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Professional Noticing into Practice: An Examination of Inservice Teachers' Conceptions and Enactment

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ABSTRACT

Teacher noticing and the related construct of professional noticing of children's mathematical thinking have proven to be fertile ground for education researchers. Professional noticing is a framework for a teaching practice consisting of three component parts: attending, interpreting, and deciding. The current study investigates the conceptions and enactment of professional noticing of 24 elementary and middle grades teachers participating in professional learning programs that incorporated professional noticing. These teachers demonstrated a wide range of interpretations of professional noticing which varied in consistency with respect to the literature in this area. This diversity of conceptions is seen as a consequence of teachers having different definitions and scopes of application for professional noticing. This study adds to current discussions about the meaning and role of professional noticing by considering the perspective of practitioners, a group whose input is often secondary to education researchers but whose conceptions and enactment of such noticing is critical for student success.

KEYWORDS

Professional noticing;
professional development;
research to practice

Research on *teacher noticing* in mathematics teacher education has grown significantly in the past two decades. Despite a burgeoning research corpus devoted to such noticing, few investigations have explored how teachers conceive of and enact such noticing (i.e., mathematically responsive in-the-moment instruction) amidst the hustle-and-bustle of a classroom. Most existing research describing responsive teaching practices has focused on the specific teacher moves involved rather than the process, contexts, and practical enactment of noticing which generated those pedagogical responses (Dyer & Sherin, 2016). This paucity of descriptions of authentic, in-the-moment noticing, from the perspective of teachers, may be attributable to methodological difficulties, detailed by Sherin, Russ, and Colestock (2011) which rest on the fundamental need to access and examine teachers' thought processes, which are not directly observable, as they teach. Ultimately, the literature does not present a clear picture of noticing enactment from the perspective of the practitioner; however, practitioner publications provide some illumination of such practice in the mathematics classroom (Thomas, Fisher, Eisenhardt et al., 2015a; Thomas et al., 2015b).

Sherin, Jacobs, and Philipp (2011) describe two features of teacher noticing, “attending to particular events in an instructional setting” and “making sense of events in an instructional setting,” as “interrelated” and “cyclical” (p. 5). Noticing is also an *active* process influenced by teachers' prior experiences and dispositions (Erickson, 2011; Hand, 2012). Schoenfeld (2011) makes the case that noticing matters because “what teachers attend to as they teach is highly consequential” (p. 223) for the students and teaching practices. This directly connects to the related construct of *professional*

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noticing of children's mathematical thinking (hereafter referred to as professional noticing), which adds a third feature to include: a *decision* to respond based on what is attended to and how it is interpreted (Jacobs, Lamb, & Philipp, 2010). While the terms, noticing and professional noticing, are often used interchangeably, there is a distinction in the added deciding factor. The purpose of this inquiry is to inform professional noticing research and to refine the construct definition by better understanding how practicing teachers conceive of and purport to enact professional noticing.

This study focuses on elementary and middle school inservice teachers' conceptions of and purported enactment of professional noticing after participation in a mathematics professional development program designed and implemented by The Kentucky Center for Mathematics. Specifically, our research questions were: 1) What are inservice elementary and middle grades teachers' conceptions of professional noticing? 2) How do inservice elementary and middle grades teachers purport to enact professional noticing? The purpose of this investigation is to better understand purported conceptions and enactment of complex practice that is well-theorized in the literature from the vantage of practitioners.

Conceptual Framework

Professional Noticing of Children's Mathematical Thinking

Current ways that researchers think about professional noticing are grounded in Goodwin's (1994) conceptualization of professional vision and Mason's (2002) discussion of the interplay between what teachers notice and how they teach. Goodwin describes three practices as comprising professional vision: coding, highlighting, and producing material representations. The three practices comprising professional vision combine to focus on ways of knowing and acceptable activity within a professional group. Of particular interest, highlighting is a practice of marking specific phenomena in order to make them salient; as such, we constructed coding schemes which aimed to "transform phenomena observed in a specific setting into the objects of knowledge" (Goodwin, 1994, p. 606).

Goodwin's (1994) three components are foundational to the professional noticing of children's mathematical thinking framework defined by Jacobs et al. (2010) as "a set of three interrelated skills: *attending* to children's strategies, *interpreting* children's understandings, and *deciding* how to respond on the basis of children's understandings" (p. 172). In attending, a teacher will pay attention to and highlight (usually mentally) student behaviors, both physical and verbal, which are strategically relevant. Once a behavioral detail has been attended to, nearly simultaneously, Jacobs et al.'s definition states the teacher will interpret that detail in light of research on the development of students' mathematical thinking to add to her understanding of one or more students' mathematical thinking. On the basis of this inferred mathematical understanding and knowledge of relevant research, the teacher will decide upon an appropriate instructional move to build on the student's, or students' thinking. Thus, this definition is predicated upon teachers' knowledge of relevant research.

