What to Do During a Whale-Nami? Supporting Preservice Teachers' Learning During an Extended Teaching Rehearsal

David Stroupe, Michigan State University, dstroupe@msu.edu
J. Brian Hancock, II, Alma College, hancockb@alma.edu
Amelia W. Gotwals, Michigan State University, gotwals@msu.edu

Abstract: Learning complex, rigorous, and equitable pedagogies requires opportunities for preservice teachers (PSTs) to approximate instructional practices and adapt instruction based on students' talk and actions. Some challenges for PSTs include learning to "notice" students' ideas as resources and to engage in principled pedagogical reasoning to inform future instruction. In our methods class, we wanted PSTs to rehearse noticing and exercising pedagogical reasoning as they served as the primary instructional leaders for an extended rehearsal of teaching we call "macroteaching". We propose that macroteaching serves as an opportunity for PSTs to encounter unanticipated talk and actions, to make purposeful pedagogical decisions based on the emergent student discourse, and to move forward with instruction based on the decisions they made in-the-moment. In this paper, we describe how PSTs negotiated four learning opportunities during macroteaching, and describe our learning as teacher educators over three years of macroteaching enactment in methods courses.

Key words: Teacher education, science education, preservice teachers, teacher learning

The *Framework for K-12 Science Education* (National Research Council, 2012), promotes new priorities for teaching science. Rather than having students memorize information, the current vision for science classrooms is to have teachers support students' learning through participation in disciplinary practices, such as developing and revising models. Supporting preservice teachers (PSTs) as they learn to enact such complex instruction is crucial; often, PSTs' default visions of teaching resemble the instruction they experienced as students, which emphasized memorization and recitation of facts. Teacher educators, then, have two important tasks: (1) disrupting PSTs' initial visions of science teaching and promoting the noticing and use of students' ideas to drive instruction, and (2) providing PSTs with opportunities to engage in principled pedagogical reasoning to inform future instruction

In this paper, we describe a practice-based learning opportunity we co-designed with PSTs in our methods courses to support their learning. Dubbed "macroteaching" by one PST, this learning opportunity is an extended pedagogical rehearsal in which PSTs take on the role of "lead teachers" for their peers (Stroupe & Gotwals, 2018). Macroteaching arose in response to the PSTs' critiques that, while their initial *micro*teaching teaching rehearsals were helpful (see below for more details), such experiences did not allow for extended opportunities to work on and with student thinking. Over three years of methods courses, we have asked:

- How do PSTs and the methods instructors co-develop macroteaching over time?
- How and why does PSTs' understanding of instruction shift (if at all) during macroteaching?
- How and why does the teacher educators' understanding of teaching a methods course shift because of macroteaching?

Theoretical framework and our inquiry stance

To examine macroteaching in our methods classes, we use a two-pronged conceptual framework. First, to understand how PSTs learned as they interacted with peers and instructors, we used a situated learning framework (Lave & Wenger, 1991). Because learning complex instruction requires a practice-based approach to teacher preparation, we use a framework that highlights the ways in which teachers' knowledge is socially, culturally, and historically constructed. Using a situated framework, we define learning as an individual's changing participation in pedagogical activities – planning, instructing in-the-moment, and reflection – over time (Greeno, 2006). The second part of the conceptual framework emerged from the need to understand *our* decisions and actions as teacher educators. We argue that the need for teacher educators to critically analyze their instruction is a pressing issue for the field (e.g., Grossman et al., 2009). Since reframing a methods course around macroteaching requires a reconstruction of multiple layers (e.g., activities, assessments), we needed to understand how our roles and pedagogical decisions were linked with PSTs' learning.

To simultaneously act as teacher educators and researchers, we purposefully took an "inquiry stance" during the methods class, meaning we purposefully critically reflected on our methods pedagogy while examining

the experiences we designed to support the emerging needs of our students (Cochran-Smith & Lytle, 2009). As the course designers and researchers, we were systematic about documenting the learning of PSTs and ourselves, accounting for multiple perspectives, decisions, and dilemmas (Cochran-Smith and Lytle, 2009).

Methods

Design experiment

We viewed this study as a design experiment, meaning that we simultaneously created particular forms of learning for our PSTs while engaged in a systematic study of that learning within the methods class (e.g., Penuel, Fishman, Cheng, & Sabelli, 2011). Throughout the methods class, we engaged in reflexive revisions to our instruction, the macroteaching learning experience, and the data collection and analysis techniques.

