said-

Speaker 4: Exactly what you wanted his to say.

Speaker 3: He said what you wanted to teach them which means their work.

Speaker 5: That was a different way to think about it. That girl was thinking, didn't she say it has to be half, each side has to be more than half of the base. To me that's pretty good- [crosstalk 00:17:34] putting that on my level, if a fifth-grader had said that I would have fell out, so that's sixth grade, so that's impressive to me.

Video Club 4 – 4.25.15, Farrah shares

Speaker 1: Your thoughts on what kids were thinking.

Speaker 2: At the end there, when I was-

Speaker 1: Wait no not you.

Speaker 3: [inaudible 00:00:11]. What do you want to do for?

Speaker 4: I thought their workspaces were really, really nice.

Speaker 1: [crosstalk 00:00:19].

Speaker 3: They had just the right amount [crosstalk 00:00:20].

Speaker 4: Level 1, level 1, level 1. Just kidding.

Speaker 3: I don't know, this might be a direct observation or a level 1, but just the culture that you had was great. Kids were engaged and they were trying to use vocabulary that they knew that they had in their toolbox to access it and it wasn't getting them what they needed to do to solve, because all they needed to do was just split the rectangle, find the missing dimensions, and then just multiply and add. It was good that you kept pushing that.

I think the goal of your conversation wasn't, "I'm going to show you the model of how to find the area of positive figures." It was saying, "You're smarter than the STAAR chart. You're smarter than the vocabulary that you know. You need to push yourself to be on that." I think that every time they had a question ... Even just taking the time to dissect what regular meant and really forcing them to say, "If you're going to use the tool, use it correctly. If you're going to say 'X', you're going to say it correctly. If you're going to use the STAAR chart and the things not there that you're looking for, what else are you going to do?"

I think by continuing to prompt kids with those questions, you saw where their gaps were. You weren't expecting to teach them about regular polygons, but you had to cue their thinking about that to make sure that Paula's thoughts were the same thoughts as the rest of the thoughts. When you gave them the freedom to start, when they realized all the other tools that they had to work they had to make their own tools. That's what I think was happening.

Speaker 1: What else?

Speaker 4: My favorite part was when you said, "I'll let you struggle for 2 minutes", I just really, really liked that because I felt like you refused to give the kids the answers, where I feel like sometimes I worry, because they didn't have a way to really structure their thinking. I was worried that it might be wasted time, but it seemed like a lot of them were really engaged in trying to figure it out and you did a good job of actively monitoring and going around and making sure the kiddos were really thinking about it. I really liked how you said, "I want you to struggle, I want you to figure it out," kind of thing. It's like, "You have the tools, so figure out how to use them," which is really problem solving.

Speaker 3: I'm sorry, Paula.

Speaker 5: The same thing that they said. The best thing about that was that you didn't give them the answer. With this example, you didn't water it down, you stood your ground and you kept forcing them to try to figure it out. The unfortunate part was that kids ... You're forcing them also to use the correct language and they were using the language, but then their thought process, they weren't connecting to how to solve this problem. The more they try, the more, of course they kept getting it wrong. The best thing I think you did at the end was said, "All right, if no one can get it then, put all your brains together and try to figure it out."

Speaker 3: It goes back to the video we watched at the beginning, which we just watched the resident students do, which was, he let her took so much time on that one student and it just destroyed the rest of the class. I think you felt in that moment the instruction and like, "Wow." We keep [inaudible 00:03:27] at what Paula is saying and everyone is reviewing what Paula is saying. Like, "Paula's not getting us anywhere. Sorry." You were being really honest. I worked with my dad in construction, when I wasn't using the tool correctly, he was like, "I'm going to do it for you and show you how to do it the right way, instead of wasting time". I think that by doing [crosstalk 00:03:45]-

Speaker 1: You could've made a giant Jenga without giving everybody splinters.

Speaker 3: Yeah I could've. I was thinking about how could I not do that, but I think what Arturo said was exactly right. Gabby, by shutting Paula off and saying, "Everyone else work," they'd be fine. We can't hear their thinking obviously. Clearly they were getting it and understanding. They learned from her, from Paula's errors in their way of thinking they figured out from Paula.

Speaker 1: Go ahead.

Speaker 4: There was only one area, just because I just talked to my kiddos about this, and I know there's a question on the STAAR if I got along with my kids, but the rectangle thing because you were insistent that they draw a rectangle and rectangles can have regular sides, it could be a square. Those are the things. I know you were like, "It's not a rectangle because ... " That was just one thing I felt like you were making sure that they saw because you were saying that rectangles don't have regular sides.

Speaker 1: A typical rectangle?

Speaker 4: Right a typical rectangle [crosstalk 00:04:37] that was just the only thing. I felt like you were hammering bad vocabulary, which I thought was awesome. You were really consistent with it and making sure they were doing it, but then the other thing was, what if the kid wanted to draw a square, technically that would've been a regular figure in a rectangle ... That was the only thing, there was that one moment when I don't know, but most kids can draw rectangles.

Speaker 5: The only thing also is I don't know how much ... You were very patient with handling the kids. How much time you would dedicate with that one example and not jumping it over into something else. For example, I was thinking, at this point I know I would've failed much quicker than you would've. I would have probably said, "All right kids, here's how much money I have." Giving them something else that's outside of the rectangle example and said, "How much money did I lose?" They would have of course said, "Well, how do we know?" I was like, "Well, this how much money I have." Hopefully someone would come to the understanding, of "first you have to tell us how much money you had, then I could tell you how much money you lost, because if this is all you have" and if see they could make that connection to what that picture is.

Speaker 1: The whole rectangle versus the piece that's missing?

Speaker 5: Yeah.

Speaker 3: Yeah.

Speaker 4: I never see it like that, I always see it as 2 parts of the rectangle.

Speaker 5: I see it as halfway full.

Speaker 1: Some of the things that you guys really didn't get to hear is that as she walked around, there was a kid who's like, "Well, I'm just gonna do 9 times 8."

Speaker 4: Yeah.

Speaker 1: Right? Then Sarah has to say, "Cool! If you do 9 times 8, you're gonna get this whole thing and you're gonna cover up this piece that's actually not there, what are you gonna do about that?" They were like, "Oh." There were also a couple of times where you had to be like "We're not looking on the chart formula anymore." It's not there.

Speaker 3: It's not there.

Speaker 1: "Tell me how to find the area of the figure."

Speaker 4: It's not there.

Speaker 1: That always reminds me of before I dismiss kids to working, I need to make sure I've reworded my question super clear because otherwise they can spend 10 minutes chasing down a question to which I do not want the answer. It sounds like they were coming at it from a lot of different ways. Now you can share.

Speaker 2: When I was walking around going table to table, it was pretty cool to see how some of the kids were going about it differently. At some tables the kids would draw a line horizontally, and they would see the 2 separate rectangles. Some of the kids were drawing the line vertically and seeing the 2 separate rectangles. Other kids were drawing it horizontally and vertically so they had to find the area of 3. Then there was that conversation, "What's easier, would you rather find the area of 2 rectangles, or 3 rectangles?" Getting them to understand that it was correct that they were doing that, what's the most efficient way?

Speaker 4: Efficient way.

Speaker 2: When you said there was a kid that was like, "Oh, well let me just do ... " I don't remember what it was, like 9 times 7 or whatever it was. Basically, it was finding the whole shape including that missing part and I did have one kid, I think it ended up being Paula believe it or not. She's really bright. I actually said, "Paula, you're doing too much". She always tries to over achieve and I'm like, "Stop trying to do all this, just tell me what we're focusing on." Anyways, I think it ended up being her when I was like, "Okay, so if you do that," then I shaded the whole entire thing including that piece of it that they didn't have. I was like, "That's what you found the area as, but what do you want? What don't you want?" Paula was like, "Oh, could we just subtract that part away?" I was like "Yeah, how would you do that?"

Speaker 3: [crosstalk 00:08:16]

Speaker 2: It was only one kid. It's pretty cool to even have one kid. Had time not been an issue, which I mean obviously everyday of my lifetime is an issue, but had time not been an issue, I think it also would've been cool to ... I wish I could've spent more times on all the different ways. I basically showed the people that drew the line horizontally and we calculated that. Then I showed the people that do it vertically, whatever one I didn't just say, and showed how they got the same answer.

Had I had enough time, I probably would've wanted to do the people that put it up into 3 groups, which is really difficult for 5th graders, as I'm sure you know with your 4th graders because finding those missing sides, but it's there. It's really a struggle for them. Also, even though probably only ... I know this is terrible, but sometimes if I don't feel like it's going to reach enough kids, I just don't do it, but I would've shown Paula's way of subtracting that away. Probably maybe like 4 or 5 kids would've seen that and been like, "Oh cool!"

Speaker 3: That's a good one.

Speaker 4: That lesson, did you then just take that one example for that much work done, would you say?

Speaker 2: For the whole lesson?

Speaker 4: No, how much longer did you go into the [inaudible 00:09:31] for that composite figure?

Speaker 2: Long enough that I went around to all the tables and everyone was doing some kind of cutting it up in some way and recognizing. I think at some of the tables like table 1 and 2 are the ones closest to the Promethean. That corner over there. Those are the kids that really struggle the most. At their tables I had to say something like, "Okay, you don't have the formula for the area of a hexagon, let's go and see some formulas that you do have."

Speaker 4: Right. [crosstalk 00:09:59]

Speaker 2: They were like, "Oh, square and rectangles." I was like, "Hmm, well how here can you make it look like ... Can you make it maybe look like something that you do have a formula for?" Those kids needed that leading, but tables 3, 4, and 5 they could get it on their own and were doing it all kinds of different ways. At least every table was doing some kind of cutting and understanding that. Then going over the horizontal cut, the vertical cut. Then adding it together. I know it sounds silly, but you'd be surprised how once we had found the area of each rectangle, how many kids ... Only because of how many kids. I thought it had been 0, but I had 3 kids that then wanted to take the 2 areas and multiply them. I'm like, "Whoa, let's really backup."

Speaker 4: Just because you think of area is something that involves multiplication doesn't mean-

Speaker 2: To me that demonstrates such a misunderstanding. [crosstalk 00:11:02] Let's backup, what is area?

Speaker 3: Area.

Speaker 2: You found the area of this [crosstalk 00:11:07]. You found the area of this [crosstalk 00:11:09]. What would be the total area? Why would you multiply that? Again, it's a time thing. But when those kids did that on their exit ticket, they were multiplying it, the next day I sat down with those 3 or 4 kids and I was like, "Here's what you did," and actually drawing out the repeated addition. Like, "You made the area of this shape several, several times repeated."

Speaker 3: That's not how many times it appears though.

Speaker 2: That's not what we have so I don't know. I was blown away by the multiplying. I get it because they're not thinking, they're just thinking, "Oh, multiply." They're not understanding what's actually happening and when I'm like, "Slow down, let's see what's actually happening. Why would you multiply?" "Oh, [inaudible 00:11:55]. Yeah, we don't understand that."

Speaker 3: I feel like explaining yourself a little before.

Speaker 4: I don't know about that.

Speaker 2: The only thing with the square thing, Gabby, the way that I teach that is I teach them, "A square is every quadrilateral that we have learned about except a trapezoid." That's what I tell them. Then that way they know that a square is everything-

Speaker 1: It is a parallelogram, it is [crosstalk 00:12:19]-

Speaker 2: It is a parallelogram. It's everything. They do know that. You saw how off we got, just because Paula was like, "We only have the formula for regular quadrilaterals." I'm like, "A rectangle is not regular, what does regular mean?" That's all I wanted to get to and then to go even further like, "And don't forget you could've drawn a square."

Speaker 4: Yeah they knew you were getting way off task.

Speaker 2: They were just getting so far off. Even with the regular thing. That's when you see me, I'm like, "Paula, now we gotta move, somebody else," and then Trinity starts talking about right angles and I'm like, "All right guys, let's bring it back." That's also why we've been learning about 5E or whatever the last couple times on our content days. Nothing scares me more than 5E. I feel like this is the closest thing that I've ever gotten to 5E.

Speaker 3: But it is like that.

Speaker 2: It was very scary.

Speaker 3: I think-

Speaker 4: I think you managed it fine.

Speaker 2: I'm just afraid of them discovering incorrectly and then the time.

Speaker 3: I felt like what was the benefit of it is you allowed them to discover where they were incorrect you clarified and that gets clarified. You didn't go so far down the rabbit hole that you lost them. Then finally you were just like, "All right, Paula, you need to be quiet. Everybody else figure out." That was the right instructional move, and all of them figured it out. Because they had the right foundational knowledge.

Speaker 4: You gave them a multitude of access points so they could figure out [crosstalk 00:13:45]-

Speaker 3: They had multiply ways of figuring it out. Which you highlighted later. "This is your 5E lesson, this is what you need to do for, Keith, you're done." I also thought [crosstalk 00:13:55]-

Speaker 2: After all of that about the rectangle, I don't think we ever actually said [crosstalk 00:14:03] very clearly, that it's not regular. I don't think we ever actually said that. I just said, "How would you describe it? Are all the sides congruent? Are all the angles congruent?" The reason I wanted to start with angles is because I love, I love throwing them off because I so badly wanted them to say, "NO!" Some of them did say "no", when I was like, "Are all the angles congruent in a rectangle?" Because they were thinking I was gonna say sides and then they would've said "no" and I'm like, "Listen to my question."