Practitioner publications provide some description of authentic enactment of noticing. For example, Thomas et al. (2015a, 2015b) propose a professional noticing of children's mathematical thinking practice that relies heavily on the Common Core State Standards for Mathematics (Common Core State Standards Initiative [CCSSI], 2010). To make the components of the practice explicit, Thomas et al. deliberately slow down the practice in a manner similar to what Grossman et al. (2009) described as the decomposition of practice. In both of the practitioner articles, a teacher gives her students a task aligned with a target standard, and a sample of student work is given. Strategic details exhibited in these samples are attended to and interpreted as being consistent with understanding at the level of a different, lower grade-level standard. In the deciding phase, a sequence of standards connecting the achieved standard and the target standard is constructed along with instructional tasks aligned with each of these standards. In this way, Thomas et al. propose that individual standards provide a robust basis for interpreting student mathematical

thinking, and sequences of standards form developmental progressions (Confrey, Nguyen, & Maloney, 2011) that provide frameworks for making instructional decisions.

Research and Practice

Connecting research to practice is widely thought of as a positive aim for mathematics education (Silver, 2003; Sowder, 2000). In 2004, the National Council of Teachers of Mathematics identified such connections as a strategic priority and further elaborated upon this position in the official report from the research agenda conference. This report described four areas of focus: (a) Emphasize the need for communication and collaboration between practitioners and researchers around issues that are important to practitioners; (b) make practitioners' research needs, both as initiators and *consumers of research* [emphasis added], explicit to the mathematics education research community; (c) promote a set of research-guiding questions that focus researchers' attention on critical problems of practice; and (d) urge funding agencies, policymakers, and other mathematics education stakeholders to support research that is grounded in practitioners' problems of practice (Arbaugh et al., 2008, p. 6). This investigation of teachers' conceptions and purported enactment of professional noticing practices addresses the second focus area of making practitioners' needs, as consumers of research, explicit to the research community.

Challenges with Linking Research to Practice

Certain obstacles impede connections between research and practice. At a very fundamental level, the research and practitioner communities hold different viewpoints regarding the worth of theoretical knowledge and perspectives. Silver (2003) writes,

In the research community, the valued currency is theory ... In contrast, across the border in the land of educational practice, the valued currency is practical application. Work has value in this community to the extent that it can be directly applied to the improvement of some important domain of practice (p. 183).

Such differences in values are ascribed to cultural differences between the two communities which Heid et al. (2006) describe in terms of cultural aims. Specifically, the researcher's "search for general [solutions] is countered by the teacher's search for solutions to particular situation" (p. 80). This often results in research ideas and proposals that do not appear to connect with the practitioner's experience and environment. Moreover, structural tensions (e.g., school curricula versus research-informed suggestions for practice) may exacerbate such challenges in that teachers are often "flooded with messages *not* to use their textbooks" which includes suggestions garnered during professional learning experiences (Hill et al., 2008, p. 499).

Additionally, there are specific methodological challenges associated with linking research to practice. Calls from the research community for increased emphasis on research centered in the mathematics classroom (Arbaugh et al., 2008; Burkhardt & Schoenfeld, 2003) are met with decreasing opportunities and enthusiasm among practitioner communities for ideas and strategies that are considered unproven (Heid et al., 2006). Further, this methodological challenge is intensified by current accountability trends that emphasize student performance on standardized measures. Quite simply, the practitioner community is increasingly averse to participating in the research enterprise as the "very mandates that encourage evidence-based teaching mitigate against the development of that evidence" (Heid et al., 2006, p. 80). The competing interests, therefore, belie the potential for disconnect between the practitioner and research community and warrant the investigation of how key practices and constructs are conceived and enacted in the mathematics classroom. In Mason's (2002) view noticing occurs in all teaching, which if true, positions such noticing as a natural connection between practitioners and the research community leading to a common goal of increasing the acuity and effectiveness of noticing, as shown by aforementioned researchers (Schack et al., 2013; Santagata, 2011; Sherin & van Es, 2009).

Teacher Conceptions and Enactment

We ground this investigation in the teachers' conceptions and purported enactment of professional noticing. As such, we define conceptions as the general, and typically implicit, understanding that individuals hold regarding a particular concept or phenomenon (Brown & Lingbiao, 2015; Thompson, 1992). Moreover, conceptions are "formed gradually through experience with a phenomenon ... and become the mechanism by which a person's reactions or responses to the phenomenon are shaped" (Brown & Lingbiao, 2015, p. 4). From this perspective, we define enactment as the realization of some reaction or response to a particular concept or phenomena.

