PROFESSIONAL NOTICING DURING PRESERVICE MATHEMATICS LESSON STUDY

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The purpose of this research was to understand how lesson study participants in a teacher education program professionally noticed as they engaged in meetings as a component of the professional development cycle. Specifically, the focus was on how the context of lesson study provided opportunity for professional noticing, defined as attending to students' mathematical thinking, analysing students' mathematical thinking, and deciding how to respond when teaching on the basis of students' thinking. Results indicated that the structured format of lesson study in the teacher education program both afforded and constrained the incidences of verbalizing professional noticing in a group setting. Findings provide perspective for structuring lesson study for use in teacher education programs to support professional noticing.

Keywords: Elementary School Education; Teacher Education-Preservice

Statement of Purpose

Recent findings in mathematics education highlight the importance of focusing on students' mathematical constructions for knowing how to support future learning and development (Norton & McCloskey, 2008). Professional noticing is a specialized practice that encompasses: a) attending to students' thinking, b) analyzing students' thinking, and c) deciding how to respond on the basis of thinking (Jacobs, Lamb, & Philipp, 2010; van Es & Sherin, 2008). From this point forward we refer to this type of professional noticing as *noticing*. Lesson study is a professional development process that provides context for noticing, but has most commonly been used with inservice teachers. While the use of lesson study with preservice teachers is limited, teacher education programs implementing this practice can provide opportunities for preservice teachers to notice through reflection (Murata, 2011). Knowing more about supporting preservice teachers' noticing through lesson study is important for structuring teacher education programs to focus attention on students' mathematical understandings. This study seeks to answer the following research question: How do preservice teachers (teacher candidates who are presently in a teacher education program) professionally notice as they engage in the lesson study process?

Theoretical framework

In recent years, research studies have examined methods for teacher preparation related to teacher knowledge, effective teaching, and the relationship between knowledge and teaching (Cochran-Smith & Zeichner, 2005). Providing preservice teachers with opportunities to understand student-centered teaching and develop the pedagogical content knowledge necessary for effective instruction is essential for promoting high leverage teaching practices (Hill, Ball, & Schilling, 2008;). One method for developing this type of knowledge is through cultivating the ability to notice (Jacobs, et al., 2010). The notion requires attention to student thinking through "both observation and the medium through which observation takes place" (Mason, 2011, p. 45). During the process of noticing, effective teachers become aware of students' thinking and are able to construct tasks that direct attention to relevant learning opportunities (Mason, 2011).

The meaning of noticing has developed through literature on professional vision, which has explored nuances between varying stakeholder perspectives on classroom events and influencing factors that shape those viewpoints (Goodwin, 1994). Studies on professional vision commonly focus on teachers recording and studying their practice and researchers analyzing the noticing and reasoning of the teachers involved. Seidel et al. (2011) describe professional vision as the

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intersection between noticing and knowledge-based reasoning with the assertion that this type of reasoning involves the ability to describe what was noticed, link observations to prior knowledge about teaching and learning, and connect to theory to predict future classroom events. A distinguishing factor between noticing (Jacobs et al., 2010) and professional vision is the difference with foreseeing future practices (Seidel et al., 2011). Considering the roots in professional vision, we focus on noticing as the guiding framework in our study because of the preservice teacher context and importance of basing teaching decisions on evidence.

Related Literature

The following describes lesson study as traditionally practiced with inservice teachers, followed by a review of the literature on lesson study with preservice teachers.

Lesson Study Overview

Teacher knowledge can be fostered through the process of lesson study, leading to improvement in instructional practice (Murata, 2011). Lesson study, originally termed *Jugyokenkyu* in Japan, means lesson and study or research (Fernandez, 2010). During the lesson study process, participants, usually a small group of 5-7, begin by setting a goal for the lesson study process and then working collaboratively to plan a lesson to teach in one of their classrooms. To plan the lesson, participants study research materials, curriculum guides, and other artifacts to decide on appropriate instructional methods and content for a mathematics lesson. Next, a teacher in the group teaches the lesson to his or her students while the other participants observe the lesson. Following the lesson, the participants meet together to reflect on the lesson and to revise the lesson for teaching in another classroom. Once the lesson is revised, the modified version is taught in another teacher's classroom. This student-focused process affords participants the opportunity to notice different aspects of the lesson (Murata, 2011).

