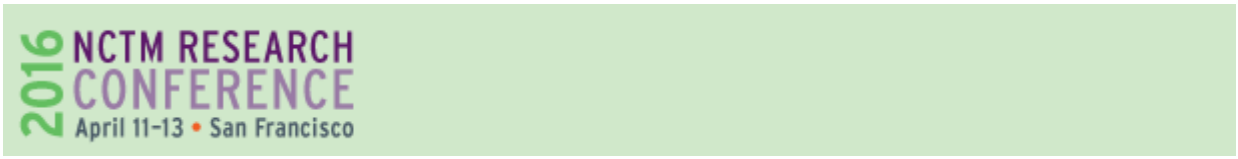

Paper Title: Navigating the Tension Between Direct and Dialogic Mathematics Teaching Practices
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Navigating the Tension Between Direct and Dialogic Mathematics Teaching Practices

This study reports on research findings describing a tension between direct and dialogic mathematics teaching practices in an upper elementary setting. Implications from findings of the study include recommendations for how to use Principals to Action to create useful professional development in addressing the tension.

Conceptual perspective and research question

Research demonstrates that teaching practices influence student learning (e.g., Boaler, 2002; Hill, Rowan, & Ball, 2005). A frequent and logical implication is to examine the use of teaching practices in order to influence student learning. If the concept of teaching practice is viewed through a sociocultural theory of learning, it becomes important to study the community surrounding the teaching practice. As Wenger (1998) wrote, "learning is an issue of engaging in and contributing to the practices of their communities" (p. 7). It follows that learning, and therefore teaching is dictated by communal practices and norms. For mathematics education, this implies that teaching practices are used to engage students in established practices of the following communities: the classroom community (students and teacher), the school and district community (teachers, students, and administrators), the family community (parents, siblings, and relatives), and the general society community (members of the town, county, state, and nation). As a teacher utilizes teaching practices to engage students in each of the educational communities, the teacher attempts to channel the educational culture, and is influenced by what that culture deems important for mathematics learning outcomes.

One way a community can influence teaching practice is through the acceptance, use, and promotion of educational rituals. As defined by McCloskey (2013), ritual is "that aspect of action that is formalized, traditionalized, symbolic performance" (p. 25). While some believe a mathematical ritual is a meaningless engagement in a teaching practice (Vinner, 2007), others claim rituals carry mathematical significance as they are enacted through teaching practices (Solomon, 1998). The current study examines an educational community's tension between the implementation of a newly introduced teaching practice and an existing value associated with a ritualized teaching practice.

The research question guiding this study is: *How does an educational community make sense of two mathematics teaching practices, one newly introduced and one seemingly ritualized, used in the community?*

Data collection and analysis methods

The educational community in this study is a rural elementary school district in northwestern United States. The participating community of educational stakeholders included seven elementary teachers, two elementary principals, six parents of elementary students, and four researchers who administered a professional development (PD) program in the participating elementary school district. The primary focus of this study is on one of the three elementary schools in the district, which contains approximately 450 students.

Data collection occurred in two phases over the course of an academic year. The goal of the first phase was to identify and describe common mathematics-teaching practices in the classrooms of three fourth and fifth grade teachers: Ana, Beth, and Fred. Each teacher's mathematics lessons were observed, on average, 20 times over a three-month

time period. Lessons were video– and audio– recorded, and the researcher maintained detailed field notes of the observations. During this time, the three teachers participated in three interviews designed to highlight and clarify their mathematics teaching practices. There were additional conversations between the teachers and the researcher recorded during most of the lesson observations with the same purpose.

Ethnographic methodology (Eisenhart, 1988) was used identify two primary mathematics-teaching practices at the end of Phase I. Analysis of observations and interviews regarding the two practices resulted in thick descriptions (Geertz, 1973) that describe each teaching practice as a series of teacher and student actions. Static animations, cartoon like portrayals, of each teaching practice were created from the thickly described series of teacher and student actions. The researcher created interview protocols, aligned with the static animations, to gather information about how the identified educational stakeholders in the community made sense of each of the identified teaching practices.