Turning attention to the manner in which noticing influences students' mathematical activity and learning, it is, arguably, tautological that the mathematical activity and practices of teachers and students are bound in very deep and complex ways. While more formalized study of teacher noticing impact on standardized student learning outcomes is still emerging, there is evidence in the literature which describes profound changes in students' mathematical activity in classrooms where such noticing is enacted. Schifter (2011) describes how an individual teacher's noticing ability influences student experiences in the area of early-algebraic reasoning as well as how such noticing moved the culture of the mathematics classroom toward productive student discourse and critical exploration of key ideas. Moreover, considering the mathematics classroom through lenses of equitable opportunities, Kalinec-Craig (2017) describes how professional noticing may address inequities related to students' status and positioning in the classroom. These are but two of many examples of how teacher noticing influences students' mathematical experiences in the classroom.

In the context of this study, we aim to discern how teachers conceive of and enact the practice of professional noticing. Given the well-theorized nature of professional noticing, we find a paucity of research that privileges the perspectives and contexts of practitioners and their professional contexts. Moreover, we hypothesize that these perspectives and contexts influence (perhaps greatly) the manner in which such noticing is conceived and enacted.

Methods

This investigation centers on a series of four focus groups conducted with inservice classroom teachers, intervention specialists, and special educators in the context of research-informed professional learning experiences that emphasized professional noticing. Focus groups were used both for practical issues of access to teachers and for the diversity and strength of responses they engender. The conversational nature of focus groups allows for participants to react to each other's responses; these responses can help to more fully develop areas of agreement or highlight areas where participants' conceptions diverge (Barbour, 2008). While additional data collection during the course of the professional learning experience would likely have proved advantageous, we considered these focus groups as an initial foray into practitioners' conceptions of this complex practice. As such, this study was positioned to more carefully guide subsequent inquiries in this area.

Professional Learning Description

This study was situated within two professional learning programs designed and implemented by The Kentucky Center for Mathematics, located in the Southeastern United States. The elementary grades (K-5) program is focused on "grow[ing] teachers' understanding of early numeracy development and their abilities for establishing in students, strong foundations for fluently adding and subtracting" while the middle-grades program is focused on "providing teachers with a greater understanding of sixth grade mathematics content (i.e., ration, proportion, equations, etc.) and strategies for assessing and teaching that content." (Kentucky Center for Mathematics, 2015, p. 21). Both programs are designed around best practices for professional learning (i.e., sustained, job-embedded, etc.) and are intentionally designed for classroom teachers, intervention specialists,

and special educators with an aim of systemically improving the quality of mathematics instruction throughout entire schools (and districts). Both programs involve periodic (approximately monthly) workshops and online support meetings throughout the academic year, as well as several days of professional learning during the summer. In recent years, these programs have incorporated professional noticing into their designs and have provided participants opportunities to refine their practice of component skills (i.e., attending, interpreting, deciding) in virtual (e.g., video-based professional noticing) and authentic (e.g., interview-based professional noticing) contexts.

Participants

The focus groups, facilitated by two of the researchers, consisted of the professional learning program leaders and the participants. The focus groups occurred within the context of a professional learning program session (immediately following or during a lunch break), thus the participants were either elementary or middle-grades educators. These focus groups were conducted during the fall (November, December) and spring (March) of a particular professional learning cycle. Focusing on teachers across a larger range of grade-levels allowed us to gain a broader perspective of professional noticing conceptions and enactment. The Kentucky Center for Mathematics' professional learning leaders are either current or former teachers with most serving in elementary classroom or mathematics intervention contexts, and these individuals (with the support of their respective schools) volunteer to participate in the professional learning events. The professional learning programs are regionally organized within the state; therefore, teachers from different regions within the state populated each of the focus groups. Specifically, elementary focus groups were conducted in suburban regions (outside of two different, large urban areas) while the middle grades focus groups were conducted in a rural Appalachian region. For each group, the professional learning leader extended invitations to participate in a focus group related to the content of the program. See Table 1 for additional details regarding the focus group participants.

The focus group participants' teaching experience ranged from one year to more than 15 years. For eight participants, this was their first experience with The Kentucky Center for Mathematics' professional learning programs while others were on their second or third iteration of a particular program. Participants are identified throughout by pseudonyms; elementary teachers are given names beginning with E, and middle grades teachers are given names beginning with M. As only one male teacher is quoted below, all participants are given female names to reduce distractions and maintain anonymity. Table 2 lists the pseudonyms of all teachers quoted in the results section along with the grade band at which they teach and their educational context (general education, special education, or intervention specialist).