Speaker 3: Hear my words.

Speaker 2: Even once we go past that, I don't think we ever actually said ... Because the whole point of that rant was to get them to understand that Paula saying that we only have formulas for regular is not correct. I stressed also, probably a couple weeks prior, when we were learning about polygons, that just because it's something that looks normal, something you would normally see, that doesn't mean it's regular. The kids always want to say a rectangle is regular because it's a regular looking shape. What does regular mean? I don't think we ever actually looped back that way. I got them to say the angles are congruent, the sides aren't. There was never actually a moment where it was like, "Okay, is a rectangle regular?" I never went back to that. That's when I was like, "All right, I'm glad we reviewed that! Back to what we are trying ... "

Speaker 1: "Let me get back to you, I really just need you to find the area of this figure."

Speaker 3: I know that with Keith at the very beginning there when we watched that Japan video, and how they took so much time on one problem. All of us were like, "This is the dumbest thing in the world." Actually seeing the value of that at the end of the lesson, I feel like [crosstalk 00:15:45]-

Speaker 2: [inaudible 00:15:45].

Speaker 4: That's actually what I was asking. That's what I was going to ask you how much longer you took on this, because sometimes I think I try to do too much, like you were saying with that girl, that you would just take one problem. Part of me wants to be like, "I wonder if I could just do that next year, just only taught one problem per day and went so deep into it." The 10 different ways you could solve it. One little quiz is going to reach one kid and they'll get it better.

Speaker 2: Pretty much, I could be wrong, Whitney, I'm pretty sure after this maybe we did one more example, if that. That was basically like, the time is up, so I gave them an exit ticket, just to see how it would go, what they would do, how many kids would grasp it. My plan was of course, follow up the next day, go over the exit ticket and actually do more examples like that type of practice way more than just this one that we talked about a lot. To what you're saying, we didn't have much time for much else. We spent a really long time on that problem and then-

Speaker 4: Exit ticket-wise, they did well?

Speaker 2: No. Uh-uh. It was probably about [crosstalk 00:16:49]. It was probably about-

Speaker 3: They all got 100s.

Speaker 4: [crosstalk 00:16:54] That's what I was waiting for you to say, I was like, "Yeah!"

Speaker 2: No, no. It was probably about 50/50, but the good thing to me ... I don't know if I seem to think this is good, but the 50 that didn't reach mastery and some of them off by only one question. 50/50 for one question to me is actually, I think it's pretty good. Especially if I saw the kids, even if I just saw them trying to draw the lines, but they're selecting the incorrect numbers. You said they haven't mastered, well no, but they're on their way. I was telling Whitney earlier, a big thing was this top side is shorter. Say the top side is 4 and this bottom side is 6 or 7 then they want to label the top side 7. Actually having them the next day on their exit ticket, take their pencil, and I'm like, "Run your pencil eraser along the side." Then they would do that. I would say, "Is that 7?" They would go, "No!" Just having them slow down because even though the mastery exit ticket sucked, it really did, just to even have them drawing lines and understanding the area of each and to put it together, the concept of it, versus a right answer. They were on their way.

Speaker 1: It looks like they were working on this for about 25 minutes. Probably about the time you brought them all back together, from when you first introduced the problem, all the way through. I think the value of spending 25 minutes on a problem like this, is that even though they may have struggled with it and they didn't necessarily immediately transfer it on their exit ticket, they had that experience and those ideas percolating in their mind. There's a richer experience to draw on when they're asked to do it again. Whereas if you would've just said, "Today I'm going to show you how to find the area of a composite shape, everybody take your pencil and draw a line right here. How do I find the area of this, how do I find the area of that?" Then you may have gotten through more examples and gotten more right answers, but it wouldn't have stuck for them in the same way I think. Which is the benefit of a more meaningful problem.

Speaker 3: Yeah. At the end of the year you can be like, "Remember that time we had that weird problem and you all thought it was a hexagon?" They would be like, "Oh yeah, that really sucked," and they would be able to access that.

Speaker 4: Do you think that next year you will introduce this a different way or do you think you'll remember, "Wow, I videotaped it, I'll introduce it and frame it the same way"?

Speaker 2: By the way, last year I just drew the line and I was like, "Do this." I think that I would do it the same way with a tweak. I think the tweak would be ... I know this probably sounds terrible, but a little bit more leading in the beginning, so it would just be less of the exploration time and my lead would be probably what I gave the lower kids. Maybe even differentiating it, where those kids that I know could handle it, "Okay, y'all go out to a table." Quick directions that they could read, independently work together to try to figure it out, checking with them, while the other kids are giving major hints. [crosstalk 00:19:59]-

Speaker 5: Will there be a cutout that's already perforated? They're like, "Hmm, wait a second, these lines seem to form ... "

Speaker 2: Seems like I could fold this right here.

Speaker 5: [crosstalk 00:20:07].

Speaker 3: It's a rectangle, "Hey, wait a second!"

Speaker 2: Or even just what I told those kids at table 1 and 2. "You're right, you don't have a formula for that, what formulas do you have? How can you make them work?" I think most kids would be able to grasp it from that big of a hint.

Speaker 1: I think if you would have been a little more pointed in your question.

Speaker 4: Absolutely.

Speaker 1: I think you were right with Paula, I think you could've cut her off even sooner.

Speaker 4: Yeah.

Speaker 1: Right? But it's always hard because you want the kids to be ... You want to give them an opportunity-

Speaker 2: Not only that, but Paula is one of my smartest students so I really thought she was going to wrap up this video for me. I thought she was going to be like, "Well actually you could." Normally, she's that kid. I think she was trying to be so impressive [crosstalk 00:20:58] that she got tied up in the vocabulary and I had to be like, "Oh no no no."

Speaker 4: [inaudible 00:21:06] something that I feel like [inaudible 00:21:04] Arturo, when he did his little bridge example with the draw bridge thing, I thought that was really cool. I don't know if this problem was like contextualized or anything or if it was just a random composite figure. It would've been cool if it was like, in your backyard you have grass and there's ... You could say that those [crosstalk 00:21:21]-

Speaker 2: Like 2 separate. Maybe there's grass and dirt. Ants. [crosstalk 00:21:25].

Speaker 4: Yeah and [crosstalk 00:21:26] there's a sandbox, they put a pool in, so then the kids that did the 9 times 8, would be like, "Oh that's actually sand, so I don't really need grass right?" [crosstalk 00:21:36] You could have more conversations that's really getting into area. If the kids that then multiplied that one section of area times the other section, "Do you really need that much area for all the grass? No it's just this chunk and this chunk, we're just bringing them together." [crosstalk 00:21:49].

Speaker 1: How many swimming pools did you say I was bringing? 57 swimming pools? Why would I do that?

Speaker 4: Over and over and over. I think it's awesome that you did that, I really love that you didn't, well I don't know we don't have it, what are we gonna do [crosstalk 00:22:00]-

Speaker 2: Maybe another shape just bring your.

Speaker 5: [crosstalk 00:22:01] I also think that maybe the reason why some kids didn't realize that there was a piece missing because I think their brains were really focused on the thing that it's a hexagon, it's a hexagon, it's a hexagon. It's not like-

Speaker 2: Instead of real life.

Speaker 5: A rectangle with the top missing out, or else have a figure where it's obvious that it's a rectangle and then have a part that's inside, that's missing. Even if you have to draw a picture with a fake pencil going through the paper like that, noting that it's not there then they will realize, "Wait something is missing," and they would be like "Oh, maybe I could [inaudible 00:22:38]"

Speaker 1: I think there are a lot of ways you can do this.

Speaker 3: Or saying it's a hexagon. How did someone draw this hexagon? How did someone build this hexagon?

Speaker 1: Yeah, sure, it's a hexagon, it's good that you know that anything with 6 sides is a hexagon. [crosstalk 00:22:52] I'm not sure this is going to help us to solve this problem.

Speaker 2: Yeah, that's probably true. Super [crosstalk 00:22:58]-

Speaker 3: I think that's the tricky part of teaching and using student thinking. At what point do you just say-

Speaker 2: Shut it down.

Speaker 3: Say, "Yeah what do you want to do," figure it out or [inaudible 00:23:07] when do you choose to use the guiding questions. I think when you're talking about being so new on this new differentiation. In a year where everything is new, that's what we'll have to do.

Speaker 4: Right.

Speaker 3: Maybe next year when you've had [crosstalk 00:23:22] practice teaching all these, you're gonna be able to pull it off.

Speaker 2: This particular one isn't actually new, but yeah.

Speaker 4: [inaudible 00:23:28] a tribute to you too, in that moment you could tell everything that you decided may be also in another classroom, but it's something different, but you were very intentional. You knew exactly what you were going to do. I think-

Speaker 3: Yeah, that was awesome.

Speaker 4: That's something when you think about those 4 levels. A level 2 teacher might go like, "Oh yeah, Paula's going crazy, so I'm gonna do this, because I don't really know, because she's [inaudible 00:23:44]," but you knew exactly, "Paula is a girl I normally could go to for the moment, but I'm gonna switch because she's getting off topic." I think developing that in a teacher that's something I really think about, is really hard. How do you develop that intentionally, how do you develop what you're thinking while everyone's thinking? You're not even thinking, but you're still always going through the motions. I think that's what really hard to develop in teachers. How do you get teachers in that moment to decide, let's abandon ship, this is? [crosstalk 00:24:07].

Speaker 2: Honestly, this might have been me doing it this one time. That's something I struggle with everyday because I really do revel in their struggle. Towards the end of the year, they don't even like, "oh, Ms. Springer." They just keep struggling. It's hard for me. Testing. Every teacher says this. Thank you, but that's just, believe me that's not all the time. At all, I wish it could be more often.

Speaker 1: There's a reason why they talk about the art and science of teaching. There are some things that you can do and there are other things that are very [inaudible 00:24:49].

Speaker 2: It's all patience, and that's something I'm really trying to work on.

Speaker 3: I think it terms of that with your classroom culture, they were into it.

Speaker 1: You can be patient and still be sassy.

Speaker 3: Yeah and that was [crosstalk 00:25:06] I think [crosstalk 00:25:07] you could tell the kids felt supported and also knew you were on their [crosstalk 00:25:15] ass the whole time. Paula didn't get deflated, she figured out another way.

Speaker 4: Yeah, that's culture [crosstalk 00:25:21]-

Speaker 3: That's a lot of grit and strength that you-

Speaker 5: Do you use a southern accent when you teach or?

Speaker 3: I think your Texan comes-

Speaker 4: [crosstalk 00:25:29].

Speaker 3: I think your Texan comes out.

Speaker 4: I think it just comes out, "Lord have mercy," I was like "Oh my god" [crosstalk 00:25:32]-

Speaker 2: I don't know why or when but-

Speaker 4: If I said that to my kids they would be like, "Oh my god."

Speaker 2: [crosstalk 00:25:34] it comes out, it's weird, it comes out when I'm teaching and also when I'm drinking, so you never know. Maybe I'm drunk. [crosstalk 00:25:44] No, but I don't know, it just happens sometimes, I don't know why.

Speaker 4: That was funny.

Speaker 3: [crosstalk 00:25:50].

Speaker 2: The country comes out.

Speaker 4: Country comes out?

Speaker 2: The kids are like, "Ms. Springer, you're country."

Speaker 1: Feeling emotional, that's all.

VC#4 – Post Noticing Framework discussion (4/25/16)

Sarah: I really don't think that I really ever think of level one and two because that's like, level one and two just have to happen and I'm moving on because three and four are what's important, it's what really has to do with learning. But what's interesting with the residents is, if level one and two aren't happening, it would definitely impact level three and four.

W: So when you say level one and two, what are you talking about?

S: When I say level one and two, I think more of like management, organization, maybe like relationships with students…and when I think of three and four I think of like student thinking, student outcomes, and what the teacher is doing differently in the moment, and changing, and how is it done better…that probably doesn't make any sense.

I think that maybe the residents focus more on one and two because they're so new, they haven't gotten to, like I said, those things have to be in place before you can focus on three and four, and I think when we come together, I think one and two is kind of like so automatic, like, of course they're engaged, of course the stations are organized, and they're sitting up, or I would…

G: But also how are you okay with that, like, 'cause there were moments in your classroom, in all of ours, every one of us had moments where kids are yelling out or kids are doing things, there's like a structure, a structure sort of way [of doing things].

S: Definitely

G: Because I think first year teachers are afraid to have that even happen because that would be crazy, right?

S: And I think that's a good thing.

G: Yeah, but then they come to my classroom, and I'm like, dang I would never have allowed this my first year of teaching, it would have gone too crazy or whatever, but now I feel like we know how to embrace that sort of fun, crazy ecosystem of a classroom…

S: It also caused me to think more about thinking, whereas that's not always straight where my brain goes to.

