Joint Faculty-Student Research Grant Proposal

Deconstructing Teaching in Mathematics: Defining and Identifying “Style” as a Distinct Component of Teaching

1. Statement of the Problem

Although prior research has been conducted to characterize effective teaching in mathematics (for a review of this research, see Franke, Kazemi, & Battey, 2007), none of the research identifies and describes how stylistic, relational, and content-specific components of teaching unfold during instructional interactions in a natural classroom context. Identifying and describing components of teaching are critical to develop a “common vocabulary” that establishes the foundation upon which to analyze and evaluate teaching to inform teacher professional development efforts (Grossman & McDonald, 2008).

The process of developing a common understanding involves a careful parsing of teaching that goes beyond examining a single component of teaching in isolation. Equating teaching practice with teaching style ignores and oversimplifies the complex and intentional actions and decisions teachers make around planning tasks and activities that are directly tied to students’ learning (Franke et al., 2007). That said, exploring teaching instruction only in terms of teachers’ and students’ mathematical interactions overlooks the non-content-specific, interpersonal relationships within a classroom that can affect student motivation and engagement (Grossman, Compton, Igra, Ronfeldt, Shahan, & Williamson, 2009).

The purpose of the proposed project is to deconstruct teaching within mathematics classrooms by identifying and distinguishing teaching style, connection-enhancing practices (i.e., relational aspects of pedagogy), and mathematics instructional practices. The research question this study seeks to answer is: What is teaching style that is distinct from connection-enhancing practices and mathematics instructional practices? Findings from this study could be particularly helpful for orienting pre-service teachers to their role as newcomers to the profession and classroom. In addition to supporting novice teachers in enacting connection-enhancing and content-specific instructional practices, we can invite them to think about their stylistic choices within instruction or interactions as separate but relevant to the kind of teacher they want to be.

2. Theoretical Framework

A common view in and about education persists – that effective teaching requires each teacher to “find his or her own style” (Ball, 1994, p. 16). Teaching style has become a pervasive concept and framework used to describe “the entire teaching-learning exchange” (Heimlich and Norland, 2002, p. 17). Often likened to the notion that each student has a preferred or natural learning style, the idea of teaching styles is that each teacher must determine “what works” for that teacher in his or her classroom. Of course, the meaning of “what works” varies and is generally specific to an individual in one situation within a particular context. As Ball (1994) argued, this view portrays teaching as an individualistic enterprise, rather than a repertoire of evidenced-based practices enacted with technical precision by professions.

We argue that, more than emphasizing individualism, the phrase "teaching style" is problematic because too often it is taken to be synonymous with instructional practice. For example, in a mathematics classroom, the process of choosing whether to begin a new topic by demonstrating how to do a kind of problem or designing activities for students to collaborate in
order to make sense of a complex task is not viewed as a matter of personal preference – or, *style* – in the current research literature. The above choices are a matter of employing mathematics instructional practices that afford particular kinds of opportunities to engage in mathematical activity (Stein, Engle, Smith, & Hughes, 2008). Correspondingly, in terms of connection-enhancing practices, teachers’ efforts to connect the learning material to students’ everyday lives or to understand and acknowledge students’ perspectives can be viewed as distinct from teaching *style*. Teachers’ intentional strategies to support students’ learning in meaningful ways are part of instructional practices which help construct a positive interpersonal climate that values students as learners and promotes student development (Stefanou, Perencevich, DiCintio, & Turner, 2004). Thus, we propose a framework of teaching that is comprised of teaching practices, such as connection-enhancing practices and mathematics instructional practices that are based on empirical evidence, which may be performed more or less effectively regardless of teachers’ stylistic choices.

We hypothesize that there is a style component of teaching that can be defined and identified independent of mathematics instructional practices and connection-enhancing practices. If that is true, delineating stylistic *choices* and distinguishing them from teaching *practices* – both those for supporting students’ mathematics learning and those for enhancing connections between adolescents and their teachers – could help refine and advance the language we have for describing teaching.