Lesson Study with Preservice Teachers

As lesson study has expanded beyond Japan to other countries and contexts, the process has begun to infiltrate teacher education programs (Fernandez, 2010). Recent research findings indicate that lesson study provides a context for preservice teachers to make connections between theory and practice as they take part in multiple components of the teaching cycle, including designing lessons and teaching (Murata, 2011). As a result, there is increased interest in knowing more about supporting preservice teachers' professional practices in lesson study.

Methodology

This research focuses on the use of lesson study with preservice teachers as a component of a teacher education program at a public university in the Midwestern portion of the United States. Case study methodology was employed to analyze how these participants noticed during seven iterations of the mathematics lesson study process (Yin, 2009).

Participants and Context

Participants in the case study included one team, comprised of six preservice teachers, one classroom teacher, and a university facilitator who taught the university course. Consistent with case study research, we focus on this one team of participants, as opposed to a larger number of participants, to provide opportunity for an in-depth examination of the practices and understandings of these individuals (Yin, 2009).

The format for the lesson study cycle was predetermined based on a university protocol. To begin the first cycle, the team met together to plan a mathematics lesson that would be taught by preservice teachers in the classroom teacher's first grade classroom. Weekly, two of the preservice teachers

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taught a whole-class mathematics lesson while the other participants (four other preservice teachers, one classroom teacher, and the university facilitator) observed the lesson and took detailed field notes. Following the teaching, the group met to reflect on the teaching with an aim toward discussing students' mathematical thinking. The university facilitator led these meetings and followed a protocol that provided opportunities for all participants to share their ideas. Following these reflective discussions, the team made plans for the next lesson that would be taught and the iterative cycle repeated. For the purposes of this research, we focus on the reflective meetings that occurred in this cycle following the teaching. We refer to these meetings as the *lesson study analysis meetings*; each of the seven iterations of the process included one of these meetings. Therefore, data for this study are video recordings of these seven meetings and the accompanying transcripts.

Data Analysis

The purpose of data analysis was to: 1) Identify instances of noticing during the lesson study analysis meetings, and 2) Understand how preservice teachers were noticing based on conversational interactions with the other team members. Data were analyzed in two phases: Phase One and Phase Two.

In Phase One, all data were coded by talk turn, signified by a change in speaker. Data were analyzed based on the degree of noticing as defined by Jacobs et al. (2010): attending (describing students' actions or words), analyzing (interpreting student actions or words), or responding (describing pedagogical suggestions for future teaching). Across the seven transcripts, 809 talk turns were coded by each of two researchers. The researchers met to reconcile differences in codes.

In Phase Two, data identified as noticing from Phase One were coded a second time to understand how preservice teachers were noticing based on conversational interactions. These instances were open coded (Corbin & Strauss, 2008). Identified themes included talk turns that were: based on a previous comment, initiated response, narrowed conversation, provided generalization, negotiated, asserting expertise, making a connection, addressed another issue, prompting participants, or provided context. These themes provided an explanation for how and why the noticing occurred within the context of the lesson study analysis meetings.

Statement of Results

Findings from this study indicate: 1) Noticing from the preservice teachers occurred in response to a prompt by the university facilitator, 2) When responding to this prompt, the preservice teachers commonly answered independently, meaning their conversation did not build on what others said, instead they reported one by one without continuity in the conversation topic, and 3) Preservice teachers noticed by attending and analyzing student thinking, but they rarely attended, analyzed, and decided how to respond on the basis of students' thinking about the same subject. The following provides short excerpts of data to provide evidence for these themes. Further data will be presented if accepted for presentation.

Response to Prompt

The preservice teachers noticed in the lesson study analysis meetings when the facilitator gave a prompt eliciting a discussion on students' mathematical thinking. The prompts encouraged the preservice teachers to respond about how students were thinking about mathematics, which resulted in noticing. Prompts included, "Let's focus on evidence of students' thinking," and, "What were specific ways students were thinking?" Following these prompts, it was common for the preservice teachers to engage in conversation to answer the facilitator's questions, during which they attended to students' thinking or analyzed evidence of student understanding. As this occurred, patterns of initiating and responding took place, meaning the facilitator would initiate a conversation, and the

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preservice teachers would respond. The following provides an example of a prompt, followed by noticing:

Facilitator: Alright, what are some specific ways that student work, students were thinking that you saw, observed as you were walking around?

Preservice 3: One thing I saw, Meagan, it was on the worksheet, and she constantly referred to the number line and I thought that was pretty neat because she's using her tools, the tools around. And like I said, I saw major improvement with Meagan, so I can tell that she's able to, able to, now being able to use tools around her without saying hey, look at the number line if you get lost!