W: Looking at the chart made you think about thinking?

S: Yeah, when I'm looking at this video, how can I think more about the thinking?

K: That’s what I was going to say, like when I was looking at the video with the chart thing, it made me focus more on what the kids were saying, and how Sarah was responding to what the kids were saying.

S: We’re all about being level 4.

K: Shoot yeah.

Video Club 5 – 9.19.15, Researcher shares, Kyle shares

Speaker 1: This kind of setting where the kids have been given a very challenging problem, it's going to take them a while to solve it. They worked on it independently, and now they're having to share their solutions. We're assuming that everybody has some sort of solution in front of them that hopefully reflects one of the ones you're getting [inaudible 00:00:21]. How does that help you see student [inaudible 00:00:27]? Or what student thinking do you see?

Speaker 2: Something that's really simple that I put was that kids definitely understood the pattern, and they knew how to follow it.

Speaker 1: Up three, down one, up three, down one.

Speaker 2: Yeah, they understood that. They struggled a little bit with when necessarily are we stopping, but I felt like they had a pretty good concept of what the pattern was, how to follow it. I think when they really started thinking was when they were talking about the part of are we out, or are we still going. To me that's an actual start of thinking. I don't think there was much thinking, just following the pattern.

Speaker 1: Okay.

Speaker 3: I think [inaudible 00:01:23] There's only four of us. I think in terms of showing student thinking with definitely having them diagram their work on the board, because you could see that each of them had a totally different way of diagramming it, so just seeing how kids are organizing it because the problem wasn't super, super hard, but if you had a strategy that didn't let you organize it clearly, then you could make some simple mistakes. I think that's why she clarified at the end what the actual question was asking. They got the pattern, so they kept going with it, which is why they're like oh, 12 20. It was really cool that they did that by taking a third apart. I think having those diagrams at work was very helpful. Then she also asked clarifying questions to make sure all the kids were understanding why they [inaudible 00:02:06].

Speaker 1: There's a culture of it being okay to show your work in a different way than your neighbor, which is great.

Speaker 3: Yep.

Speaker 4: I feel like she also didn't ... I don't know if I can talk about that.

Speaker 1: No, you can talk about that, that's okay.

Speaker 4: Because that was where I felt like, that's ...

Speaker 1: You did it, right?

Speaker 3: Yeah.

Speaker 1: I watched you do it.

Speaker 3: Mm-hmm (affirmative).

Speaker 1: So talk through.

Speaker 4: Did you do [inaudible 00:02:27] No.

Speaker 3: It depends if you read the question. I didn't mean to do the problem but I was like I kind of want to see the problem before I do it. Starting in zero and then I made another one up to 13, the 13th foot hole.

Speaker 4: No that's ...

Speaker 2: Dang your supposed to be a different teacher.

Speaker 4: No I wasn't trying to figure out ...

Speaker 3: She got it because like at 11, it's right when she's at the top of the hole, so technically it's not out yet, because he's right at the top but he hasn't gone over the precipice of being out of the hole. Then it's like, if he has to go back and hour and then decline the three something feet to get out.

Speaker 1: The third ...

Speaker 3: The third ... it really should be like 12 21 technically maybe because at 12 20 he would actually be right at the top where he was before.

Speaker 4: Okay. I was confused about how she was going to explain ...

Speaker 1: This is the question that I kept thinking. Do you have to slide back or do you have ... are you at the top clinging by your fingernails and you just have to rest, or can you pull yourself ... is that the top? I'm here, and I'm climbing out.

Speaker 5: I think that's a mistake on the teachers part. If she really meant for the kids to think, all right once you get to the top, you're out automatically. In this case, if she wanted to add controversy and have the kids debate because it's ambiguous. Ask if you have a bus and it can only hold 50 kids, couldn't you have 51 kids and then what do you do? Of course the answer is ...

Speaker 3: You leave one kid at school.

Speaker 5: That's okay because that's what you want kids to say. You know what, squeeze them in. One kid would say it's ridiculous, you can't get another kid on the bus, just look for him. They won't think separate and give more room to other people. If she meant to do that, that's fine, but if she didn't she should have said something like there's a bell on the edge. Once he hits the bell then the games over.

Speaker 1: Go back and look at the problem. What does the problem say?

Speaker 4: When he reached the top.

Speaker 1: What time is it when he reaches the top, not when he gets out right? There are kids who definitely thought, he had to get out of the hole. Reaching the top meant getting out of the hole, and so maybe he didn't have the energy to get out and he was going to slide back and then I have to climb up. To me then you climbed up at the top and maybe you still ... I don't know. Do you need to rest again? Do you slide back again? Is it a never ending ... right? You can see how it could be either one. I think really the answer is 11 o'clock.

Speaker 5: I wish we had the rest of what she says. Here is the answer, lets have everyone vote. Let's see what would happen, but there is a definite answer and ready and unveil. Then ask the kids, where do you think you made your mistake. Have a kid say oh, I actually thought. [inaudible 00:05:19] actually brought out, or maybe I thought he had to get to the end, or I thought you know what? He did get that break, and he did that. I think he would have been correct there with the way he talked.

Speaker 4: That's really cool. I like that the teacher didn't approve. She was like, nope you're right. You're good. She just was kind of like, all right attitude.

Speaker 3: Poker face, all right next person. I just got up in front of everyone, I didn't have any good feedback. Just keep going.

Speaker 4: I think the feedback was confirmed in that she was expanding her thought process and the teacher was restating it to the class. Maybe that's also part of their culture too. You're going to present a problem. It may or may not be right. We're going to talk about that, but I just want to see what you do. Having that delayed gratification.

Speaker 1: Maybe it's enough also to have the gratification of having other people in the class saying yes, I think you're right. I agree with you. That's a big classroom culture thing, that you have to decide to set up. I guess what I was thinking as I was watching this, is this is ... it's hard to miss the student thinking in this case, because the kids are doing most of the talking. The teacher is just occasionally inserting something, but we don't always get to teach that way. Depending on what it is that we're teaching. I was thinking about this kind of while I was looking at your video.

Speaker 4: Now that I'm thinking about the video, I'm also thinking about what you're saying.

Speaker 1: I just started from the beginning. We can skip forward if you want. I didn't transcribe your entire video but I'm thinking probably if we want to keep going in places where there's no transcription, I think we'll survive. This was more of a direct instruction kind of video. This was when you were teaching them volume. Apparently you had just done surface area, and you were following it up with volume. How much of this is review for them.

Speaker 4: Some of it's review. We did this last year. We taught it to 7th grade. We did an example like this but it was just teacher modeling, with stacks of paper. When I did the lesson again, I wanted [inaudible 00:07:42] the physical experience.

Speaker 1: I love that they're having the physical experience. I wonder am I supposed to be hearing any ah ha moments or do they already kind of know this? I didn't hear anybody go like, oh this many times because it's ... you know?

Speaker 4: I feel like ...

Speaker 2: What grade is this again?

Speaker 1: 8th.

Speaker 4: 8th grade. I feel like ...

Speaker 2: Algebra or regular math?

Speaker 4: Regular math. I wonder if it's like an ah ha moment, so it's like oh yeah, I've done this. I think what I wanted to do with this was remind them, that this formula would be ...

Speaker 1: They've seen this formula before.

Speaker 4: Yeah, and I think the issue is, the reason the lesson was designed to talk about area first and then stacks ...

Speaker 1: Because the big b.

Speaker 4: The Big b, so the volume formula on the STAAR reference chart, it's volume equals base times height. Know that all my students ... we're going to memorize for certain shapes what they need to do, but other shapes they're going to look and they're going to say oh, b times h, I'm just going to do the two numbers I see.

Speaker 1: Right, because in lower grades, volume is length times width times height, but then if you get in the 7th and 8th grade it says big b times height.

Speaker 2: 8th grade says big b now.

Speaker 1: Does it now too?

Speaker 2: It said both. On one side it said big b times h, and then there's a space and then it also says length times width time height. The thing is in 5th grade the only base that they ever have is a square or a rectangle, so always really need length times width times height, but understanding that length times width is the area of the base. I do something like this with the 5th graders so I'm just kind of surprised I guess. I don't know. It's a good refresher reminder, when you're introducing again. You get to remember what it actually is.

Speaker 1: I think there are a lot of times when 8th graders don't get the hands on experience because they're in 8th grade and they don't need that anymore and the fact that you let them do that, gave them the opportunity to engage with it in a different way. I guess what I wondered is if when you were going around, do they already have it and you were just checking or were they like oh? Or were they like oh yeah I forgot about this?

Speaker 4: More like I forgot about this.

Speaker 3: Really? That would make you so mad as a 7th grade teacher. All my work was in vain.

Speaker 1: Logistically I was thinking about, as you stack the rectangles, yes you're building a height, but they unit your stacking with does not have the same height as the length or the width right. It's not a single unit, as if you stacked base 10 flats. Then helping them understand if you stacked 8 rectangles up, it's not that the height is 8 necessarily.

Speaker 4: The actual rectangle they had, had those little squares which were base 10. There is a lot more to this which is legit exploring and where I was going to have cubes out and they were going to measure how many cubes out there, and the instructional coach which was like, you give them the basic idea and get to practice which I didn't get to practice quickly either.

Speaker 1: If you're using ... it's hard. What it looks like you were using was a very thin rectangle, right because it was transparent.

Speaker 2: Was it really really thin? Like a piece of paper?

Speaker 4: The idea was, all the time in the world and kids moved quickly and the process quickly.

Speaker 2: You're like so patient, when you're like stack, stack, stack. I would have lost it. I don't have patience. I would have been like why aren't you stacking? I seriously would have lost it on the kids. Hello, did I just say stack the blocks? What are you all doing? Props on that in your patience.

Speaker 4: What we did is we created a little ruler, if we were going to do it there's a ruler that's based on the squares on the block so then they would stack it like 6 high. I wanted to download unit cubes and build the square tube and be like okay, I stacked this flat rectangle as many cube units high and it takes the same number of cubes times width times height as the actual cubes that try to build it. I think that, yes they get it in 5th grade and in 6th grade and in 7th grade but they really don't have any, or I hope they do. I just felt like they didn't have the experience to really understand when I can build this three dimensional shape, an it can build over the cubes, that's why it's cubic units. It's about remembering this.

Speaker 1: What I wondered was, did they get to say it's times height, or did you say it for them?

Speaker 4: I feel like I when I went around and checked with kids, they were just like oh it's height. I think for that ... the girls in the front I kind of like said it again for them which I didn't need to, but I think when we all came back, do you remember that it's length times width times height for this? They were like oh yeah.

Speaker 1: Oh yeah, that's sounds familiar. Now they have something they can hang it on. Right yeah. I know.

Speaker 4: I feel like maybe, I'm doing this again this year and maybe I want to do something similar, but maybe like the idea ...

Speaker 2: I did it with actual unit cubes and I made them build the first layer, and we talk about layers. Whenever we speak about height, we first refer to it as layers. The thing is, I think that's what you were saying, that the thing wasn't one unit. Is that what you were saying?

Speaker 1: Yeah, like if it's a clear plastic rectangle [crosstalk 00:13:36], it's not actually one square thick. Then if you stack them your not getting each unit.

Speaker 2: The idea of the layer.

Speaker 1: You're getting an idea of it but you're not getting the most accurate idea. If you're using the little cubes, then they're one by one by one at least.

Speaker 3: One of my favorite lessons to teach. They took volume off the 4th grade, so now it's just in 5th grade, which is why they do the base. I did it at the very end of the year. I was like it's [inaudible 00:14:04], 5th grade. The thing that I did, I take like the dryer sheets that are in the little laundry box, and I [inaudible 00:14:10] to go to college, and I want you to guess how many boxes are going to fit inside the truck. I make this little laundry box into a truck, a moving truck and so they're all like okay. They just say random numbers. They have no idea but I put one in there so they can kind of see, and then I start filling in the length and they have a new estimate and they have to estimate that they add more boxes in, and then we do the width and then they have to guess there's this many on the layer. Then they start seeing, no actually there would be stacks. They discover that on their own.

By the last time when I just put the length and the width in there, most of the kids get the correct answer for the volume just because they can kind of look at the box and be like, I think three more layers would fit on top of it, without me ever saying length times width times height. I'm like, what did you actually do? We just multiply that number times that number and then how many stacks would fit in there. Some kids I needed to prompt them a little bit. I'd be like, did you buy a whole moving truck and you can't put anything on top. Oh yeah, we have to like stack boxes. That's why we have boxes right? I think that helps them to understand why their boxes and not like, why don't we pack our stuff in spheres, because that would not be a good use of space. There would be all this extra space, we have boxes for a reason. We have packing things, that's something that they, I feel like that's always really good to help them in terms of making that [inaudible 00:15:23]. I use the little units cubes like you said.

Speaker 2: Yeah, in a relatively small box. I think it's even like a toothpick box. It's even smaller. How much time do I have?

Speaker 1: I think the fact that you gave them this opportunity, gives them something to hang it on, which I think should hopefully give them long term information. Then I'm fast forwarding to where they've worked on an independent problem, and then Denise is coming up.