3. **Methods**

In order to define these three components of teaching – teaching style, connection-enhancing practices, and mathematics instructional practices – and articulate the relationships between those practices and choices for supporting learning, engagement, and motivation in the mathematics classroom, we propose conducting three sequential analyses of the same classroom video data. In the following paragraphs we describe the data sources and the proposed analyses.

3.1. **Data source**

The video data we will analyze were collected in a previous study, the Middle School Mathematics and Instructional Setting of Teaching (MIST) project, which partnered with four urban school districts implementing district-wide reforms aimed at improving mathematics instruction for middle school grades. In the MIST study, teachers (*N* ≈ 120) were assessed annually with an adapted version of the Instructional Quality Assessment (IQA), developed at the University of Pittsburgh (Boston & Wolf, 2004). Members of the MIST research team used the IQA to code video-recordings of two consecutive days of classroom instruction for each participating teacher in late winter of each year (2007-2011). Scores from the eight IQA rubrics from a teacher’s best lesson were averaged to create an overall IQA score, which could range from 0 (low) to 4 (high).

All video observations from the first four years of the MIST project will be ranked from highest to lowest in terms of their overall IQA scores. We will view instructional segments (50-90 minutes in length) from middle school class sections in the MIST study dataset with the highest overall IQA scores (*N* ≈ 20). This purposeful sampling procedure is designed to create a subsample of class sections with teachers exhibiting effective mathematics instructional and a high probability of connection-enhancing practices.

3.2. **Coding Schemes**

*Teaching Style.* In order to identify a list of potential aspects of style (as well as a number of categories within each), we will examine the aesthetic and performative qualities of the teaching
episodes from a performance studies perspective. For this analysis, we will view teaching as a social performance, recognized through potentially meaningful representations (Carlson, 2003), and a reasonable focus of an analysis of performance-based, or stylistic, features. To articulate what constitutes performance style, we will examine a teacher’s role in the classroom as a performance that is embodied, material, and aesthetic/spatial. A priori coding categories will include: embodied means of communication (gesture, physicality, vocal tempo/pitch, language and dialect); material means of communication (dress, hairstyle, accessories); and aesthetic/spatial means of communication (the composition of lighting, sound, and space—for example the arrangement of desks, chairs, and concomitant color, texture, shape, and movement). Additional categories will be identified inductively as stylistic themes emerge from the data (i.e. three consecutive lessons from which no new coding categories are identified).

Connection-Enhancing Practices. A previously developed coding scheme will be used to identify and categorize teachers’ instructional practices that enhance connections between teachers and students as well as help students form connections to the content material. Connection-enhancing instructional practices consist of observable explanations, responses, comments, and/or questions from the teacher that could be classified within one or more of the following categories: 1) providing meaningful choice, 2) fostering relevance, 3) being adaptive in practice, 4) promoting independent thinking, and 5) using an open communicative style. The categories and the instructional practices within each category were chosen to represent distinct, but key connection-enhancing interactions between students and teachers based on empirical research (see Assor, Kaplan, & Roth, 2002; Allen, Pianta, Gregory, Mikami, & Lun, 2011). Furthermore, the connection-enhancing coding scheme presents a detailed, but practical framework that encompasses a wide range of instructional practices that may uniquely contribute to students’ perceptions of classroom relational and affective climate.

Mathematics Instructional Practices. For this coding scheme, we will focus on the kinds of “common professional standards” of mathematics teaching that Ball and Forzani (2011) proposed as alternatives to merely identifying individual “style.” Segments and aspects of the lessons identified in the first two rounds will be coded according to a framework derived from recent work in identifying and conceptualizing mathematics instructional practices, including choice of mathematical tasks in relation to the lesson’s learning goal(s); launching the task so that all students can meaningfully engage in the task (by attending to the problem context and requisite mathematical knowledge or understanding); selecting and sequencing student responses to highlight and use in a whole-class conversation; orchestrating a productive whole-class mathematics discussion (in which connections among a variety of strategies and representations are made); making and using public recordings of ideas; using and teaching academic mathematical language; making productive use of student errors; valuing students as competent sense makers; and encouraging students to question one another’s reasoning (Ball & Forzani, 2011; Charalambous, Hill, & Ball, 2011; Hiebert & Morris, 2012a, 2012b; Lampert et al., 2013; Stein, Engle, Smith, & Hughes, 2008; Stein & Smith, 2011; Woodward et al., 2012).