Preservice 2: And I saw that with a lot of kids, actually while they were doing their worksheet, I know this is six oranges but how do I write six? Have them look at their number line and then would count up to six, they're like oh! And then they would write the six down, like they knew the objects.

In this instance, the facilitator asked a specific question, and even encouraged the preservice teachers to discuss students' thinking in the prompt. Following the prompt, preservice teachers responded by specifically discussing how students were making connections between figures of pieces of fruit and writing the corresponding numeral. Thus, the preservice teachers responded to the prompt by providing evidence about how students were thinking as they were learning to count and abstractly represent quantity with numerals.

Individual Response

As the facilitator gave a prompt and the preservice teachers responded, it was rare for the preservice teachers to relate their responses to other responses (as was done in the aforementioned example when Preservice Teacher 2 continued discussing the same topic Preservice Teacher 3 had initiated). Instead, it was typical that the preservice teachers would independently report on what they had noticed instead of trying to make connections across the different types of students' thinking that were noticed. Essentially, each preservice teacher responded to the prompt as if the other preservice teachers had not already responded, which resulted in a defragmented conversation in which the conversation did not build, but rather preservice teachers operated as individuals all responding on their own to the same prompt. The following provides a small excerpt to demonstrate this pattern:

Facilitator: Right we're just going around and saying what went well.

Preservice 4: I thought the book was a really good way to launch off your lesson. I think since they were familiar with the book that also helped. You know they knew what the book was about and were excited about it.

Preservice 5: Um, I think… I liked that they were able to take something home. The kids were really excited that they could keep this so you know, they were proud of what they did, which I thought was nice.

Preservice 6: I liked how you guys did the counting from like all the way up to twenty because they were doing five, ten and twenty. There were some kids having trouble with the higher numbers so it was like as a group they got to explore the numbers.

Preservice 2: Um, I liked the little wrap up at the end and kind of liked the flashcard thing where you held up the numbers and they tell you.

The preservice teachers each responded on their own to the facilitator's prompt; their comments did not clearly connect to each other to create a cohesive conversation. Instead, each preservice teacher highlighted something she noticed and contributed to the discussion by responding to the prompt, but not necessarily responding to the other preservice teachers' responses.

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Attended and Analyzed

Across the seven transcripts, the preservice teachers engaged in noticing by attending to students' thinking, analyzing their mathematical thinking, and deciding how to respond on this basis; however, these three types of noticing did not commonly occur together. Instead, the preservice teachers engaged in dialogue that included attending to students' thinking and analyzing students' thinking, but did not make clear connections based on this evidence to verbalize noticing about how to respond. This does not necessarily indicate that they did not consider this connection mentally, however verbal evidence was rarely present in the lesson study analysis meetings. When the preservice teachers did make comments about how they would respond, they were often disconnected from conversation that attended to or analyzed student thinking. In other words, attending and analyzing occurred at points in the meetings and deciding how to respond occurred at separate times in the conversations. Therefore, incidences when all three identified types of noticing took place based on the same idea were rare. Within each meeting, it was common for attending and analysis to occur at the beginning of the meeting and for noticing that focused on responding to occur at the end; there was essentially a shift mid-way through the lesson study analysis meetings. Possible explanations for this are included in the discussion section.

Discussion of Results

The intent of this research was to describe how preservice teachers noticed as they engaged in the lesson study process. This information is critical for teacher educators to consider as it provides insight for knowing how to better support preservice teachers' focus on students' mathematical thinking through the act of noticing.

Importance of Prompts

As the preservice teachers engaged in the lesson study process, the prompts the facilitator asked were paramount in eliciting responses in which the preservice teachers noticed. The facilitator asked very pointed questions about students' thinking, to which the preservice teachers responded. In this way, the facilitator encouraged routine noticing by providing a context that required preservice teachers to be reflective in their responses and consider students' thinking (Miller, 2011). In doing this, the facilitator provided scaffolded support that is necessary for teaching others to notice (Star, Lynch, & Perova, 2011). Thus, the facilitator's prompts supported noticing by scaffolding preservice teachers' thoughts and directing them toward students' thinking. This is an important finding for teacher education programs looking to provide a similar context for the development of professional practices. In this instance, it was the facilitator's questions and prompts that often elicited noticing from the preservice teachers.