Speaker 2: Denise, do it right here?

Speaker 1: Yeah, it's at the bottom of page 2 is it? 3. This not it.

Speaker 4: [inaudible 00:16:35] triangles.

Speaker 1: Yeah. I think that's really ... I thought I knew right where it was.

Speaker 3: Was that going to be you're OG [inaudible 00:16:47]?

Speaker 4: I didn't say it like that. I think that ... you don't know what OG is? Original Gangster.

Speaker 5: What? Well you did work at the hood.

Speaker 1: Okay, here we go. This is a triangular prism right?

Speaker 4: This is not a [inaudible 00:17:06]?

Speaker 1: No it's not. [crosstalk 00:17:16] I had him transcribe it but it's hard to hear.

Speaker 4: She like figured it out and solved it. All I said was trace the base, and tell us what it is. She [inaudible 00:17:46] the whole thing and I was like, I'm going to try that again.

Speaker 1: Was it a right triangle?

Speaker 4: No.

Speaker 1: Okay, we can't even really hear her but what are we getting out of it now?

Speaker 5: That a kid is able to figure things out on her own, and not only figure it out but also have the class process it for other people to interpret it so they can understand.

Speaker 1: If you are Kevin, you have a very clear idea of what she understands, and based on what you saw when you walked around the room, you could tell how many people were close to where she is and how many people were struggling just to name ...

Speaker 4: Where the base was.

Speaker 1: Yeah, and where the range was. That's where you have to lean on having high quality note materials. If I don't have something good. If I just give kids blank paper, and I'm like write down what you want, then I may have no idea what they're thinking because they may choose to write nothing, because they will choose to write nothing. That comes down to the guided notes that you provide, the directions, what you insist upon and what students do right? Are they using notebook paper in this one?

Speaker 4: No, this was all notes before we had a blank sheet of paper and started ...

Speaker 1: The beginning of class, yeah. If you didn't have that you wouldn't be able to see, but because it's very clear what they're supposed to be working on, you can check it. That's one of the things that I wanted us to think about today is that there is the kind of student thinking that's very obvious on video like in Cathy's class, where the students are sharing their solution, and then there's the other kind that isn't so obvious on video, because most of it is on a kids paper and unless you were actively in the room you can't see that. I wanted us to think about how we can challenge ourselves to go for both of those things because I think they're both really valuable. Do you all have thoughts about that?

Speaker 2: It makes me think of Eureka because we're doing Eureka now, at kid everything is Eureka and it seems like the vast majority for 5th grade, it's different for K through 5 than it is for 6th grade. Very different. For 5th grade there are no notes. There are no notes. The only notes that you have are basically teacher stuff so it will say like do these three problems and it's basically scripted out how you want to explain it to the kids, how you want to question kids and get they're thinking going. Where are kids writing this? They're writing it on a whiteboard. A dry erase board and sometimes there isn't any sort of base line chart. Sometimes there's not.

Sometimes they're just ... I'm still a little upset about [inaudible 00:21:21], so it just makes me think of how that's our notes right now. A fricking white board and it scares me. I don't ... I'm stubborn so I don't do what they say, but I've been making guided notes according to what it says, but I have to type and do everything because there are ... then there's a problem set, after the notes.

In the notes there's 6 examples. I need to type that up for kids. Give them space, space to do things, space to take notes. The lower kids need steps. Your kids doesn't believe in that, but the lower kids, you give them three steps and they can do it. I think kids need notes. They need space and have the teacher, like you're saying, it's easier to walk around and I know I'm looking in this general area for this certain thing, versus a whiteboard, and I'm like what do you mean you erased it? I haven't checked you yet. This might be getting a little bit more off, but I've just had [inaudible 00:22:35] on my chest lately. Also parents wants notes at home. They want to know how to help their kids with homework and I'm like, sorry we erased it all off the whiteboard. We have the problem sets, which is basically independent for 10 minutes, which normally we spend 20. Just to let the kids go independent through the problem set for 10 minutes and they do as much as they can do. It's ... the kids have no notes. If I'm doing it the way Eureka wants me to do it, they don't even have notes to go back and reference to say how do I do this type of problem.

Speaker 4: That was something that I challenged our middle school math people to be like, you want us to use this Carnegie book which is very similar in that there's a lot of text to read through, there's a lot of discovery but at the end, there's no like, this is what you just figured out.

Speaker 2: Now practice it.

Speaker 4: Now practice it, and vocabulary is embedded in these paragraphs using really high technical math language for 8th graders. I just was like, this is not effective, but what we focused on with the 6th, 7th and 8th grade curriculum writers over the summer was to say, what's the best example from Eureka or what's the best example from carnegie? How do we simplify these questions and the CFU's that your asking out loud are ones that kids could read, so it kind of ends up scaffolding so that higher kids can read stuff on their own, answer the questions and be like boom, I got this. Lower kids you, can like read the question out loud. Have them write it. Then talk to them about it. There's like that balance of ... at some point we all shut up when we'd go to the key points page and I'd say this is how we do this. Remember this. The kids are like, yeah, we all got it. Now they have this one page that's going to live in their notebook forever that the parents can look at.

Speaker 2: The most important, most helpful page.

Speaker 4: It's tough when I feel like, when I look at Cathy's class I'm just like, I think if I did that lesson with that group of students, they would have been just as engaged and able to process the information, when it's a very technical ... you need to understand why that formula is what it is. I know these kids. When they see it on the star exam, they're going to see b times h, and I know that half of them are going to be like the base of this is 5, because I think about base times height for a rectangle, so I'm not going to think about all the things that are part of the shape. I really needed, maybe it was a fault reminder [inaudible 00:25:12] much, but they really needed to know this is the big base of the shape.

Speaker 2: You're absolutely right.

Speaker 4: They need to be really clear that this is how I need to think about solving this problem, which I think helped with Denise because she got it. She was like whatever the base shape is, area of that stacked up. As we moved forward through that unit, the kids were epic. I don't know if carnegie or Eureka would have said good job, you taught a ton.

Speaker 2: Do you remember at what point at a student that that finally clicked for you, that was actually the area of the base? Whatever the base is?

Speaker 4: I knew that my junior year of college when I was taking special education math, and we went and learned. We did concrete pictorial abstract, and we talked about why all this stuff is true. I was like, oh that makes sense.

Speaker 2: I was in college too. Now these are like 13 year olds.

Speaker 4: It's like a college level understanding.

Speaker 2: The thing is I don't even think it's college level.

Speaker 1: It's not.

Speaker 2: We're 100 percent capable of understanding it. It's just how we were taught was, this is the fricking formula, can you just do it and I can walk ... I feel like I've had some really bad teachers.

Speaker 4: Yeah.

Speaker 3: We know that there's very little student thinking.

Speaker 2: I can remember one time I was in college and somebody explained it that way. I was like oh. This is so easy. I don't even need a formula chart anymore, because I just have to get the area of the base. That's easy. I know what a triangle looks like.

Speaker 4: If I understand area then like ...

Speaker 2: Yeah.

Speaker 3: [crosstalk 00:26:51] if somebody would have helped me understand that from the beginning.

Speaker 2: Miagi you're so quiet.

Speaker 5: I was just getting everything. [crosstalk 00:27:01]

Speaker 3: I was going to go back to Eureka actually. I've been very impressed at so don't ... yes that are definitely things that Eureka should have that I'm surprised that it's such a great curriculum that it doesn't have 110 percent, but I would say that Eurekas way of always having kids [inaudible 00:27:18] idea and having all kids back to an array to a trip diagram, all the stuff that they do, I have been floored by what I see kids outputting in terms of what all their things look like. Even when they took their math test, teachers didn't really have the discussion of you need to have these test taking strategies, da da da da. The amazing amount of paper that kids were ... I was just looking around just walking through and badgering all the kids taking their tests, in third and fourth grade both, kids were just drawing and showing their thinking so much more because I think that's how the curriculum is designed. It's more like draw the array, draw the trip diagram, show your thinking. Do this vertical number line instead of being like ... round it that way instead of being like oh, I'm going to write a number circle it's friend.

Speaker 2: Shut up.

Speaker 3: That's not really like students thinking.

Speaker 2: I understand that.

Speaker 3: One like you actually see that. I think it's actually really cool about you're [crosstalk 00:28:04].

Speaker 2: The first time, when I wrote the first rounding lesson for 5th grade, I seriously, the way that we do our lesson plans is we have to notate all of our lessons and work all of the problems and there's this other thing that we have to do when you turn it. As I'm notating all over the lesson, I'm like this is depressing. This lesson is taking my soul. My manager read it all and commentated on it and she thought it was funny, but once I dove a little deeper, and then the rounding lesson was like two consecutive days, and once I was diving into the second of the rounding lesson, I was like okay. All right. At first the decomposing of the numbers and how many tenths do we have? 39 tenths. What do you mean we have 39 tenths? 3.9, 39 tenths. Once I started doing it, I was like oh. You even get the midpoint.

Speaker 4: I think there's that combination of if every kid has the notes, and is answering those questions and they're either part of the notes or there's the problem and there's the teacher that frames what it is, I don't' have to hear all 20 of my kids articulate a verbal response. What you're saying for the math test is I can walk around and see on their paper, they are making sense of what they're doing based on concrete pictoral stuff, that really gets them that understanding, so then the next day when you jump to this is a way to think about it abstractly and remember it, they're like oh, this clicks.

Speaker 2: Have you given any module assessments? Mine is coming up this week and I'm so nervous. I'm sure you know, it's like Taylor Swift, Blank Space. There is no multiple choice. The first question on the test, thank got it was a word document. I went and reworded the heck out of it and put it in layman's terms but it was seriously like, the following equations both have different operations involving the same number, however the results are the same. In other words this one's multiplying, this one's dividing by this one is a power of 10 and this one is a power of 10, that maybe this one is 10th's and this one is 100th's and that's why it ended up being the same result. I was just like nope. You know what I reworded it as? I said, the first one is multiplying, the second one is dividing. All the numbers are different but they get the same answer. Explain why you need a place factor. Even my lowest kids, that is so tough. I went through and spaced everything out so they have way more space.

Speaker 5: I think going back to your exercise, there's good things in it and one of the things that I see that you could have just pushed harder, and I know it's a culture in your classroom as the kids, they may not be comfortable with their language so they're kind of timid to talk. I think that I see that very clear because they're ESL kids. When you have kids who have a much stronger grasp on the language, you won't be able to keep them quiet.

Yeah, I think in a situation like that, I think you were talking about, how you were teaching the lesson.

I really like to teach my lesson first. I like to have, I was thinking about the 5 E structure, so at first I won't even mention what we're talking about. Started talking about something that has to with volume, talk about a goldfish bowl or something, and take from there. You can start getting something out of the kids that you want them to. An easy example that had nothing to do with, you never use the word height or base or whatever. A small fish aquarium and the bottom is just the area. As you pour the water into it, now something is changing within this structure, what is it? Only the kids can see wow, now you just don't have an empty fish tank, you have water in it. The question is what has changed. You just keep acting them until they start saying it on their own, the space inside this thing is changing.

You can say what is changing and only some people come to the conclusion that there's less empty space and there's more space taken up by the water. You might even want say how do you know, we're going to measure this in, in order for me to answer that question because I can't tell you. A lot of water, a little bit of water, it hasn't been cupped in something. Then from there take it to a everybody throw the books away, we're just going to talk. What do you think for example, because you mentioned dimensions, what for example do you tell your kids the first dimension looks like? What do you think, what do you tell them?

Speaker 4: I'm just measuring the length of something.

Speaker 2: Point.

Speaker 3: I thought it was a length?

Speaker 5: You're right. I tell them imagine, I put an ant in a straw and I blow through that straw, so that ant is just moving in this direction or that. It can't really go up or down, it can't go left or right. They're like oh, that's what one dimension would look like in the real world. If you become and ant, you go through that pipe. That's all you do, that's one dimension. Now ask the kids, what is second dimension. What do you tell the kids second dimension is?

Speaker 4: I'm trying to think of a better way to explain that. I think it's like when you take the line and you turn a corner and you draw another line. Actually that's not true. We like took a blanket and we covered the ground and we said what shape are we covering on the ground, and their like oh, the squares. They'll say well how many directions did we, when we look at the square we can walk one this way, walk the other way.

Speaker 5: I tell them there's a sheet of paper with an ant on it. The ant can walk forward, left, back so then again ...

Speaker 3: But he can't jump.

Speaker 5: He can't jump you got it.

Speaker 3: Between 2 sheets of paper.

Speaker 5: An ant in a vacuum, put little wings on ant and it will fly in the classroom so you just ant [inaudible 00:34:16].

Speaker 4: That's great.

Speaker 5: Something that is super duper concrete that they can always go back and reflect on and maybe put themselves into it. They can do that, then they have a deeper understanding. At one point I came up with that dumb, I guess not dumb but I guess that overused thing where you stacked stuff, so I brought a telephone book, how big is the telephone book with one page, and then I keep flipping pages, putting on and it get's to a height. I think with your kids it's just that comfort. Are they comfortable messing up, because they seemed like they were not saying anything.