4. Analytic Plan

Our unit of analysis is primarily instructional interactions. We will watch full lessons \((N \approx 20)\), starting with the highest IQA ratings, from each of the sampled class sections. We will use the video analyses software, Transana 2.52, to apply codes to specific times/places in the lesson that identify aspects relevant to each specific coding scheme. There will be 3 sequential rounds of coding with the same classroom video data. During round 1, a coder will work down the
ranked list (selecting one lesson from each teacher) and code aspects of style. During round 2, connection-enhancing instructional interactions will be identified and coded. During round 3 of coding, mathematics instructional practices will be identified and coded.

After the third round of coding, video segments coded only for style that do not overlap with codes for either connection-enhancing practice or mathematics instructional practice will be identified as teaching style. In addition to identifying teaching style, we will examine video segments with non-overlapping (e.g. only mathematics instructional practice) and overlapping (e.g. both mathematics instructional practice and connection-enhancing practice) codes to make clear distinctions among the three components of teaching and examine how each component is enacted within the lesson. Another result of this analysis will be multiple potential sub-sets of data with various combinations of non-overlapping and overlapping coded video-segments that can be a launching point for further, detailed research on teaching.

5. **Educational Significance**

By clarifying and describing components of teaching, we advance theoretical frameworks for understanding how components of teaching style and teaching practices unfold during class time (for example, what mathematics instruction looks like in an interactional environment) and the ways in which different components of teaching can effectively fit together (for example, how teachers can incorporate their own style into mathematics instruction and daily interactions). Furthermore, describing and distinguishing among teaching style, connection-enhancing practices, and mathematics instructional practices will help inform the professional community and improve teacher education by facilitating the communication and dissemination of practice-based frameworks that articulate and describe distinct and identifiable components of mathematical teaching. Lastly, this study will aid in constructing a definition of effective teaching that incorporates multiple aspects of teaching and looks beyond teacher style, instruction, or interactions alone.

6. **Research Team Roles**

The project will be conducted by a cross-departmental research team. A doctoral student will be collaborating with two faculty members. All members of the research team, graduate student and faculty members, will coordinate and conduct data analysis. Faculty member 1 will focus on video coding mathematics instructional practice, and graduate student and Faculty member 2 will focus on video coding connection-enhancing practice. The faculty will be responsible for refining coding schemes as well as coding videos. The doctoral student will be responsible for coding videos, determining patterns across coded video segments to characterize mathematics instructional practice or connection-enhancing practice, and understanding overlaps in components of teaching practice. A third doctoral graduate student will be funded to provide coding for teaching style. After rounds of coding, all members of the research team will be involved in identifying and defining components of teaching and constructing a framework encompassing all components. After data analysis, all members of the research team will contribute to writing and submitting a report for publication.
References


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Budget for the study

1. Video coder for stylistic coding $1,000
   ($25/hour for 40 hours of video coding)
   ~20 lessons x 2 hours per segment of coding
2. Research assistant to transcribe video $1,000
   ($25/hour for 40 hours of video coding)
   ~20 lessons x 2 hours per segment of coding
3. Second coders for reliability $500
   for math instruction
   ($25/hour for 20 hours)
4. Second coders for reliability $500
   for connection-enhancing
   ($25/hour for 20 hours)

TOTAL REQUESTED: $3,000

Justification:

1) A video coder for stylistic coding is needed for round 1 of data analysis. The video coder is a doctoral graduate student outside of the School of Education who will be able to code for the performance, or stylistic, aspects of teaching.

2) In order to code with the video analysis software Transana 2.52, a typed transcription must be time-linked to the video file. A research assistant will type verbal transcripts of the teachers in each video file.

3) A doctoral graduate student from DIL will be a second coder to code a randomly selected sample of video clips in order to measure reliability.

4) A doctoral graduate student from PIE will be a second coder to code a randomly selected sample of video clips in order to measure reliability.