Attending and Analyzing

When noticing occurred, the preservice teachers commonly attended to students' thinking and analyzed their thinking (Jacobs et al., 2010). This required the preservice teachers to observe classroom events and make interpretations based on these events (van Es & Sherin, 2008). Hence, the lesson study analysis meetings provided a focused and specific context in which this type of analysis could occur, indicating the plausible benefits of using lesson study in a teacher education program. Within the context of lesson study, the preservice teachers engaged in a structure that was focused on students' thinking: as they taught or observed lessons, they were cognizant that they were going to be asked to report back on the basis of students' understanding. Likewise, as they planned lessons, they were mindful that they would be held responsible for teaching and or observing the lesson and then reflecting on the lesson—this process provided them the opportunity to complete a cycle of formative teaching by engaging in the three components of noticing. These findings indicate that teacher

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education programs should consider the possible benefits of lesson study for promoting the noticing practices of preservice teachers.

Lesson Study Structure

Despite the positive outcomes based on the noticing that occurred in the lesson study analysis meetings, findings identified segmented noticing responses in the meetings. Specifically, attending and analyzing student thinking was often separated from discussions about deciding how to respond on the basis of students' thinking (Jacobs et al., 2010) One possible explanation for this findings is the structure of the lesson study analysis meetings, as designed by the teacher education course. With the course, the facilitator followed a protocol in which the group reflected on the previously taught lesson, then discussed changes they could have made to the lesson to improve student thinking, and concluded by planning the next lesson. Perhaps the structure constrained the inclusion of further discussion of implications of analysis of students' thinking because preservice teachers and the facilitator understood the structure of the lesson study analysis meeting to progress along those three steps. This also could be related to the finding that the preservice teachers did not necessarily build their comments based on the aforementioned comments. These results indicate that a more fluid structure to the lesson study analysis meetings may provide for increased incidence of all three types of noticing occurring at the same time. For teacher education programs, this structure within lesson study may initially be helpful for encouraging noticing; however, facilitators or programs should be aware of this disconnect among the three types of noticing and perhaps reduce the stringency of a similar protocol for the meetings over time. Nevertheless, findings show promise for the use of lesson study in supporting preservice teachers to professionally notice.

References

Cochran-Smith, M., & Zeichner, K. M. (2005).*Studying Teacher Education: The Report of the AERA Panel on Research and Teacher Education* (pp. 816). Mahwah, NJ

Goodwin, C. (1994). Professional vision. *American Anthropologist, 96*, 606-633.

Hill, H., Ball, D., & Schilling, S. (2008). Unpacking pedagogical content knowledge: Conceptualizing and measuring teachers' topic-specific knowledge of students. *Journal for Research in Mathematics Education, 39*, 372-400.

Jacobs, V. R., Lamb, L. L., Philipp, R. A. (2010). Professional noticing of children's mathematical thinking. *Journal for Research in Mathematics Education, 41*, 169-202.

Mason, J. (2011). Noticing: Roots and branches. In M. G. Sherin, V. Jacobs, & R. Philipp (Eds.), *Mathematics teacher noticing* (pp. 35-50). New York: Routledge.

Miller, K. (2011). Situation awareness in teaching: What educators can learn from video-based research in other fields? In M. G. Sherin, V. Jacobs, & R. Philipp (Eds.), *Mathematics teacher noticing* (pp. 51-65). New York: Routledge.

Murata, A. (2011). Introduction: Conceptual overview of lesson study. In L. Hart, A. Alston, & A. Murata (Eds.), *Lesson study research and practice in mathematics education: Learning together* (pp.1-12). New York: Springer.

Norton, A., & McCloskey, A. (2008). Teaching experiments and professional development. *Journal of Mathematics Teacher Education, 11*, 285-305.

Seidel, T., Stürmer, K., Blomberg, G., Kobarg, M., & Schwindt, K.(2011). Teacher learning from analysis of videotaped classroom situations: Does it make a difference whether teachers observe their own teaching or that of others? *Teaching and Teacher Education, 27*, 259–267.

Star, J. Lynch, K., & Perova, N. (2011). Using video to improve preservice mathematics teachers' abilities to attend to classroom features. In M. G. Sherin, V. Jacobs, & R. Philipp (Eds.), *Mathematics teacher noticing* (pp. 117-133). New York: Routledge.

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

Bartell, T. G., Bieda, K. N., Putnam, R. T., Bradfield, K., & Dominguez, H. (Eds.). (2015). *Proceedings of the 37th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*. East Lansing, MI: Michigan State University.