Speaker 4: I think that certain students as the video progressed became more comfortable with messing up. Someone like Denise, or there are other students who like as they became more successful, when they got it wrong they were like oh I can go back and figure out where my work is. I felt like one of the reasons I probably got to be so explicit, is that there were kids who don't even get started because they don't feel like they know how to access it until what Sarah was saying. If I give them a few steps or give them the vocabulary reviews or the tactal experience, it's going to absorb more.

Speaker 5: You're right and they do need that encouragement.

Speaker 2: This is 8th grade math right?

Speaker 4: Yeah.

Speaker 2: How does it work at your school? If kids aren't in algebra, are these already your most struggling students anyway right?

Speaker 4: That was last year. Last year was if you're common assessment scores in math data gave me this formula on average going to make an 80 or better, they put you in algebra. If you're getting an average of 79 or less, so what I did with that data, I presented it, I found out that my students on average were supposed to make a 70 in my class. I didn't' even realize that until I did my masters defense.

Speaker 2: Based on previous data.

Speaker 4: Based on previous data.

Speaker 2: [inaudible 00:36:02]

Speaker 4: What do you mean, this year? [crosstalk 00:36:09]

Speaker 3: You hit 70. [crosstalk 00:36:10]

Speaker 4: I hit 70.

Speaker 1: That's not your curved yes numbers?

Speaker 4: Yeah, my curved yes numbers were almost all my kids passed and did better than they were expected to, minus like 2 kids who [inaudible 00:36:26].

Speaker 2: You didn't answer my question though. Are the kids in 8th grade math, kids that super, super struggle otherwise they would have been in algebra?

Speaker 4: That was last year yeah. This year everyone is in 8th grade math because of the way the standards changed.

Speaker 2: Oh Felicia. Really.

Speaker 3: Algebra is now waiting until high school?

Speaker 4: Yeah. For the time being. I like ... you were a genius and have taught much longer and better than me, but my push back to you, if you were my DOI and telling me this, I would be like, I want to have that conversation. How do I capture kids what they're writing and eventually I have this big conversation with him as we go through, and what's weird about 8th grade math is that it's ... there's no area basics. You don't review areas, you do surface area right away which means you need to know all the formulas or all the stuff. Then once you do surface area you move right into volume. It's like there was no 2 dimensional review to get them there, and my thought is always like if I had this conversation with them in class, how long is it going to take for them, how quick are they going to make those realizations. How am I going know they're going to make those realizations.

Speaker 2: The conversation thing to, the reason I ... I'm not saying I shy away from it. Conversations are really great to have. Especially math conversations. I just always, I'm just a control freak, and it's just like how many kids are really engaged in this conversation right now. How many kids are totally checked out and their not thinking ever unless I'm pencil and paper, we're writing something down. I know a lot of kids don't think that way. They think more of conversationally or ...

Speaker 1: Do you remember the first meeting we did where we watched the video of the guy from New York, and it was basically a conversation between him and the one girl and a lot of what we all said was, what is everybody else doing? Here's this one kid, and who knows what anybody else is thinking. There's no way to tell.

Speaker 2: I guess you can call kids too, but that's a whole nother thing. Some kids ... just figuring out the balance. Maybe even having that rich conversation, maybe even this is a total and, but guided notes for the conversation. If you know what you're going to do with the ant and the blanket and the flying ant, if you know what you're going to do with that, the and is the guided notes and maybe a picture of an ant in a straw. Let's talk about that.

Speaker 4: Some kids are just like what is a straw.

Speaker 2: Write down what you think about it.

Speaker 5: It's funny because I've never given notes, I've never given guided notes, I almost never have kids write.

Speaker 2: My manager says the same thing.

Speaker 5: Right, one of the things I see that's wrong about you is that I think it would work well with you because you're a person who I've seen on the video, you're just like this. No one is doing anything dumb because they're always focused. That's why I know my kids, if you're going to use the process that I use, every kid has to have your eye. Your neck is always turning and you're always looking at eyes, and you're always throwing 2 questions every 5 seconds. You don't allow a kid a chance to look out the window or rest.

Speaker 4: I also wonder too what do you do at the beginning of the year to get that. I felt like when we watched your video it was like that. You were asking questions, and you could see from me, when I had to write something on the overhead for them to write down they just were like ... and it took a long time. What do you do that keeps kids in moment?

Speaker 5: At the very beginning it's just the culture. Once you decide what you want your classroom to be, then you do everything you have to be. The first thing I tell them is they're 6th graders. They have to be more mature than they were last year. One of the things I do is I just talk a lot about myself, the dumb things that I did. What's one dumb thing that you did as a kid? You got 5 minutes, I'm going to tell the story. I tell them something, they're like oh my. Okay. Then we move on. We understand it both in my classroom. Now unfortunately they go to another classroom, same grade level and the teacher is not ... I ask the kids, if I were a bird, what would I be. They would say a hawk. They know that I'm a hawk. They know my expectations.

Speaker 2: I like that.

Speaker 5: Some teachers in other classes don't have the same expectations as I have, and they really can go to the classroom and ... yeah you have that, you have to be on your toes and you have to come up with these things quickly. If not then you have to write them down, like that and make sure that it's presented. Last thing I think is I have to know who my kids are. I have to know what they like, what they don't like. I have to know, even what music they like. I ask them what's a famous quote from a movie they've seen or cartoons. They're giving me cartoons that are current and I haven't seen them, and I don't know. Tell me about Sponge Bob, tell me about Scooby Doo.

Speaker 4: Adventure time.

Speaker 5: These other ones that they were telling me, it's like oh my gosh I'm going to have to find out. It needs to be at their level when I'm talking to them.

Speaker 4: I feel like I do all that. I don't know what I'm missing. Maybe I just need to do my video tapes of myself.

Speaker 1: Some of it may be grade level. I think there's a difference between 6th grade and 8th grade. I think 8th graders who kind of know they're on the behind side, plus their battling the language issue, are just going to give you a harder time in terms of engagement and speedy work and all of that.

Speaker 5: Our peer pressure is lower than ... they also know about peer pressure. I told them, who combs their hair down. They do, tell me boys who like girls, and they're like yeah. The kids who don't comb their hair, they're like I don't like girls. It's obvious you don't like girls because you don't care about yourself. There's no peer pressure with you. They're like what?

Speaker 4: I'm so confused.

Speaker 1: They're not worried about grooming.

Speaker 4: They're not wanting a girlfriend so they're not like ... sorry.

Speaker 3: I'm lost but okay. God I'm so glad I don't have boys.

Speaker 4: My classroom this year is more like yours, where we can have faster discussions and kids are pointing stuff out and even I have my lowest students from one of my blocks yesterday. We did a retake question and we just did part by part and they were like we do this, we do this. Last year, it wasn't like that. It wasn't that I wasn't connecting with the kids. It wasn't that I didn't know a lot ... I knew them for 2 years, and they'd come hunt me down all the time.

Speaker 3: What time was it?

Speaker 4: It's like right after lunch and homeroom which are horrible times of the day. I don't know, I just think everything that you're saying is stuff that I've been doing, or maybe I'm not doing it as best as I should have, or I didn't do it the best I could last year. I feel like watching it and then thinking about what things I want to put in the culture in my classroom.

Speaker 1: I'm going to pause us there, [inaudible 00:44:09].

Appendix E

Post-Study Interview Transcripts

Post Study Interview

1) Please describe your experience as a participant in this study.

2) What did you learn about yourself as a teacher?

3) What do you think about video club sessions as a forum for professional development of teachers?

4) What was beneficial about participating in this study?

5) What was challenging about participating in this study?

6) Additional comments:

Jenny Post-Interview Transcript

Researcher: Okay. Jenny.

Jenny: Yes.

Researcher: Would you just briefly describe your experience as a participant in our study?

Jenny: Yeah. My experience. Very open. (laughs) Yeah. I would say I think it was something ... I think when I actually signed up to do Relay, I was wanting more concrete feedback on my practice and just thinking about how I could get better. I really liked our cohort of teachers because I love that it was specifically math. Most of the people in my elementary cohort were lower elementary. I was the only pure math person. I felt like it was great to really, really get specific feedback on my own practice and watch exemplary teachers teaching math, no matter what grade it was.

It was always really reassuring for me to see, even if I'm the lowest grade to the highest grade, it was a lot of very similar things. I was like, "Well, you know, [inaudible 00:00:51] is very different from high school," but I was like, "Oh, no. Actually, we can have a great conversation about this based on seeing students thinking." That was nice. I love that it offered me specific feedback, and it also offered me the experience to see other great teachers. Then, also, just really thinking through the questions that I asked and just my ratio talking versus other kid ratio, I think that even scripting it out, like you do in that, was really illuminating, and that experience, being like, "Wow. I do stuff way more than I expected." Trying to kind of balance that out.

Sorry, that was a very general question, so I feel like I had a very general answer.

Researcher: Yeah. You mentioned getting an idea into your ratio being more than you thought. When you think about stuff you learned about yourself as a teacher as a result of participating in the study, is there anything you want to add to that?

Jenny: Let's see here. I think I learned to be even more manipulative-heavy. Before this year, I think going through the CPVA in Relay made me think, "Oh, yeah. Concrete's really important." I think even more so, going through it with even seeing our high school teachers and our middle school teachers using manipulatives, I was like, "Wow." It just helps kids understand, and it allows you to see they're thinking without even talking. The way they construct things. I think as a teacher, I kind of grew more in terms of being like, it's okay to have kids use more blocks, as long as you're a good manager of that, and really making kids explain their thinking doesn't always have to mean they're talking, right? Just giving them ways and tools to show it in different ways, even by the way that they're using different tools, is a great way to do that. I think that was something that I learned a lot from, which was really helpful.

Then, even just like saying, "What are kids thinking?" Even just trying to make myself more aware of student thinking kind of changed my practice, as well, because sometimes, I feel like I would ask a question and then be like- I think I always was good at asking way, but then really, really listening, and then being like, "A-ha." Then, kind of really making sure I was paying attention to why and making sure all the other kids understood why that kid also thought that way.

Researcher: Mm-hmm (affirmative). Great. What do you think about the idea of a video club as a model for teacher professional development?

Jenny: I think it's tough. I think even now, being someone that is a teacher coach and having a team, I think teachers can tend to be very insecure about their own practice. A lot of times, they get nervous that, oh, people are going to look for this thing or that thing. Especially in a club where there's a lot of different experience levels. My third grade team, we have teachers that have been teaching for five or six years and then three brand new teachers. It was very, very different levels of ability and kind of what we talked about at the very beginning, levels of noticing, so noticing that- Our younger teachers, our less experienced teachers are noticing things that I'm like, "That's not what I want you to pull out right now." I like that you said this. I'm like, "No. That's all you got out of that amazing clip?"

I feel like it would almost have to be something that is grouped on people with similar abilities, if you really wanted to be- I feel like whatever your purpose would be, you would want to have similar people that want that same purpose. If I'm really looking to up my level of questioning and make sure that kids are showing their thinking, I think that's an awesome thing for first year teachers to see, but I don't know if they're ready for that yet. If you were going to do a video club, making sure that they have similar purposes for being in the video club, and they have similar abilities in wanting to push themselves, I would say. That's just what I've notice with my own teachers, in terms of some teachers. A lot of trust would also have to be there.

Researcher: Mm-hmm (affirmative), because they'd be sharing their own-

Jenny: Mm-hmm (affirmative), and then being very open for feedback and ready for whatever's going to happen. Even one of our teachers, who's one of the best teachers at our school, I would say, we watched a two minute video of her teaching, and she was so embarrassed. She was like, "I'm so bad." They all were like, "No, that was amazing." You could tell she felt so bad after the experience, and I was like, "Yikes." I think you have to have a very specific structure if you'd want that to be something that worked for teachers. I think it's awesome. I think I've learned a lot from it, but you'd have to be very careful how you frame it and structure it for teachers.

Researcher: Right. You have to know what the ego [inaudible 00:04:54] is in the room. It sounds like you've been using a little bit of video, when you're working-

Jenny: A little bit, yeah. Not as much as I'd want to. Today, we're actually going to do, I'm going to take my two brand, brand spanking new teachers, two brand new Corps members that are in third grade, and I'm going to take them kind of see the veteran teachers on our team, just to see how they're working on with pacing. Because the two of them, I've been coaching them around pacing, but they're still struggling. I've shown them videos of them teaching, and they've appreciated that, but I think even being in the room would be more powerful for them.

Researcher: This isn't a common planning time right now that you're about to ...

Jenny: For some reason, they're the only two that had this plan. It's just the two of them, the two brand new teachers, which is not the best. They like to feed off each other sometimes. I'm like, "Oh, no. I should have paired them with a veteran teacher."

Researcher: It's nice for them to be able to-

Jenny: Actually see.

Researcher: To be able to go observe.

Jenny: Exactly.

Researcher: Because a lot of times, if you're all off at the same time, then when can you do that?

