Dimensions of Curricular Noticing

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This brief research report presents a new theoretical construct, *curricular noticing*, by drawing upon the results of four coordinated research studies. We define curricular noticing as how teachers make sense of the complexity of content and pedagogical opportunities in written or digital curricular materials (Authors, 2014). In this presentation, we consolidate findings from our overarching study involving pre-service teachers (PSTs) in methods courses at four universities to illuminate dimensions of curricular noticing. We hope to engage the NCTM community in considering implications of curricular noticing, and how it may support PSTs' engagement with curricular materials.

Curricular noticing draws upon the extensive work in professional noticing, a core instructional activity that is integral to ambitious teaching (Philipp, 2014). Research has decomposed professional noticing of children's mathematical thinking into three components: *attending to*, *interpreting*, and *responding* to children's thinking (Jacobs, Lamb, & Philipp, 2010). These aspects of teaching have brought clarity to the teacher-student dimension of classroom instruction. In our paper, we argue that this framework may be productively applied to yet another dimension of classroom instruction, *curricular noticing*, which focuses on the teacher-curriculum dimension of classroom instruction. In terms of CN, attending refers to those aspects of curricular materials that teachers notice, interpreting refers to how teachers make sense of that to which they attend, and responding refers to curricular decisions as a result of attending and interpreting. In this proposal, we first provide further detail about the relation between professional noticing of children's mathematical thinking (NCMT) and curricular noticing (CN). We then briefly describe our research design and empirical techniques. We lastly delineate our findings, reported as *dimensions* of curricular noticing that have emerged from our data, before providing key questions for discussion in the presentation.

Beyond applying components to CN that first emerged through work in NCMT (Jacobs et al., 2010), CN and NCMT have important commonalities, two of which we highlight here. First, both CN and NCMT treat task selection as a necessary and

critical component of ambitious teaching. While there have been varied empirical techniques in research on NCMT, much of this underscores the role of teachers' attending to the mathematics of the present task and interpreting how students interact with the mathematics of that task, and in some cases how to then strategically respond with a new problem, task, or lesson. As we will present, we see tasks as a critical component of CN as well. Second, both constructs allow the field to consider methods to support PSTs. Cultivating NCMT practices has been identified as a mechanism to provide PSTs with opportunities to understand student-centered teaching and develop the pedagogical content knowledge necessary for effective and high-leverage instruction (Fernandez & Zilliox, 2011; Hill, Ball, & Schilling, 2008; Jacobs et al., 2010). Similarly, we see CN as inextricably linked to these efforts to support PSTs. As teachers make decisions in order to support children's mathematical thinking, curricular materials--specifically teachers' interaction and understanding of the complexity and hidden opportunities reflected in such materials-- influence their decisions. In practice, teachers collaborate with curricular materials (Remillard, 2005). Noticing, therefore, is related to both the teacher-student dimension and teacher-curriculum dimension of instructional practices.

Yet choosing a task or implementing a lesson strategically--core components of NCMT-- is not at all straightforward. A curriculum, designed for novice and veteran teachers alike, is a tool to support a range of learners in a variety of schools--urban, suburban, rural, private, public, charter, etc. Across these contexts, teachers are constantly making decisions to find and adapt particular lesson sequences and specific tasks to support one or more students. A curriculum does not offer a one-size-fits-all solution for instruction; rather, curricular materials serve as a key medium through which teachers analyze and make decisions to support the students in their own classrooms. Curricula also reflect varied philosophies in their design; for example, a teacher may make a particular decision in the context of a spiraling curriculum in which concepts are frequently revisited that she would make differently using a non-spiraling curriculum. Furthermore, some curricula may treat teachers as collaborating with the curriculum, whereas others provide scripts that a user may follow. We propose that by decomposing how one may notice in the context of varied curricular materials, specifically what and how a teacher may *attend, interpret,* and then *respond* in the context of these varied materials, teachers similarly become aware of opportunities in these materials and are able to use them effectively and strategically to support children's mathematical thinking.

The need to understand dimensions of curricular noticing is further justified due to the fact that, despite a collective goal of supporting inquiry-oriented instruction in most university methods courses, we simply have no control over district-adopted curriculum. There is evidence that reform-based mathematics curriculum is used in only 25% of elementary mathematics classrooms, 11% of middle school classrooms, and 0.2% of high school classrooms in the United States (Banilower et al., 2013). Researchers have proposed that reform efforts should include assisting teachers in examining unfamiliar curriculum resources and developing new ways to use these

materials including learning to read, adapt, and evaluate curriculum materials (e.g., Remillard & Bryans, 2004; Sherin & Drake, 2009). As mathematics teacher educators, we must be concerned with how to support PSTs' noticing in the context of curricular materials.