Interviews were then conducted with 16 educational stakeholders. Each stakeholder was interviewed once for about one hour, and was asked questions regarding his or her educational values towards and interpretations of the two identified mathematics-teaching practices. During the second phase of analysis, ethnographic methods (Eisenhart, 1988) were used to sort and categorize stakeholders' statements into themes. These themes were analyzed for relationships among each other and compared to the observed teachers' interview statements as well.

Findings

The first teaching practice identified is similar to a direct instruction model of teaching (Munter, Stein, Smith, accepted). This teaching practice can be described in three stages: a teacher's introduction to the topic, student practice on multiple exercises, and a filler activity for students who finish early. The three stages can be exemplified by a lesson introduction from one of Fred's classes. He stated, "Today you're going to do addition and subtraction of decimals. I'm going to show you some basics, give you the assignment, and then after you are done with the assignment, you can do some math games." He followed this introduction by demonstrating three examples of basic decimal addition and subtraction. The assignment to which he referred is a single-page worksheet containing addition and subtraction exercises. This was the second phase of the lesson, during which the students practiced exercises that looked very similar to the examples shown during the introduction. The third phase was students playing with math games around the classroom, which included different card games that they had previously learned. This teaching practice is consistent with McCloskey's (2013) definition of ritual because it is a formalized, traditionalized, symbolic performance. This performance contained specific predetermined and expected actions from the students and the teacher, which makes it formalized and traditional. The performance is also symbolic in that it symbolizes mathematics as content that is to be demonstrated by a teacher and memorized by students.

The second teaching practice, which did not fit the definition of ritual, is similar to a dialogic instruction model of teaching (Munter, et al., accepted). This teaching practice can be described in four stages: teacher's introduction of a mathematical task; students

working in groups engaging with the task; student presentation of solutions or reasoning; and a teacher-led discussion of strategies used. The observed tasks typically engaged students in problem solving and pattern finding. This teaching practice did not show evidence of being formalized, as teacher and students interacted differently with each other during each occurrence. Therefore, it is not considered a ritualistic teaching practice.

All three of the observed teachers, as well as many of the educational stakeholders, expressed tension between the two identified teaching practices. They stated a desire to focus more on "open-ended" (Ana) and "high-level tasks" (Fred) during their teaching, and to stay away from "using the textbook" (Fred) or "rote memorization" (Beth). However, the teachers also expressed a belief that sometimes students need "more direct instruction" (Beth) and "to build basic skills for tests" (Fred). Additionally, the other teachers, one of the principals, and parent stakeholders interviewed expressed conflicting beliefs. One teacher said that students should "have a deep underlying concept of how numbers work and what numbers are," and a parent expressed the belief that sometimes "you have to have some boring sitting down with worksheets." While not all the stakeholders expressed this belief to the same degree, there was consensus that teaching should primarily focus on building students' conceptual understanding, but should also incorporate some aspect and amount of student practice. The specific combination was greatly varied among stakeholder responses during the interviews.

Discussion

While there seems to be agreement among the educational community that engaging students in activities that promote a conceptual understanding of mathematics is

preferred, there is also a lingering belief that direct instruction and student practice on mathematical exercises are valuable teaching practices. That lingering belief manifested itself uniquely during each interview with most of the study participants. Almost every participant had a different response to the desired amount of student practice and the role it plays during a mathematics lesson. Additionally, the goal of the researchers' PD was focused on generalizing and justifying mathematical tasks, and did not include discussion of how and under what circumstances to integrate student practice. As with many PD sessions and teacher education lessons, the focus was on correct implementation of a new, desired teaching practice.

The direct instruction teaching practices showed evidence of ritualization within the educational community, and many stakeholders expressed value in the idea of student practice, as was depicted in the direct instruction static animation. Rather than ignoring the ritualized practice, the results of this study imply that it may be useful to try to incorporate an expressed community value observed during a ritualized teaching practice into a newly introduced and more desirable teaching practice.

Results from this study emphasize the need for teacher educators to bridge the gap between existing and desired teaching practices. One resource that can be useful in this endeavor is *Principals to Action* (NCTM, 2014), as the authors write, "effective mathematics teaching focuses on the development of *both* conceptual understanding *and* procedural fluency" (p. 42). Specifically, they suggest building students' procedural fluency through conceptual understanding, and provide specific suggestions of how teachers can do this. Explicit descriptions of how to use *Principals to Action* in this way will be further explored.

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