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Author(s) Danielle E. Dani, Ohio University; Lizhen Chen, Ohio University; Courtney Koestler, Ohio University; Kayla Heacock, Ohio University

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Teacher identity development: Examining a prospective science teacher's positioning

Danielle Dani Ohio University dani@ohio.edu	Lizhen Chen Ohio University lizchen@ohio.edu	Courtney Koestler Ohio University koestler@ohio.edu	Kayla Heacock Ohio University kh426613@ohio.edu
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This study draws on the field teaching experience of a prospective science teacher and explores the ways how she discursively positioned herself before and after participating in a STEM camp at the beginning of a teacher preparation program. We collected pre-camp one-to-one interviews, post-camp group interviews, and individual STEM written reflections. Our findings demonstrate the prospective science teacher shifted her positionings of what effective STEM is that moves from general ideas before the camp to specific examples and strategies that she can use after the camp. Finally, we discuss the importance of fostering collaborative mentorship and cultivating reflective and culturally responsive practitioners in prospective teacher education.

Keywords: Teacher Education - Preservice, Teacher Identity, Reflective Narrative, STEM Education, Field Practicum

Current research on teacher identity examines how prospective teachers (PTs) construct their teacher identities by negotiating multiple factors including their lived experience, personal learning and teaching experience, and social contexts (Miller Marsh, 2002). Friedrichsen et al. (2008) used “incoming identities” to denote three types of PTs’ identity—“Always a Teacher”, “Late Deciders,” and “Career Explorers”—at the beginning of a teacher education (TE) program (p.175). However, it is unclear what teacher identities particularly identities regarding teaching and learning to teach PTs bring to teacher preparation programs. This study, part of a larger study, focuses on the learning-to-teach experience of a prospective science teacher by exploring the ways she discursively positioned herself before and after participating in a STEM camp, an early clinical experience. Positioning theory (Davies & Harré, 1990; Friedrichsen et al., 2008) is useful for examining PTs’ discursive construction of their selfhood. The research question that guides our study is: In what ways does the STEM camp support prospective teachers’ positioning as science and mathematics teachers?

Theoretical Perspectives

Sfard and Prusak (2005) defined identities as collections of “reifying, endorsable, and significant” stories about professionals (p. 16). We focus on one facet of identity, the reflexive identity—the self’s view of oneself—as told to others. The construct of reflective positioning is used to describe the (re)presentations of identity in reflexive narratives (Davies & Harré, 1990; Haniford, 2010). Teacher identity is constructed within social participation in different communities (Boaler et al., 2000; Lave & Wenger, 1991). Drawing on sociocultural theories of learning and development (Cole, 1996; Rogoff, 1990; Vygotsky, 1978; Wertsch, 1991), we recognize that (1) identity forms in culturally organized and authentic activities that are tied to specific contexts (Browns et al., 1989; Lave & Wenger, 1991), (2) as learners engage in social interactions with peers and more knowledgeable others, they progressively appropriate the knowledge, practices, and ways of thinking that allow them to participate in their communities of practice (Barkhuizen, 2016; Lave & Wenger, 1991; Resnick, 1991), and (3) learning and

development are mediated and shared by the learner, other individuals, and various physical and symbolic tools (Resnick, 1991; Wertsch, 1985). From a TE perspective, Putnam and Borko (2000) emphasized the importance of performance and pedagogical tools to enhance and transform teacher thinking and practice. In this study, PTs' identities as STEM teachers form as they teach STEM (situated authentic activities) during a summer camp at a rural high school (specific context) while engaging in co-mentoring with peers and faculty (pedagogical tool). As PTs describe to others significant stories of themselves as effective teachers in STEM camp, they reify their developing identity as STEM teachers.

Methods and Modes of Inquiry

This study occurred during the first semester introductory STEM Education course of a graduate TE program at a large midwestern university. STEM camp, a key component of the course, was a one-week summer camp for 11- to 14-year-olds to learn STEM-focused content and also a place for PTs to enact and reflect on their developing ideas about STEM teaching and learning. At the time of the study, the focal PT in this proposal, Ms. Dana, was matriculated in the Middle Childhood Science and Language Arts Education program. We will provide additional information about her background and describe a second PT (secondary mathematics) during the paper presentation.