Jenny: Mm-hmm (affirmative). I've definitely been trying to use the video more because I think that was something that I realized was awesome, in terms of what we did in our session together and having- Because sometimes, teachers don't remember a specific moment, but actually being like, "Let's watch this video. Let's pause it." I think it's something that it's worked better for me in one-on-one conversations versus a whole group because I don't know if our whole team trusts each other yet, or if they would get out the right things yet.

Researcher: You mentioned ... You kind of already talked about what was beneficial for you, but participating in the study, were there things that were challenging for you?

Jenny: Challenging ... Challenging, just like anything about it can be challenging?

Researcher: Anything.

Jenny: Okay. I can be very open. I would say at times, and I think this is something that struggles when you're with a group of people, kind of the norm of monitoring your air time, or sometimes, people getting off-task or just talking about different things. I feel like there was a few personalities that sometimes that happened with, where I feel like [Alex] was very specific to the point. He was someone that I wanted to hear more from. Other times, there was other people that might have dabbled in other conversations more. I think that's just like tricky, but any time, right? I can see that in my own team meetings sometimes. One of our teachers today was talking about a bad dream they had last night, and I was like, "Oh my god. Why are you talking about this?" I struggle with how do I redirect people? Now, we're all adults. They're not a child. I can't be just like, "Stop talking. We're moving on." So that's just something that's tricky with adults, so setting those norms kind of quickly from the beginning.

I don't think anything was too challenging for me. I think specifically the videos, I think I've always been someone that's open for feedback and excited about it, anything that can make me better for my kids is really important to me. That wasn't a moment of vulnerability or anything like that. That was something I was excited about. I think us sitting there together, I usually really liked that. I think sometimes, I might have been a little bit nervous to say what I totally felt in case I was going to offend someone. I think I kind of realized that the things I should say are what I should focus on. I think you were as good about being like, "We're focusing on student thinking." Instead of being like, "This management is crazy, or I wouldn't have done it this way," versus focusing on what kids are actually saying.

Researcher: Right. It's nice because you can pick your focus. Your focus doesn't have to be student thinking.

Jenny: Mm-hmm (affirmative). Yeah.

Researcher: For a first year teacher, maybe it is management. Maybe it is things like-

Jenny: Yeah. [Ratio]

Researcher: How are you calling on students? What are you doing? Yeah.

Jenny: Mm-hmm (affirmative).

Researcher: That's one of the nice things about video. Was there anything in addition that you wanted to say?

Jenny: A challenge, or anything else?

Researcher: Anything, like any additional comments you have.

Jenny: No. I really did like it. I think it's something that I thought I could do in this new role more. I haven't done it as much, so I think this conversation will hopefully be my impetus to go and do it more, especially for some of our math teachers. I think you can do it reading, as well, but I think I would be more comfortable doing it with math teachers first. Yeah, I thought it was really, really helpful. I think it was something that challenged me to really be a critical [observer of] what my kids were saying and instead of being like, "That's not exactly what I need to say," how do I keep asking better questions?

I think when we looked at Alex's transcript, seeing that he just, it was also like sentence. It was like him, kids, him, kids, and it was always in the same ratio, that was crazy to me. I feel like there's always a moment when I'm just like, I'm just going to tell you this. I had to go on a diatribe at least of like a minute or so. How do you get really good at knowing exactly what you want kids to say and keep questioning until they get there? Kind of like, how do we teach, or how do we get teachers to do that? I think, watching videos, you get better at it. Even, yeah, a lot of my first year teachers now, and even veteran teachers sometimes, I'm just like, ugh. How do I teach you to keep pulling, and also, when is the point when you're just like, I'm just going to give you the answer because at this point, it's going too far down the rabbit hole?

Like that time you observed me, remember, and it was like the decimal, and they couldn't figure it out that they move it this way or that way. I kept wanting to get them to say it, but then eventually you're just like, "Just tell them what it is." I can't remember what it was. It was something about the decimal and just being like, "Just tell them!" I was like, "Okay, really, ya-da-da." Then I was like, "Oh, yeah, I guess I think maybe I should just have told them," right? Kind of like knowing that moment of what's the decision point and how do you know to keeping pushing.

Researcher: It's hard, right?

Jenny: Yeah.

Researcher: Because ultimately, we want kids to come up with the knowledge, but if they're just guessing and guessing and guessing, then there comes a point where maybe you should just say, "All right, y'all."

Jenny: Or just get a [inaudible 00:10:00].

Researcher: Yeah.

Jenny: Yeah, exactly. I think, yeah, how do we ... I think just seeing the transcript of when Alex was teaching, I was just like, "Yeah." I mean, he's done this so many times. He's had so many more at bats. He kind of knows the right question to ask. You kind of have that toolkit of, "When I teach this lesson, I'm going to do this, this, and this, right?" I feel like there's definitely lessons in my repertoire that I was like, "I know all the best questions to ask." Then, how do you get teachers to get good fast and get teachers to also see that? I don't know. I don't know the right answer to that. It's tricky stuff.

Researcher: Yeah. It sounds like the transcript was really helpful.

Jenny: Mm-hmm (affirmative).

Researcher: Yeah. If I were to do additional studies, the transcript is something that [you'd keep].

Jenny: I think yeah. I think even just watching a video- I don't- Yeah, it's interesting. You would think watching a video would have the same effect, and it definitely does at times. Even just seeing it, or it's almost like a graph that goes with the video. Just being like "pssh." Then, it's like, oh, yeah, wow.

Researcher: [It helps] focus.

Jenny: Mm-hmm (affirmative). Definitely.

Researcher: Okay. Cool.

Jenny: I love transcript.

Researcher: Yeah. Well, that's all I've got, unless there's something else [crosstalk 00:11:06].

Jenny: That was mostly painless. Jeez.

Researcher: Yeah, right? 11 minutes.

Jenny: I'd like you to drive all over her for that. Jeez.

Kyle Post-Interview Transcript

Researcher: Okay, can you describe what it was like to be part of our video study?

Kyle: I really liked it because I think, as a teacher, you think you're making the right instructional moves. The last one that we watched of mine where it was like stack the things, do this. I was watching it again like, six months removed and with the help of Farrah, Alex, and Jenny. I was just like, "Wow, I could have made that point a lot faster and gotten kids to practice a lot more." Which was goes back to what we were talking about because I think the more you're talking with teachers and analyzing your own lessons you see ... You see where you're not distributing the cognitive work to kids and where you think you're ... Where you kind of feel like every conversation you had was I understood what you were doing there and be more concise or have a more direct question and waste less time on the discussion if it's not getting you where you need to go. Get the kids there and then get them back on track of practicing the objective.

It's a very humbling experience and through it being humbling made me even more self-reflective than I already am about what I do with my students.

Researcher: What do you feel like you've learned about yourself as a teacher, as a result?

Kyle: That's a really good question. I think ... I don't know. I'm trying to articulate. I think in the two videos from me that I watched, I spent so much time in that basic exploration phase and guiding students through that, that we lost practice on the most rigorous stuff. That's what I really wanted them to be doing. As much as I thought I was putting it in the hands of the kids and then having these discussions to clarify basic vocabulary or basic concepts that they might have already known. I think I should have gotten to the point quicker, and I think that's a hard thing to figure out as a teacher.

The kids last year, it was like I knew them already. A lot of times what I asked them to do and I thought they were going to be able to go more quickly. I'd make the connection faster, or they were just too polite and could have said with a volume on like, "Fritz you stacked a bunch of paper last year. We know what we're doing. Give us the harder stuff." I think it kind of taught me ... We talk about ratio, right? When I think I'm putting the work in the hands of the students it's still more about me guiding them through. What I really want to see them thinking is on those middle, harder problems. How are they thinking through that? The only way I'm going to see that is if ... Kind of what we observed is if I'm tracking what they're doing on paper on those harder problems. Then talking about that as opposed to this deep exploration of why the formula is true.

I think that's important, but it's like back to the hammer analogy. It's like, look at this hammer. It' made of wood. It's made of metal. It's like how did it happen, right? It's just like not ... They need to know how to build a table.

Researcher: The importance is this is a tool, you need to know how to use it.

Kyle: Exactly, and I think I was focusing more on the understanding of what the tool was as opposed to applying it.

Researcher: Yeah.

Kyle: That took me a long time to get to that point.

Researcher: No, but understand that ... I think it's easy to hear how important conceptual understanding is and then start living in conceptual understanding land. Then kids never do any application. Then, guess what? They can't do any math and you're like, "But I spent all this time developing concepts." But they didn't actually get to see what the concept is for which is ... Yeah, you have to find the balance.

Kyle: Like, how could the hammer have been made? They're just like, "Cool." I think that's this tension that exists in math, period. A lot of the second half of instruction Keith was like how do you get them to see this ... One of the examples that always comes up is with multiplying fractions. You draw the grids and the conceptual understanding. It's really deep and it's awesome. We even did that this year with kids as a review, but on the common assessment the question was: How do you multiply two mixed numbers that are both negative? You're just like, drawing those grids and stuff-

Researcher: Doesn't help.

Kyle: That's not going to help them. They need to know the algorithm or they need to have a different strategy of how to do that one efficiently. If they're not practicing that they're not going to be [successful].

Researcher: That question is asking them about the process, not like, "Draw a picture to represent ..."

Kyle: Exactly, so our intention is ... What I felt like a lot with these units, these lessons that were made and given to us this year, was focusing more deeply on the conceptual understanding. Then the questions being asked in the application at a high level. If you only have one lesson that's conceptual, you don't ever get to apply the stuff.

Researcher: Yeah, figuring out how to get there.

Researcher: When you think about this video session construct as a forum for professional development, how do you think that works? What works? What doesn't?

Kyle: I think it works, period. When I was in school, that was the first thing we had to do. We had to watch videos of ourselves teaching and then analyze it on our own and then submit our own evaluation of our teaching. I think it helps you as a teacher in the moment to be really self-reflective and critical. I remember in my first year of teaching knowing as soon as I put something in front of kids and starting talking, I was like, "This is not at all what I should have done, dammit."

I think that as you advance in your teaching you kind of trust that the moves you're making are strong. In the moment you're thinking this is right, this is good, and now kids aren't achieving. If I maybe were to go back and look at the data and then compare it to how you instructed the lesson helps you to be able to see: Was the question clear? Was this activity necessary? Who is dominating the conversation in the class? Even as I'm thinking this year, does there need to be a conversation about this or does it .... You know what I'm saying?

What should the conversation be about? Is it about how the hammer was formed or is it about like, they made a table but why are there so many nails in the table? You know? How could you have used the hammer more efficiently.

Researcher: Right.

Kyle: I think it's great. I think what you were saying on that continuum thing of like ... First year teachers are looking and saying. "Everyone's listening. Everyone's doing the work." We all were looking at it thinking like, "Dude, this dude is having one conversation with this one girl." Or like when Alex is like the discussion was really [great] but nobody was capturing that information.

Researcher: Nobody wrote anything down.

Kyle: Nobody wrote anything down or mine were just ... The conceptual stuff is great but they're not in fourth grade, they're in eighth grade and they need to know how to find the volume of three things and see what percent fits into another. That's what you want to be asking. I think that's where you can kind of look back and say, "Was the time spent best to get kids to this level over here?" I didn't move in the moment. I didn't feel successful.

Now looking back at the tape I can better analyze why it wasn't successful and what I need to do too fix that.

Researcher: What's the difference between just committing to tape yourself and look at your own tape and coming together the way that we did.

Kyle: I think you can look at your own stuff and say like, "Oh, I'll make this change. I'll make this change." But I think, especially with Farrah and Alex and Jenny, because I've had a lot of conversations with her. With Farrah and Alex we had gone through a whole year together so we knew our own perspectives on teaching and our own style. By being with people that know you as a teacher and as a person in your own… your own theory of how you want to instruct. They can look and say, "I can see what you're trying to do there." They can offer you a different perspective on how to strengthen your practice.

If you're kind of going through thinking ... If I keep going through the rest of the year thinking direct instruction, practice. Practice, practice, practice, practice. I might think that's working and then at some point in the year, there's going to be some lesson where I think it's working and it's really not. Then if I'm looking at that with someone who teaches higher level math, someone who teachers lower level math, or someone who teaches the same level as me. They're going to be able to say, "You asked this question and you only made sure like one kid understood." Or like, "You asked this question and you had a really great discussion, but no one really captured that data or that information." Or, "You posted a rigorous problem and gave the answer. This would have been a great point to do culture of error and see like why are kids thinking the way they're doing." Instead of you explaining why they're wrong, them thinking to themselves like, "We think we're right. Oh, We're not."

Like that last video we had when that elementary school class with the worm climbing up and climbing down. Even looking at videos like that and seeing what system or what practices are other teachers putting into place that I could use in my classroom that are research based. How do I implement and make those a routine?

Researcher: Yeah. I think that makes a lot of sense, because you get something out of knowing you're going to show it to somebody else. I feel like I prepare differently if I know I'm going to video something for somebody else to see.