Table 1. Focus group participants.

Focus Group Type	#Classroom Teachers	#Intervention Specialists	#Special Educators	#Other Ed. Professionals	Total # Participants
Elementary Focus Group 1 (PROGRAM NAME A)	4	2*	2	0	8
Elementary Focus Group 2 (PROGRAM NAME A)	2	2*	0	0	4
Middle Grades Focus Group 1 (PROGRAM NAME B)	4	0	1	1**	6
Middle Grades Focus Group 2 (PROGRAM NAME B)	4	1*	1	0	6
Total #Participants	14	5	4	1	24

* One of the intervention specialists was also the leader of the professional learning experience
** District curriculum specialist

Table 2. Focus group participants by name.

Name	Grade Level	Context
Elaine	Elementary Grades	Special Education
Elisa	Elementary Grades	General Education
Elizabeth	Elementary Grades	Intervention Specialist
Ellen	Elementary Grades	General Education
Elsie	Elementary Grades	Special Education
Emily	Elementary Grades	General Education
Erica	Elementary Grades	General Education
Eva	Elementary Grades	Intervention Specialist
Evelyn	Elementary Grades	General Education
Maria	Middle Grades	General Education
Marissa	Middle Grades	Intervention Specialist
Mary	Middle Grades	General Education
Megan	Middle Grades	General Education
Melanie	Middle Grades	General Education
Michelle	Middle Grades	General Education

Focus Group Protocols

Prior to the focus group session, the professional learning leader disseminated several practitioner articles describing various ways to enact professional noticing. Although participants had discussed and engaged in the practice of professional noticing (i.e., attending, interpreting, deciding), they had not yet been presented with portrayals within practitioner literature. As such, we instructed participants to read their respective articles prior to the meeting, and copies of each article were provided for reference during the focus groups. The purpose of this was to help participants develop some practical perspectives of the practice prior to engaging them in conversations regarding its nature and application. For the elementary groups, an article from *Teaching Children Mathematics* (Thomas et al. 2015a) and for the middle grades focus groups, an article from *Mathematics Teaching in the Middle School* (Thomas et al. 2015b) was selected. Both articles portray professional noticing in a manner consistent with Jacobs et al. (2010) as well as enactment in conjunction with mathematics standards.

A series of discussion prompts were developed for each focus group (see Table 3) and were designed to elicit discussion about participants' conceptions and enactment of professional noticing within their own school and classroom contexts. While there is considerable similarity between the

Table 3. Focus group discussion prompts.

Focus Group Prompts for both Elementary and Middle Grades	
Based on what you read in the article, do you feel that professional noticing is a realistic and useful practice in your classroom? Why or why not?	
Similar to the example in the article, is there sufficient flexibility in your curriculum and/or school structures to use tasks for grade-levels other than the one you are teaching?	
Do you feel that you have adequate time to focus on individual students' strategies? Why or why not?	
The article describes professional noticing at the individual level. Do you feel like professional noticing can be accomplished at the whole-class level? – Explain why or why not.	
How do assessments and/or progress monitoring tools play into professional noticing?	
Do you feel equipped to connect student strategies to specific mathematics standards as the teacher did in the article?	
Do you feel equipped to create instructional tasks or games outside of your curriculum to advance students' thinking toward a mathematical goal?	
Additional Elementary Prompts	Additional Middle Grades Prompts
Occasionally, we have to “drop back” and help kids fill in the gaps. Give an example of how you determined how to teach in such a situation.	In a classroom discussion, describe how professional noticing guides how you choose which students share their thinking and in what order?
Describe how children's development of math knowledge informs your choices about when and how to teach outside of your curriculum.	

elementary and middle grades prompts, alignment to respective practitioner articles resulted in some minor differences (e.g., referring to article mention of “whole-class professional noticing”). Further, these focus groups were conceived as semi-structured experiences and each focus group facilitator posed frequent probes around the discussion prompts. These follow-up probes were improvised in the moment and based on participant responses to the structured prompts. Each of the sessions was audio-recorded and transcribed. The duration ranged from 20 minutes and 4 seconds to 24 minutes and 17 seconds with an average duration of 22 minutes and 19 seconds.