Macroteaching

Macroteaching takes place at a large Midwestern University, where PSTs participate in a five-year teacher preparation program in which they major (and minor) in a science discipline while fulfilling requirements for a teaching certificate. During the PSTs' senior year, they participate in two sequential four-hour per week secondary science methods courses. In addition, PSTs approximate instructional practices during microteaching opportunities. Macroteaching emerged from PSTs' three critiques of microteaching: (1) the episodes were too short (i.e., twenty minutes); (2) too much time elapsed between microteaching opportunities (e.g., about two weeks); and (3) PSTs taught 3-4 peers acting as students, limiting the number of student ideas they could elicit and use to inform their teaching. Given these critiques raised by the PSTs, we decided to model responsive instruction based on students' expressed and emerging needs. Thus, we co-developed macroteaching during the Spring semester to allow for an elongated peer-teaching opportunity to better reflect the daily work of secondary science teaching. Macroteaching involved groups of PSTs planning, teaching, and reflecting on 11-12 consecutive hours of instruction to their peers during methods class.

Data collection and analysis

For three cohorts of PSTs, we have collected and analyzed multiple forms of data from four types of interactive episodes: requested or informal planning communication, observations of macroteaching, participant-generated artifacts, and professional development sessions called "critical friends' groups." To analyze the data, we engaged in two interacting phases of work: developing and applying codes, pattern finding and triangulating data, and member checks. The coding scheme was initially informed by the literature on complex instruction and approximations of practice and later by emergent themes from the data. The coding scheme was debated and iteratively revised in weekly research meetings until we reached a consensus. Second, we examined the codes across data sources to look for patterns in our data. After coding each data source, we triangulated our data by looking across data sources to find supporting or disconfirming evidence across data sources to enhance the credibility of the codes and subsequent claims (Merriam, 2009).

Findings

Over three years of enacting macroteaching with PSTs, we have noticed four emerging features of methods class that offer opportunities for us, and our students, to grow as teachers.

Opportunity 1: Teacher educators co-learning with PSTs

During the first year of macroteaching, we were responsible for the original framing and planning of the pedagogical experience. As we explained the plan for extended instruction to the PSTs, we were prepared for questions, confusion, and the need to adapt the experience along the way. We did not anticipate, however, that PSTs would utilize macroteaching to create learning opportunities that we would carry forward into future iterations of the pedagogical experience in subsequent methods courses. During the first few PST-taught lessons, we realized that rather than impose too much structure, we needed to work with PSTs to co-develop the learning experience. By co-develop, we mean that the PSTs and instructors had opportunities, both in-the-moment during instruction and in assignments, to articulate emerging and shifting learning needs and to advocate for solutions.

Over three years, five primary learning opportunities have been co-developed with the PSTs during macroteaching. The PSTs and instructors agreed on a name for each learning opportunity, thus establishing a shared language and resource for future cohorts of PSTs. Below, we name and describe each co-learning opportunity: (1) *In-the-moment consultations*. The teaching team gathers to discuss their immediate and upcoming instructional decisions, often done during transitions between episodes of instruction. (2) *"Time-out/time-in."*

PSTs pause their instruction – calling "time-out" – in order to engage in immediate reflection about a recent event. When the issue is resolved, the individual or team restart the pedagogical action by calling "time-in." (3) *Rewind*. At times, following the time-in/time-out or instructional coaching, a teaching team member would want an immediate opportunity to re-try an interactive episode. (4) *Question and answer session at end of each lesson.* During the final 5-10 minutes of each lesson taught by the teaching team, the PSTs and instructors had an opportunity to ask the teaching team to both decompose pedagogical decisions they made during class, and to inquire about upcoming lessons. (5) *Teaching team debrief at the end of the unit.* Similar to above, these moments occurred at the end of the unit where the PSTs and instructors had an opportunity to ask the teaching team to decompose pedagogical decisions they made during the unit, and to reflect on instructional opportunities they might shift in the future.

Opportunity 2: PSTs learning together

A second feature of macroteaching is that PSTs learn about instructional practices together because they serve as both instructors and students throughout the semester. Over the duration of macroteaching, the PSTs learn from each other and help co-develop emerging norms given the needs of the class. In addition, while seeing peers teach, PSTs had the opportunity to experience instruction from the vantage point of students tasked with constructing and revising an evidence-based explanation for a puzzling phenomenon. The student perspective became important to the PSTs as they realized the high level of intellectual rigor and equitable participatory moves they planned into their own macroteaching units.