We were guided by the following questions:

- How do PSTs *attend* to mathematics curriculum materials, analyze and evaluate materials for *interpretation*, and *decide* to enact lessons?
- What are particular dimensions to noticing across various research institutions?

Research Design, Data Collection, and Analysis*.* Our coordinated studies involved 80 PSTs in methods courses at four institutions. Two courses were elementary, one Grades 6-12, and one Grades 9-12. Our studies engaged participants in one of the following two aspects of noticing: (a) *attending* and *interpreting* in the context of particular tasks; or (b) noticing (*attend, interpret* and *respond*) in the context of multiple published curricula. Data included pre/post measures, video of interventions, and written assignments that were collected and qualitatively analyzed. Analyses resulted in categories that emerged from data. These coding categories led to the dimensions of curricular noticing that will be described in the presentation.

Findings*.* In our presentation, we describe four dimensions of curricular noticing that emerged across our coordinated projects. Two dimensions are at the level of task (Dimensions 1 and 2), while two are at the level of a curricular sequence and comparisons of curricula (Dimensions 3 and 4).

Dimension 1: Distinguishing task design. PSTs need opportunities to consider affordances of open-ended versus more structured or closed tasks, and to orient themselves to considering under what conditions these may be more or less strategic. Such opportunities allowed PSTs to notice nuances to tasks, including how prompts affect mathematical discourse and alter student engagement with the mathematics.

Dimension 2: Analyzing the relationship between mathematical ideas and task design. PSTs benefit from task exploration involving typical, routine tasks and modified, non-routine tasks (see Figure 1 for an example of area models for 1/4); most curricula feature routine tasks, which may hide underlying mathematics with which students may need additional support. PSTs notice the mathematical opportunities in routine tasks when provided with opportunities to explore the mathematics of non-routine tasks.

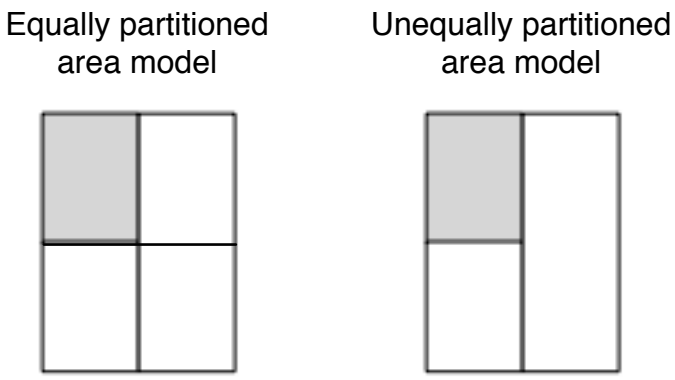

Figure 1

Dimension 3: Evaluating and planning using available curricular materials. PSTs need opportunities to attend to a specific mathematical concept and analyze representations of the concept simultaneously across multiple curricular resources to make decisions about how to respond. PSTs notice curricular concepts that both relate to their former experiences and those they consider representative of ambitious teaching.

Dimension 4: Evaluating explicit and implicit properties of curricula with different design principles and philosophies. PSTs benefit from opportunities to analyze and evaluate curriculum materials using a specifically designed analysis tool focused on a) content, b) practices, and c) equity, assessment, and technology. These opportunities for explicit and implicit curriculum analysis afford comparisons of curriculum analysis at distinct points in time, providing insight about shifts in what is noticed. Engaging with curriculum materials in this way provides PSTs with a lens through which to view materials and language with which to articulate their evaluation of materials.

The construct of CN draws together research on teacher noticing and teachers' use of curriculum materials as a decomposed professional practice, complementing existing work on ambitious teaching (Philipp, 2014).

In our presentation, we will present our theoretical framework, connections to professional noticing literature, and a brief synopsis of our four coordinated studies before moving into the four dimensions that emerged from our work. We will then devote 15 minutes to engaging with the NCTM community about this presentation and potential directions for research and practice. Key questions for discussion include: How do we operationalize curricular opportunities? What do we want teachers to notice across curricular materials? How do we influence curricular noticing in methods courses?

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