Data Analysis

This investigation is organized around iterative, inductive analysis of the focus group transcripts. Two researchers (who were also the focus group facilitators) enacted a process of open-coding (Corbin & Strauss, 2007; Creswell, 2014) with one of the focus group transcripts to develop initial, parallel qualitative codebooks. One researcher’s initial codebook contained 28 codes (e.g., Affirmation of utility, Denial of feasibility, Professional Noticing as Cyclical, etc.) while the other researcher’s codebook contained 27 (e.g., Emphasis on individual student, Professional Noticing in the moment, Exclusion of gifted students, etc.). The researchers compared the parallel codebooks to reach consensus, and to refine and organize the codes around specific themes. This process was reiterated for another focus group transcript, which resulted in further refinement and reorganization of the codes. The researchers used this final codebook to analyze the remaining two focus group transcripts and re-code the initial two focus group transcripts. The final step of analysis, axial coding (Saldaña, 2015), was used to fit codes together into categories or dimensions that identify a common theme of those codes.

Findings

The concluding phase of analysis resulted in the identification of themes and related subtopics (final negotiated codes) within each of the themes (see Table 4). For each subtopic, the number of distinct segments of conversations assigned that code is recorded, as well as the number of teachers who participated in those segments of conversation. While three broad themes emerged from our analysis (conceptions of professional noticing, enactment of professional noticing, external influences), we will focus primarily on practitioners’ conceptions and enactment of professional noticing as these exist within immediate purview of practice. In the following sections, both of these themes will be explored and representative quotations from the focus groups will be provided.

Table 4. Themes and subtopics of professional noticing.

Theme	Subtopic	Frequency	Number of Teachers
Conceptions of professional noticing	Typical or Exceptional Practice	17	10
	Context Specificity	24	14
	In-the-Moment Noticing	8	8
	Differential Noticing Based on Ability	7	6
	Collaborative Noticing	9	7
Enactment of professional noticing	Continuously Guide Instruction	5	4
	Remediation (of Misconceptions)	13	10
	Orchestrate Discussions	3	3
	Assessment-Driven	9	6
	Affect-Driven	2	2
External Influences	Standards-based Planning	9	5
	Curricular Rigidity and Flexibility	27	14
	Adjacent Concepts	17	10

Theme 1: Conceptions of the Practice of Professional Noticing

Professional Noticing as Typical or Exceptional Practice

The teachers interviewed consistently expressed a belief that professional noticing is a useful practice, with proclamations of its usefulness being the type of statement most likely to result in agreement by the rest of the group. Some teachers went so far as to say that professional noticing is necessary to effective teaching, as Emily (Elementary-General Education) illustrates, “you almost have to do that daily to know where all the students are, so you aren’t leaving kids behind as you are blazing through material.” The notion that professional noticing is a typical teaching practice was expressed in all four focus groups; most concisely by Marissa (Middle Grades-Interventionist) who said, “I just think that’s a natural part of instruction ... noticing what your kids are doing and letting that drive where you go from there.”

There was, however, little agreement about whether or not teachers effectively perform this practice in their classrooms. Regarding the feasibility of professional noticing, most responses fell into one of two categories: claims that noticing is simply a rebranding of more typical teaching practices, or protestations that, while noticing is fundamentally important, it is also extremely difficult. Eva (Elementary-Interventionist) represented the first category when she said, “I think that teachers do this, there’s just this new professional name for it. For attending ...”. Similarly, Elsie (Elementary-Special Education) claimed that noticing is automatic and continually ongoing by saying, “I think that’s what we do all the time, we just don’t call it professional noticing.” Contrasting these claims of professional noticing as a typical practice are those proclaiming it as an exceptional practice to be aspired to. In the following exchange, Evelyn (Elementary-General Education) articulates the profound challenge of noticing while echoing the cyclical perspective of Elsie:

Evelyn: *It’s a continual learner base for the teacher as well as for the students in terms of where they are, where they need to go, assess them where the goal is and then you need to figure out another goal. I mean, it’s a continuous process.*

Elisa: *And saying that, I think you can always get better at it. I don’t think it’s something you ease into.*

Context Specificity of Professional Noticing Feasibility

In conversation about the feasibility of utilizing professional noticing as a regular teaching practice in the classroom, a clear divide was apparent between the considerations of general education teachers and special education teachers. The influence of class size and time constraints on the general education teachers’ ability to notice individual students was best summarized by Ellen’s (Elementary-General Education) blunt declaration that, “it’s not practical to know exactly why my students are performing the way they are.” By contrast, interventionists and special educators did not report that time constraints restricted their noticing, as Elizabeth (Elementary-Interventionist) explains:

I feel like in my situation as a math interventionist that I am able to spend more time meeting individual needs of the students. While the classroom teachers may see the importance of everything we read in the article, [they] have a harder time with the larger class sizes of being able to meet all those needs.