Kyle: That's really true. We talked about it with the research study with the rap team. They analyzed ... They had to write a letter to the President, that we may or may not send, that advocated for hip hop to be taught in schools. Then they also analyzed the lyrics that they had to perform in front of 100, 900, 1000 people, right? Throughout the course of a year. What they noticed was kids were using high level vocabulary but they were using it more accurately and a more compelling way in the lyrics than in the letter to the President. Then the question was: Why is it in their informal writing it's stronger than their formal writing?

My friend came and presented the data to the kids and they're like, "We're going to spit this in front of 900 people in a day. We don't want to look like idiots, and you're only giving me 25 minutes to write this letter to the President." You know? I think when you're video taping yourself and you're thinking, "Somebody is going to watch me." It's like when you get a full observation too. You want to be at your best, so it kind of forces you to be at your best and I think it also just forces you to come to the conversation with something. I think every time someone's presenting a video there was always the "You're going to see me do this and I know this is wrong and don't judge me. This is why I thought to do this and I need help.

It's almost like you were like recognizing the deficits in your own teaching. You know what you want to do and you know what happened. You're trying to think of like where that disconnect is and to everyone else it's like, "Okay, I don't need to watch this video until Kyle ... He needs to do X, Y, or Z."

Researcher: That so and so could have been paying more attention there. Whatever, yeah.

Kyle: He knows how to do X, Y, and Z or he wants to do X, Y, and Z and he tried it and like, something went wrong. It's almost like more surgical. We're looking for that like one piece that if I do this one thing differently it's going to expand. Like, when Alex talked about one dimensional, two dimensional, three dimensional thing. I was just like that's ... With the ant on the paper and through the straw. It's like, that is freaking awesome, because I think I have a lot of kids who ... Maybe when I teach three dimensions they realize it's a solid but they don't think about how that means we can move through the space. It's more concrete without it being like a physical thing they touch. It's a think they can like visualize and have done before.

Researcher: Very strongly.

Kyle: It's really cool.

Researcher: Yeah.

Kyle: I really like that.

Researcher: It sounds like you feel like there were some good benefits to being part of the study.

Kyle: Absolutely.

Researcher: Is there anything you want to add?

Kyle: Like to the-

Researcher: Benefits in general. You can say no.

Kyle: No, I feel like I've said everything I cannot to say. I .. Yeah.

Researcher: That's fine. What about challenges? What's hard about participating.

Kyle: I mean, I think you have to have a level of humility about your own practice. I think for someone who's coming in and you think you're the shit. Then someone's like ... Sorry [inaudible 00:14:51]

Researcher: It's fine. It's not for children's ears. It's okay.

Kyle: Someone's going to come in an critique what you've done. If you aren't prepared for that, it's going to be hard for you to receive the feedback. I think there's other people too that ... I think since Farrah felt comfortable with all of us, she was willing to receive feedback from us. If it was someone who you didn't have a raport with and you're just like, "You need to do this differently." You're just like, "How do you know? You're not in my classroom. You don't understand the struggles."

Researcher: You don't know my kids.

Kyle: "You don't know my kids. You don't know the dynamics of my school. I think having a cohort of people that know each other and have different views about teaching, but all respect each others views and can see the benefits from others, it created a really cool dynamic.

Researcher: What do you think about ... You guys all had, I mean, fairly similar levels of experience. Alex's been teaching like, a long time. Regardless, none of you were new, right? You'd all been doing it at least for a few years and knew your content and felt comfortable with. Nobody was learning any of their curriculum for the first time, or any of that. What do you think about if we had people in the room who were different levels of experience? Do you think that would work, or how would organize that? If you're talking about I want to work with all the math teachers at my school.

Kyle: Yeah.

Researcher: Right? I've got a range of experience. How do you thing that maybe should be organized?

Kyle: I would do it where you have one experienced teacher in the room. Then I think it depends. Say you have mainly first and second year teachers and that's the majority because I think that's ... If we're talking about the kid yes dynamic that tends to always be the case. Then I would like an experienced teacher with two to three newer teachers. They're going to be able to get the tape and know that the newer teachers are going to see more behavior management things and classroom culture things they need to focus on. That experienced teacher can, in addition to that, add that layer of view. Here's some cognitive instructional strategies that you can change differently.

I think if you only put new teachers in a group together and it wasn't facilitated by someone with more experience than them, then they're all going to be looking at the same stuff. Which is like, "Oh my gosh! You got them all to listen. That's so great." Which is what we want them to do and you don't want to leave them there. You want to push them to be-

Researcher: Do you think the experienced teacher in that situation would get as much out of participating, or would they just be basically a pusher, facilitator kind of person?

Kyle: I think that anytime you're facilitating ...

Researcher: Yeah.

Kyle: What I'm saying is that I would get something out of that, because I think the more ... I sort of feel like in my relationship with [the new teacher I'm mentoring] this year is like I'm ... She's asking me stuff about anger management and how do I deliver content.

Researcher: And she's brand new.

Kyle: She's brand new and it's reminding me sometimes kids are not experienced students with being good math students. Sometimes they don't know how to listen and take notes. You can like balance that perspective. I also think it's going to force the teacher to look at someone else's tape and to say like, "Here's a way that you can do both. Here's a way that you can increase behavior management and here's a way you can push rigor in your instruction." I think the more you're able to teach someone, the better you're going to be at your own. I don't know if that translation is always necessarily true, but ... Sorry, I'm trying to think of other-

Researcher: No, I'm just thinking it would be interesting to me if you had say two or three groups where it was mostly new people with one or two experienced people. Then experienced people then all got together and got to feed of each other because I worry. It's kind of like when you have the top kids in the class do the peer tutoring. Then is there a point that they're no longer being pushed? Right? Would then getting all the experienced people together

Kyle: Talking about it.

Researcher: Then push them.

Kyle: Yeah, I think you would have to do something like that, because ... I think both needs to happen. I think that there's two tracks. Sometimes you get better by like coaching people that are underneath you. What's going to end up happening eventually is they're going to move from a place of the basics to the intermediate to the expert. If you're kind of coaching them through the year you're going to follow that trajectory ahead-

Researcher: It's reminding you of the things, yeah.

Kyle: Yeah, and something when you're like with people of your own ability level that interaction pushes all of your stats higher.

Researcher: Right.

Kyle: Both things do it, but you're getting better at different skills, right? When I think about students. This student's really good at error analysis because he's going to look at his friends work. I have two kids that grew beyond their push goal level and went from like a four to a five. They were supposed to stay at a high four and they've gotten to a five and I think it's because I put them in charge of kids that like knew nothing. Because they were forced to explain work-

Researcher: It solidified their knowledge.

Kyle: They really had to know what they were doing. Then I have this other cohort of kids that all sit next to each other and are fours and push themselves to fives because they were like, "Oh, I can't do this, then I do that." I'm like, "This one's really tough." I think it's depending on what skill you want to get better at. I think teacher coaching beginning teachers it's going to probably have stronger, positive climate in their class. Have a stronger sense of urgency. Have like better systems and routines that make sure kids get the work done, because that's like the thing they really want to focus on and that's naturally going to elevate the work of their students.

These experienced teachers are probably going to have rigorous lesson where they're able to put cognitive work in the hands of the kids. I think if you're a teacher that's in both camps. You have this really beautiful classroom set up where you come in and the culture is great, and the systems and the routines support this higher level thinking.

Researcher: Kids are working, working, working.

Kyle: Kids are working, working, working. They're amped about it and it's challenging work.

Researcher: Yeah, I think that makes sense. Yeah. That's my list of questions. Do you have anything else you want to add about-

Kyle: I want to keep doing this. I've been thinking about this year so much and I really miss talking to people that don't teach at my school about what to do. I think I'm learning. I'm always going to still be learning. I have to do this job at the best level because every kid is different. Every kid has his own unique situations. Every class of kids is different, every cohort within that class. As I instruct them standards change every five years, so there is always going to be stuff to do. I really liked somebody that wasn't [inaudible 00:24:10]. Looking at what I was doing and saying, "It's good. Here's how you can make it better."

Researcher: Right.

Kyle: Getting a perspective from people that don't see me everyday. That don't maybe follow the same mind set but that respect me as a teacher, and know that every move I'm making is because I have the best interest for my child. When those two things are present then I think the video thing goes well. That was like really pleasant with all-

Researcher: Given the time constraints that you're all under, how do you think we might be able to make something like that happen?

Kyle: I think that if it were really nice for everyone to hang out ... When was that? Was that in August?

Researcher: September. When we just ate chips and queso and guacamole.

Kyle: It was great. Just having an hour on a Saturday where we all got together. I think during the week is almost an impossible task.

Researcher: No, during the week is murder.

Kyle: Unless every ... You had some campaign business had the same 1:15 to 4:15 time to do professional development. We've been doing it one a month, I'm just saying. I videotaped a one dimensional lesson. This is one thought ... you could even say this is one I though was really strong, this is one I totally tanked, this is one that I thought was going to be strong but landed in the middle. Kind of getting to choose and building more choice about what lesson you want to do.

Researcher: Even if you picked a few clips, didn't worry about a transcript. Right? Just brought them and said I would love your feedback on these. You know, as long as the sound is good. I mean, I think the transcript is nice because it does help you focus and it ... Jenny was talking about how eye-opening it was to look at Alex's transcript next to everybody else's because his was like: Him, kid, him, kid, him, kid, him, kid. Everybody else was like: Teacher, kid, teacher, kid, teacher.

Kyle: Yeah, that was like ... I didn't think I was talking that much.

Researcher: Right. She said the same thing. Sometimes you have to talk a bunch to lay out a strong idea. Right? Talking a bunch is not all bad, right? Part of that is also teacher style, but if the goal is really more to just get together and Share and get some feedback, then it could be less formalized with the conversation before and the transcript and the, you know?

Kyle: I think having maybe that less formal approach in terms of reading everything. I think you could watch a video of yourself teaching and just be like, "Dammit. Why am I only talking to this kid? Why is my decision to talk to this one kid about their behavior so much more important than everything else? I should just tell them please stop and get going."

Researcher: We're going to talk about this later.

Kyle: Exactly. I'm sorry. One kid says something wrong and when you ask a question like, "What is this?" They still display misunderstanding. Just saying, "You know what? This is why this is what it is and if you have a question about that, talk to me later." It's like the both of those things, but I do think going into is almost like a purpose of ... I'm showing you these clips because this is a thing that I want to work on. I think the thing that we all wanted to work on was student distribution of cognitive work. Then saying, "Well, I was planing on doing this." Even if you're someone who wants more written work, taking the video camera around and taking work samples. Saying you want to ask this question or when we did this problem this is what kids produced.

Maybe we didn't discuss all of the work, but this was what I got from it. How do we get these written responses? I'm asking kids like we did 00 table, or added 00 and the table yesterday. Why does 00 make sense for this table? It was like total animals, reptiles, and some kids were just like, "Duh." Other kid we're like, "What are you even saying?" I don't know what that means for my instruction. You know what I mean?

Researcher: Mm-hmm.

Kyle: I kind of want to sit down with some people that are probably seeing the same thing and be like, "I'm asking kids questions that I think are really clear and rigorous, and they don't even have an access point to write it down. What do I do about that?" You know?

Researcher: Right. Yeah.

Kyle: That's a legit question that I really want answered and I feel like If I talked to Alex, Jenny, or Farrah they would be like this, this, this, and that. They'd give me like three totally different ideas and a combination of all three of them is going to be like [inaudible 00:29:18]

Researcher: All right. I can put that feeler out there.

Kyle: I like it and I think like for really moving forward it was great with Keith asked Claire to show a video of her class, make me show a video of mine, and Denning to show his, because we just got totally different vibes from all of them. Every single one exposed something about everyone else's practice that they wanted to challenge them, or something that they were like, "You know what? I don't think about this when I teach. I need to-"

Researcher: I did not know I did that. All sorts of things, yeah.

Kyle: I think like incorporating into like the relay model of you're going to videotape yourself teaching, you're going to bring it to class, and you're going to analyze your teaching as a part of your own graduate work.

Researcher: Yeah.

Kyle: You know? That would be an incredible paper to write of I used these instructional models when I executed. I either executed them successfully, or I didn't. Here are the adjustments I made. Here is the result of my student mastery of the objective on that exit ticket. Here are the results on the quiz. How do we bring all that stuff together?

Researcher: All right.

Kyle: That's stuff that, if you're an excellent teacher, you are doing that all the time.

Researcher: Right, right.

Kyle: That's every day you should be thinking about that.

Researcher: I love the idea about like ... This is not something that as we talk about relay alumni stuff. This is not something that has come up. This idea of like continuing to meet and talk about our teaching, right? You bring up such a good point about you've already got these existing relationships. You're already comfortable sharing your work with each other, you know? I think that would be cool, you know? All right. Would you do it just with the four of y'all or would you invite the other math people out there if they're interested.

Kyle: I would be fine with any of the like-

Researcher: Any of the people you're in class with? The math people?

Kyle: Yeah. Yeah, or just anyone who like taught math. Even if they're an elementary school teacher.

Researcher: Yeah.

Kyle: I think keeping it like content-wise is going to be good, but there's also this benefit of having people whose instruction is more literacy, like reading based, look at what a math teacher is doing.