Opportunity 3: Designing opportunities for PSTs to thrive when encountering uncertainty

As our PSTs noted in their critiques of microteaching, learning pedagogy that hinges on public discourse and relational work with other people requires connected opportunities to approximate practices and adapt instruction based on what students say and do. We agree with colleagues (e.g., Sun & van Es, 2015) who argue that the development of pedagogical judgment to respond to unanticipated features of instruction, such as student thinking and actions, is a difficult aspect of ambitious teaching to learn. Since a core feature of teaching is the elicitation and revision of ideas, PSTs need opportunities to "notice" and use students' ideas as resources to make instructional adaptations given the uncertainty of next steps. (Manz & Suárez, 2018; Sherin et al., 2011). During macroteaching, PSTs reported the value of noticing and making pedagogical judgments about students' emerging science ideas. As opposed to microteaching, in macroteaching, PSTs had time and opportunities to elicit students' ideas and use them in productive ways both in-the-moment and from day-to-day. However, across three years of macroteaching, we have found that all of the PSTs expressed the difficulty in working with unanticipated student ideas.

Whale-nami

One instantiation of macroteaching, which highlights how PSTs learn to notice student thinking and navigate uncertainty, began with a team of PSTs from the second macroteaching cohort. This group planned a unit around the phenomenon of a graveyard of whales in the mountains on the west coast of Chile. The PSTs' driving question for this earth science-focused unit was, "How did these whale bones end up on land, high in the mountains?" During the introduction of the unit, the PSTs hoped to elicit their "students'" ideas about the phenomenon to leverage those in subsequent lessons. After presenting the phenomenon to the "class," each group of students was then instructed to develop an initial model, illustrating the "before, during, and after" of the whale phenomenon.

Three of the four student groups shared models that aligned with the PST-instructional team's initial expectations of what students might construct (e.g., drawing on plate tectonics and sedimentation in their explanatory models). One group, however, provided an explanation that the PST teaching team did not expect. This group of students proposed that a tsunami lifted the whales out of the water and carried them to the Chilean mountains, where they ultimately came to rest and were slowly buried over time. "Whale-nami," as this model became known, provided a moment for the teaching team to notice student thinking, and to make a pedagogical judgment about what to do with the students' model, and more importantly, how to treat the students' ideas. The decision was not taken lightly. The PSTs could have perceived whale-nami as "off-topic" and simply discounted the value that the students' ideas added to the conversation. However, the PSTs chose to treat "whale-nami" as legitimate, and to publicly acknowledge the value of the ideas that led to the initial model. Further, whale-nami continued to be discussed throughout the unit as a possible explanation.

Opportunity 4: Learning as teacher educators

The fourth feature of macroteaching that has emerged are two continual opportunities to learn as teacher educators. First, we initially viewed macroteaching from our perspective as researchers, assuming that we could identify and name difficult problems that might arise for PSTs when enacting complex teaching. While this was true in some sense, we quickly learned that the PSTs, themselves, could name and identify tensions, problems, and conundrums that we could not anticipate. Second, macroteaching quickly forced us to confront and publicly advance our understanding of teaching beyond naming and representing instructional practices for the PSTs. This public elevation of our thinking blurred lines between typical boundaries of pedagogical "expert" and "novice," thus representing a foundational principle of teaching for the next generation of practitioners.

Discussion and conclusion

As teacher educators, we must find ways of providing PSTs with opportunities to try out instructional practices, make pedagogical decisions in the face of inevitable uncertainty, receive feedback about their progress, and reflect on and plan for future teaching. In the context of our five-year program, we were able to use macroteaching as an intermediary step in PSTs' learning between microteaching and student teaching in secondary science classrooms. Rather than oversimplifying the practices of teaching, macroteaching allowed PSTs a safe environment in which to approximate complex professional work, such as weaving unanticipated student ideas into an entire unit of instruction. Having a supportive group with which to practice flexible and responsive instruction was critical for PSTs as they elicited, noticed, and used students' ideas in moment-to-moment and day-to-day interactions with students. Macroteaching provided us, as teacher educators, with a real-time and accessible window into the PSTs' reasoning and actions that we could use to develop specific and immediate feedback to support their learning.

By engaging in macroteaching as both teacher and student, PSTs had the opportunity to work through entire units of instruction based on puzzling phenomenon and envision what teaching could look and feel like in their future classrooms. Experiencing instruction as students was a large part of the humanizing aspect of the work. The PSTs learned the importance of building safe classroom cultures in which sensemaking was valued rather than simply getting the correct answer. Macroteaching provided opportunities for PSTs to experience this relational work inherent in teaching. Rather than experiencing teaching as simply a set of practices that are sterile, disconnected, or prescriptive (Philip et al., 2019), macroteaching highlighted the importance of teachers and students co-developing classroom communities in which equitable and intellectually rigorous work occurs throughout the school year. Thus, we argue that macroteaching is one opportunity within practice-based teacher preparation that can provide PSTs with a strong foundation to design, enact, and adapt pedagogical practices that help students learn.

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