The benefits afforded by a special education resource room are explored by Elaine (Elementary) and Elsie (Elementary), the two special education teachers, when Elaine said of her small group teaching, “I like figuring out these quirky little things about the kids and make these adjustments and send them back to class.” Elsie elaborated on these benefits with the following comments about inclusion:

I think also with special ed., even, there’s this huge push for inclusion, which I absolutely agree. Inclusion is a wonderful thing. However, we’re special education teachers ‘cause we need to provide that foundational support

for them, so it's easier for us to pull them to the resource room and do that professional noticing. I have a hard time doing it in the general ed room because I get sucked into all the other situations.

Differential Noticing Based on Ability

Combined with implicit calculations about the immediate value of interactions with students, participants indicated that this in-the-moment nature of noticing results in differential noticing based on ability, as the following exchange illustrates:

Ellen: *You don't sit down and say today I'm gonna attend to this here or this here, it's just sorta whoever pops up whoever flies by, and unfortunately, it's usually the students that are at the lowest end ... and your students who are like gifted or special are just kinda oh, you got it, so ...*

Eva: *I think there is less professional noticing for the gifted students.*

Elisa: *Which is unfortunate.*

Likewise, Mary (Middle Grades-General Education) reported that her emphasis on trying to make sure that every student understands the material results in paying special attention to students who need more support: "and I end up ... that the ones I went back for they still don't have it after I went back, and the other kids are bored out of their minds." While not all participants indicated a lack of noticing of gifted students, no teacher indicated that he or she attended to all students individually. Invariably, someone gets left out; for Megan (Middle Grades-General Education) it was the students in the middle, when she commented about the "middle ground" students that don't stand out so "those steadily growing and learning ... lot of times you probably don't individualize to them a lot."

Collaborative Noticing

Somewhat ameliorating the perceived difficulties of noticing in general education classrooms was the general impression of some teachers that noticing can be performed collaboratively. Elaine, an elementary special educator, reports sharing noticing details with the general education teachers because "having other colleagues that work with the same kid, it's easy to pass that information along. Because I see it more easily than they do because of our small groups." Similarly, Elisa (Elementary-General Education) noticed a specific difficulty that a student was having and "so then, I was like, now I have to tell the teacher tomorrow you better check on this." These two quotes are consistent with a theme from three of the four focus groups in which special educators and intervention teachers share their specific knowledge of students with the general teacher so that the general teacher can plan more effectively. Likewise, Elisa related how she uses students to notice each other so that specific mathematical behaviors are attended to by other students:

So, they're kinda doing my noticing for me like Milly will say, today Rodney made the mistake and he mixed up the tens and ones place so he wrote 21 instead of 12. And so, then I have that information where I couldn't have made it around to every single student, but I can make it around to the groups of 4 ...

Theme 2: Enactment of Noticing

When asked how and why they used noticing in their classrooms, participants responded with a wide variety of purposes for noticing.

Noticing to Continually Guide Instruction

Evelyn explained that noticing was a continuous cycle of assessing students and modifying instructional goals accordingly. Maria (Middle Grades-General Education) detailed the most comprehensive usage of noticing:

I think that noticing drives your students ... if you're trying to get out of them how they're solving it, what's right, what's wrong, what are the common misconceptions of the class. Does that common misconception go back to something you taught previously? I just think that a natural part of instruction is noticing what your kids are doing and letting that drive where you go from there.

Noticing to Remediate, Especially Misconceptions

The most commonly expressed purpose for noticing was more limited; many teachers expressed that noticing was useful for identifying and remediating misconceptions. Melanie (Middle Grades-General Education) describes encountering and responding to common misconceptions in her classroom:

Some of them, just by going through the homework quickly, I see some have it, some don't. From this, what we've done in the last few days I see I can pick out some [common misconceptions] from those problems, instead of dealing with each individual one, I might take the kids that have it and pair them and let some peer tutoring go on. Or I might address a small group of them ... But that's an intervention within my classroom that can be done for those that you notice didn't get that particular concept, where others did. And that's the hardest thing, where I get behind all the time in teaching.

Elisa expresses the same focus on identifying and “fixing” misconceptions, but with a greater emphasis on individual student strategies, as she described a situation wherein she follows the steps students are using to solve a problem “and then deciding how am I gonna help everyone fix that situation for that kid.”