Researcher: Yeah.

Kyle: Say like, I think with the literature people it's like how are you going to access this text in the right way? What things [inaudible 00:32:06] are you thinking about with their comprehension. Then math people coming back and saying like, "Well, when they have to answer one question, what strategies are they going to use?" I think you need to have both of those to be a good teacher and both of them kind of ... Initially, they exist in these separate worlds of task analysis and reading comprehension where both groups kind of need to be-

Researcher: Yeah. Yeah, I think I would probably keep it math, but it may be that people who didn't feel like they had the bandwidth for it last year might have the bandwidth because they're not doing their relay coursework this year.

Kyle: No, they are not. Absolutely.

Researcher: That's a good idea. I can probably stop recording.

Alex Post-Study Interview Transcript

Researcher: Tell me about your experience participating in our study.

Alex: Well it was news, eye-opening to see how other people teach and what they think makes sense to a kid and to see how they spark new understanding in children's heads.

Researcher: Do you feel like there's anything you learned about yourself as a teacher as a result of participating?

Alex: I think it's a good idea to look in the mirror more often. I think we look in the mirror too often for vanity reasons, you look to see, you check your hair, you see, what would you look like. Maybe there's a pimple on your nose or whatever, you need to shave but when it comes to what really matters, you're reflecting how you do your job, I think we need to do it on a more consistent basis.

Researcher: It can be so easy to just get caught in the day-to-day of everything so this was an opportunity to be forced to look at it. What about using this kind of model for professional development, say with your math team here at school or with other teachers that you work with?

Alex: I think it'll be pretty good because right now, we're doing teach-backs and the problem with teach-backs is that you don't really see yourself. All you do is get feedback from other teachers and the problem also is that it's a condensed version. Instead of an hour class, it may be condensed to 15 minutes and then that condensed version really doesn't taste as good as the homemade version. If we could actually videotape a person actually teaching kids and not actually teaching to adults pretending to be children, then I think you get a better picture of the effects that the students get from the teachers teaching.

Researcher: You guys have been meeting as a department and pretending to be a class of kids and doing a sample mini lesson?

Alex: Correct.

Researcher: Then you get feedback and then do you do it again or you just say, "Thank you", and ...

Alex: The problem is when we do have those department days, there isn't enough time to actually reteach again. That's why it'd be better to go ahead and videotape someone on a Monday and then critique them on a Tuesday and then they'll have time to review, to modify, to do whatever they need to do so then maybe within a week's time, they can go back and reteach the lesson, teach a new lesson with the advice that was given, and see the difference.

Researcher: What do you think about how people's different levels of teaching experience impacts that kind of work?

Alex: At first, it seems obvious that the less experienced, it's the more of, "Let me show you how to do it," when-

Researcher: To the kids?

Alex: To the kids and when there's more experience, that usually people already can expect misconceptions. They can already foretell where a kid might be going in a variety of tangents but unfortunately, if we don't keep looking back into the mirror, we may think that the way we become comfortable with, I'm talking about experienced teachers, then they may think, "Wow, I'm doing right because I've been doing it for so many years," and unfortunately, you fall into this, I don't know, this pseudo way of thinking of saying that whatever you're doing must work because it's worked in the past. If you don't take time to adjust, then you might be making a misconception on and on for the next 2 or 3 years.

Researcher: Your whole math team has been here a while, right?

Alex: No, unfortunately, it is now the 7th and 6th grade team, we've been here together for more than 15 years, about 15 years, while the 5th grade math year is brand new, this is his first time teaching and then the 8th grade teacher, she's taught at another district, I think for 3 or 4 years but this is her first year here and also teaching the grade levels that she is teaching.

Researcher: You got 1 totally new, 1 semi-new, and then 2, it's you and [Swisher] who have been here long.

Alex: Right.

Researcher: One of the things I noticed when I did this work during my first trial with teachers elsewhere was there was a big difference in what teachers could see depending upon how long they've been teaching. It made me wonder, should you do a new teacher targeted video session and then a more experienced teacher or would everybody get something out of coming together with this really broad range of experience? What do you think?

Alex: I think the biggest challenge that we've had here on our campus is just a growth mindset. Some teachers, doesn't matter if they're experienced, have a very open growth mindset. They want to learn, they want to change, they want to develop, they want to get better while sometimes, unfortunately, some people have a very narrow minded way of looking at things and so it just depends on the personality. If someone is willing to change then this will be a very good system to use in order to better their teaching. The first thing is people just have to buy into it. They have to buy in to looking at the mirror, and whatever the mirror says, that's what it is. If that happens, then either experienced teachers or inexperienced teachers can benefit from it.

It's also more beneficial if we focus on a few areas instead of on a broad range. When we did our last team teaching, we just focused on the framing of the lesson and that way, the person wasn't too overwhelmed by the data or the feedback that was given to the person.

Researcher: I think staying focused helps which is why I wanted you guys to really only worry about student thinking when we looked at our videos. Don't worry about management, don't worry about the systems. What are the kids thinking? How can you tell? Otherwise, you could just talk for hours about 10 minutes of tape. What was difficult for you about the study?

Alex: I think for everyone, it's difficult getting the feedback, I think for any human. Again, the more you do it, again, you just look into that mirror, you look good when you have a fancy outfit on but if you take that outfit off, about halfway off, and either you're overweight, or you're underweight, or you have a skin rash, or whatever, you see the ugliness and ugliness of it. Unless you're comfortable with your body, the same thing is unless you're comfortable with people giving you feedback, then that's going to be a tough thing to swallow.

Researcher: Do you think it helped that you guys had already been working together?

Alex: Yeah, you definitely have to know the people that are going to give you feedback, you have to know their personalities because you have to know what message is coming of a person's mouth and the reason they probably say those things because if you didn't know that person and the person would say something, then you may take offense it. Making sure that it's a very low anxiety with your relationship with the other people, it's very, very important.

Researcher: If I were to do this with another group of teachers, what advice would you give me? What would you want me to keep in mind?

Alex: I think the first thing would be to understand everyone's, first of all, point of view on their belief system when it comes to mind growth. I think people should be aware of their mind growth so it may be advisable for them to take some personality test to see where they really stand and they may think they're this mindset but maybe they may not be.

The second thing is also maybe create some sort of rapport with one another in order to state what offends someone would not offend someone. We've done that here before when we asked people, "If I'm going to comment on something, critique you, how many positive things should I say before I may say a negative?" Some people have said, "Just give it to me between the eye," and some people say, "No, it has to be a ratio and this right here has to be this specific ratio or not than this or that."

I think lastly, everyone has to come to the understanding that it's for the benefit of the children mainly. It's a benefit for them but mainly, it's the children who benefit from whatever we tell each other.

Researcher: Thank you. Is there anything else you wanted to add?

Alex: I think also if somebody's going to be videotaped, I think, maybe, they should also set the context of whatever the lesson or the presentation's going to be to that the people who are viewing it. Let the viewer know which day this lesson is already into, let the viewer also know whether there may be any kids with IEPs. Let the viewer also know the level of the ELL kids, that they're in the classroom. Let them know the personality of that group as well because I know here, we have 3 classes and 1 class, they're a little different from the other, the composite of that class itself. If the viewer knows the setting, these things that they cannot see in the video, they cannot get, they can just guess at, they knew that beforehand, then the critique may be more valuable to the person who's in the video than just like, "Well, I wonder if he's doing this because he's done that," or, "I wonder why the kid's answering this way. Maybe he's already done this." There's too many variables in the viewer's mind if it's not put in a correct setting.

Researcher: That's true if they're a particular kid’s issues. It can be easy if you're watching a classroom to hone in on a kid who's just acting strange and if you knew ahead of time, this kid's going to be acting a little strange because of X, Y, and Z, then it might be easier for you to let it go and focus on what you're supposed to be focusing on when you watch the video. Good point. Thanks, appreciate it.

Farrah Post-Interview Transcript

F: I think it was really helpful for me, I guess just from being, I remember Alex’s video especially. I think it was really helpful for me to see other teachers because it’s kind of been hard for me at my school to see others teaching, we didn’t really have time to go see other teachers to just observe and kind of see what other people are doing, you know? Also it was nice to not only get to see other teachers, but also I really do believe that the group I was with, everybody was so great, I feel like I had a lot to learn from them. I really enjoyed it. You got to see how they interacted with the kids and how they explained things, and how they really just had a lot of joy, too, you know? So yeah, it was good for me.

RESEARCHER: Do you feel like there’s anything you learned about yourself as a teacher during the process?

F: I think maybe I need to relax a little bit more and not be so high strung or uptight or on edge almost, because I feel like watching Arturo or Kevin, Arturo was really high energy, but it was all positive energy, even when the kids were a little bit off, he would still stick with it and he stayed really positive and relaxed, and Kevin just seemed really at ease and relaxed the whole time. Maybe if anything I learned, you know teaching is important and you take it seriously, but I think I take it a little too seriously, and I think if I relax and just kind of give the kids time to process and get it, and understand that they might not get it today, and think about tomorrow to see about where it goes, to think about your expectations, you know?

RESEARCHER: It’s hard when you’re in the moment.

F: Yeah, you put so much into it, and sometimes when it’s not what you think it’s going to be, really you just start to kind of get mad at yourself, and sometimes that can come off as high strung and impatient feeling, you know?

[Goes into how she’s a completely different teacher once testing is over.]

RESEARCHER: What are your thoughts about using a video club like ours for teacher professional development?

F: I think it’s a great idea. I was just thinking that. We did a [deep dive on] Eureka 2.0 this year and we talked about getting videos so teachers can watch what a good Eureka lesson looks like and be able to share their video and get feedback.

It’s hard for me to take feedback sometimes, you know, I can get defensive and I don’t mean to. I think it helps because the video is factual, it’s right there. It can be hard to watch yourself, but somehow it feels less judging. You could watch a video with your manager and I love it when she asks me, “What do you think about the lesson I observed?” With the video you have it to see and I could give my thoughts about what worked well and what wasn’t great.

And it doesn’t even have to be content, it could be classroom management or something else that a teacher needs to work on, to see a video of a class where the teacher’s management is really good, so they can learn. Yeah, I think video is great for PD. It also means that if you can't meet right away, you can also look at the video and say, no, this is what happened. It takes a lot of grey out of the way.

RESEARCHER: What was hard for you? You talked a little bit about it can be hard to get feedback or feel a little defensive, which is totally normal. Is there anything that was challenging for you in our sessions?

F: Not during the study, necessarily, I was just thinking in general, but I was just nervous because I was in the room with a lot of amazing teachers, and that was intimidating, because I have a lot of respect for the other teachers that were in that group, and I think I had a lot to learn from them, so when we watched my video, I just felt a little intimidating because I didn't know how they would see it or think about it, and I didn't want to seem like lesser, you know, because I feel like I have a lot to learn from them, but I didn't want them to think like, "oh, she's not that good," you know? That's what's hard about the video, even though it is black and white, if you mess up it's hard to put yourself out there so everyone can see that, you know? But I think at the same time I really think that we need that really bad, because I think sometimes people try to, I know I do, I try to put out that I'm this amazing teacher, and oh, my classroom management, and my questioning, and I do a pretty good job, but I think it's so much more comforting for other teachers to actually see when you mess up. But you don't want them to see that, you know?

RESEARCHER: Right.

F: It's good for everyone to see, but if you're the one, it's difficult. And even keep in mind, like I picked this, so it's not like it's going to be too crazy, but still having other people able to say "she's not that good," I don't feel that way, but knowing that other people could judge me. And they didn't, right? But when someone's like, bring in your videos, uhhh, yeah, it's hard.

RESEARCHER: Totally. So if you were going to give me some advice on doing additional studies like this, what would you tell me?

F: I don't know…the only thing I would, maybe…and maybe you did this and I missed it, but just give us the guidelines on what to bring in.

RESEARCHER: Yeah, it was general, asking you to think about instances of student thinking in your class, but maybe it could have been more clear?

F: Yeah, I mean you're going for what you're going for, but just give more on what you're looking for? So that we could give better examples of it. 'Cause I still don't know if that content in mine was what you wanted, or if that mattered. You know what I mean?

RESEARCHER: yes, that's super helpful. One of the challenges for me is to think about how to give you enough guidance so you know what to bring in, but not so much that it limits what you share, you know?

F: Yeah, you don't want them to make a lesson just to make a video.

RESEARCHER: Right. Is there anything else you want to talk about?

F: I just really enjoyed it and watching other people's videos, and even though it was hard for me, it was good to show my own, and then once I showed my own it wasn't bad, I was overthinking it. I think that as far as PDs go is I might worry about showing all these videos of someone doing a phenomenal job, and how does that teacher who's struggling feel? Because you want someone to say, "I did it and it was a total flop," or "I redirected a kid in this way and they had a total meltdown." Because sometimes you need to see the 'don'ts' and be able to admit that we're not perfect, we make mistakes.

RESEARCHER: Yes, because you can’t learn if you think everyone else is perfect and it doesn’t fit what you have going on.

F: Right. Exactly.