Noticing to Design and Guide a Class Discussion

The middle grades teachers read a practitioner article involving using noticing to help orchestrate discussions. They commented extensively about noticing student strategies and using what they noticed to aid class discussion. Mary (Middle Grades-General Education) focused on identifying and presenting a variety of strategies:

We do a lot of drawings and sketches in small groups and as they're working, I'll just walk through and just say when you're done, let me have yours. And I'll try to get a variety of different strategies, and show them to the class, discuss, and it's fun to watch them a lot of times seeing one go up and go “oooh, I didn't think about that” you know, even if they hadn't studied it, just seeing the way it's laid out. It's ... I think it really helps to see how other kids are solving it.

On the other hand, Maria (Middle Grades-General Education) used a more stratified approach, incorporating student strategies in order of sophistication, by putting “the one with the most advanced thought last after the others ... have developed a sense of what's going on. You kinda work your way into the more complex answers.”

Noticing in Assessment

In their descriptions of examples of noticing, teachers frequently situated their noticing inside of an assessment; Eva (Elementary-Interventionist) provides a clear example of this:

Now, with individual students, I think it's harder for a classroom teacher than for a special education teacher. I am a math intervention teacher, so I have more time to figure out exactly how they are thinking about the math. But even your classroom teacher when they're doing formative assessments ... You're still looking at their responses, attending to what they're looking at, and then moving forward from that.

Noticing of Affect

While the above descriptions of noticing were either general or focused on student strategies, a small number of participants also mentioned a focus on affect when asked about how they enacted professional noticing within their classrooms. Ellen (Elementary-General Education) mentions affect as one factor of what goes into noticing:

I think it's something we all do, and we do it naturally. But one of the things is like keeping a record of it, and I don't think that's something ... when I was referring to not having time, that's what I was meaning, is like writing down exactly what you notice, like Jimmy had a sad face while he was manipulating his math tools today.

A specific example of noticing of affect was presented by Elaine (Elementary-Special Education):

When you asked [us to provide a specific example of using noticing], I thought of one student in particular, because he gets frustrated, and when he gets frustrated, he won't do anything, so I can see that frustration we just chill and then we start back from the beginning.

Discussion

Analysis of the focus group discussions resulted in multiple themes and subthemes, which are discussed here. Indeed, inservice teachers' conceptions and enactment of professional noticing vary widely both across the practices of the teacher in these focus groups and sometimes within an individual teacher's reporting of his/her practice. Additionally, instructional contexts appear to contribute to inservice teachers' conceptions and enactment.

Diversity of Conception and Purported Enactment of Professional Noticing

Across grade levels and contexts, it is evident that the teachers who participated in this study possess a variety of interpretations of professional noticing. This diversity of conceptions is most apparent in the way that the conceptions of some teachers sit in near contradiction to the conceptions of other teachers. One such contradiction is that Eva and Marissa both conceive of professional noticing as being just another word for natural teaching practices which teachers are already employing, whereas Evelyn and Elisa indicate that professional noticing is a difficult, learned, essentially aspirational teaching practice.

The scope of what activities are noticed during professional noticing is another area in which teachers' conceptions were highly varied. On one hand, Maria consistently speaks of students' strategically relevant behavior and mathematical competences, but on the other hand, Ellen and Elaine include student affect as a valid target for noticing. Finally, Melanie and Ellen describe noticing as something they employ in-the-moment, particularly for identifying and remediating misconceptions, but Elaine and Elisa take the view that noticing can be performed on longer time scales, and even collaboratively with other teachers of the same student. While this list is by no means exhaustive, it is sufficient to demonstrate that teachers' conceptions of professional noticing are divergent, with no clear picture of what professional noticing means or how it is performed emerging across our groups.

Contrast Elisa and Maria: Elisa applies noticing opportunistically but narrowly to identify and fix misconceptions. Maria notices to acquire precise information (standards matching) about what her students are doing so as to drive instruction moving forward; she also mentions discussion guiding. The diversity of inservice teachers' conceptions of professional noticing discussed here represents a challenge to the research community. Varied conceptions tend to push the definition of the construct of professional noticing, potentially distorting the construct to the point of deconstructing it. However, diverse interpretations can also challenge the research community to further our understanding of the construct to clarify the boundaries of the construct. This warrants further research, discussion, and professional development for practitioners *and* researchers to refine this important practice and our ability to study it.

Alternatively, perhaps the variety of conceptions of professional noticing is a result of the capacious framework that *can* be considered at multiple grainsizes. The term, professional noticing, stemming from Jacobs et al.'s (2010) work on *professional noticing of children's mathematical thinking*, is a very specific framework, many times shortened to the term *professional noticing*. The shortening of this term has perhaps led to its application in myriad ways. It is likely that Mason's (2002) view of noticing is at play in the broader, larger grainsize applications the teachers in this study discuss. For example, Elaine describes noticing a student's frustration and uses this cue to slow down and back up. While this is an important noticing moment for a teacher in the ultimate mathematical success of the student, the teacher has noticed general behavior rather than the student's mathematical thinking, thus not meeting the Jacobs et al. (2010) construct of professional noticing of children's mathematical thinking.

If one considers the history of the development of professional noticing, it may be possible to discern a hierarchy of constructs, each level of which is increasingly narrow in its definition. The origins of noticing may be traced to Goodwin's (1994) idea of Professional Vision in archeology, followed by Mason (2002) who applied the notion of noticing to teaching. As discussed in the literature review earlier, many researchers have studied noticing under different terms and with differing levels of inclusion of attending, interpreting, and deciding. The inclusion of all three components aligns with Jacobs et al.'s (2010) definition and is the narrowest construct to date in this hierarchy. Perhaps there are analogous constructs to professional noticing of children's mathematical thinking that encompass broader aspects of teaching. For example, Amador, Males, Earnest, and Dietiker (2017) describe the application of teacher noticing to curricular materials and Choy (2015) integrated noticing into lesson study.

A broader framework could potentially be introduced to include the diversity of construct interpretations that would involve room for noticing of standards' evidences, student behaviors, and even distributed forms of noticing that are enacted collaboratively. Such broadening of the construct may better accommodate the needs of practitioners (such as those of this study) as they consume and act upon emerging research.

Consistency within Instructional Contexts

Since not every teacher is deemed *highly effective*, this brings up a question of whether professional noticing is something that is consistently practiced within instructional contexts, despite Elsie's claims that all teachers do it automatically. Elsie does extend her thoughts by discussing the fact that it is a continuous process for teachers to develop effective professional noticing. However, with the discrepancy in how teachers are using professional noticing within their everyday teaching, it appears that the broader process of noticing (Goodwin, 1994; Mason, 2002) may be distinguishable from the more specific process of professional noticing of children's mathematical thinking in elementary and middle grades classrooms. While Jacobs et al. (2010) found that professional noticing is not a practice that naturally improves with teaching experience, Schack et al. (2013) found that it is, in fact, *teachable*. This could justify the need for sustained professional development in the specific construct of professional noticing, as defined by Jacobs et al. (2010).

Conclusion

At the onset, we note that these focus groups were somewhat small and not necessarily representative of the larger teaching community. Indeed, the findings reported herein represent but an initiation of such examination and should be treated quite cautiously. However, as beginning of important work in getting the needed professional development to better enact this skill of professional noticing and to more precisely define the construct of professional noticing and its position in the hierarchy of the more general constructs of noticing and perception. Sherin (2017) remarks,

What belongs in a theory of teacher noticing? ... On the one hand, when we have found a theoretical construct to be productive, and to newly illuminate aspects of teaching, there is a tendency for us to want to push that theoretical construct as far as it will take us. On the other hand, if a theoretical construct is pushed *too* far, then it might become so diluted that it loses the very power that makes it attractive.

A similar caveat exists for practitioners. Often a new term emerges in educational literature and soon "everyone is doing it." From the varying conceptions and purported enactments presented here, arguably, the construct of noticing is being shaped and molded by practitioners such that it fits within their respective contexts and meets their unique aims.

The notion that practitioners may adapt constructs from the research literature worthy of much engagement. Arguably, it is quite desirable that teachers are reflecting upon such ideas and how they might fit within their professional practice. However, when such adaptations result in the loss of

meaning (to some extent) of the original constructs, researchers, professional developers, and practitioners are faced with a key challenge – how a particular practice may manifest within professional contexts that are not always accommodating of such practice. Although a primary aim of this study is to understand such manifestations (i.e., conceptions and purported enactment), a primary implication for professional developers, in particular, is to anticipate varied conceptions as a function of one's professional context and orientation, and work to synthesize these with literary portrayals of professional noticing.

Further study of relationships between conceptions, enactment, and professional contexts would greatly illuminate the nature of such adaptation. Indeed, this study is reflective of teachers' describing their conceptions and enactment within the context of focus groups. A key next step would be to test such findings, purported enactments in particular, via classroom observations and interviews with teachers to ascertain professional noticing practice in situ. Such study could potentially open the doors to viable variants of professional noticing that have not yet been explored by researchers. More broadly, though, loose application and/or adaptation of constructs often leads to the proverbial "pendulum swing" in education. If professional noticing is to serve us well in both describing a skill of teaching and in supporting teacher development, it is incumbent upon both researchers and practitioners to define and apply the construct, or constructs, carefully and responsibly.

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