Data collection included (1) a 45-minute pre-camp interview focused on the purposes, rationales, and images of science and mathematics education as well as expectations for and assessments of student learning; (2) a post-camp group interview focused on PTs' take aways from camp, excitements and challenges, and goals for growth as science and mathematics teachers; (3) PTs' individually written reflections. A group interview was used to help PTs reflect on their teaching experience with camp students and clarify their reflective narratives when different viewpoints were shared. Data was analyzed inductively through an open-coding process (Denzin & Lincoln, 2000) that generated a set of initial codes (e.g., background knowledge, inquiry, facilitation, interest). Further, we developed categories based on incidence, interrelatedness, and substance (e.g., purpose for teaching science and mathematics, beliefs about students, perspectives on STEM teaching). Finally, patterns and differences across categories were used to determine themes that describe holistic perspectives about PTs' positionings before and after STEM camp.

Findings: Ms. Dana's Case

Ms. Dana's main purpose for teaching centered on nurturing good people who can "work with each other better and collaborate" and make sense of "what is going on in this world" around them. Her love of science and her belief that it permeates all aspects of our lives undergird her goal of instilling a similar love and understanding in her students "so that maybe they can be more interested in a subject that a lot of times, people see as difficult or hard" (Pre-camp interview). The following themes describe Ms. Dana's positionings as an effective science teacher supported by excerpts from her reflexive narratives.

Creator of Learning Opportunities and Orchestrator of the Learning Environment

Ms. Dana positioned herself as a creator of learning opportunities for students before the camp. She described several strategies that would help her achieve her teaching goals, including the use of student-centered activities that engage students in doing science. Ms. Dana prioritized situating learning within current events such as “climate change,” using science practices and a discovery-oriented approach, and meeting state standards. She emphasized the importance of engaging in scientific practices in a manner that mirrors what scientists do. She stated, “a lot of scientific discovery comes through the process of investigation and setting those investigations up and figuring out these things...having them [students] make observations, investigate, and figure out on their own sort of replicates that practice most closely” (Pre-camp interview). Ms. Dana shared the following example of a lesson on plants to illustrate her ideas:

Have [students] bring in [plants] they find outside or get pictures... have them make observations and then start using those observations to guide them towards what parts of [plants] are relevant ... start organizing [observations] into different categories and then start helping [students] figure out what the names of all those pieces are. (Pre-camp Interview)

Ms. Dana’s positioning about good STEM teaching did not change at their core after the camp. She stated, “The biggest goal I have is continuing to work on not being afraid to let the students do real inquiry and science” (Post-camp interview). Ms. Dana’s expanded ideas included notions of an orchestrator who plans for clear directions, structure, and responsiveness to students’ needs. She believed that providing directions was an important part of developing students’ ability to complete hands-on activities. She reflected that a lack of sufficient “intentional and purposeful... directions” in her teaching led to students’ confusion while doing some camp activities. Ms. Dana specified that assigning roles served as a key strategy for providing structure and ensuring that individual learners have the opportunity to complete all elements of an activity. She reflected:

To make the activity more effective for these learners, next time I might structure the activity by explicitly tell[ing] students to take turns in different roles ... one student could fetch the materials and create the landslide, the other makes the observations and writes the notes [and these roles could be written on cards that are passed out]. For the next phase of the experiment, the students could switch cards [and therefore roles], and then at the end they could share data and discuss the results. This would allow students to gain experience in all facets of the experiment and would also establish clear expectations of turn-taking at the start. (STEM camp reflection)

Ms. Dana’s awareness of students’ different learning needs also emerged when she positioned herself as an orchestrator of the learning environment. For example, she emphasized providing choices for written and oral communication and recounted a story from the camp:

Alex expressed that he does not like to write on paper, because he does not like the feeling of it ... I asked Alex if he would like to use a whiteboard instead. He obliged, but he ended up only using the board to doodle and write occasional

words ... I then tried to assign roles to them. Evan became the group's note-taker (which worked especially well, because he then revealed he loves taking the time to write thorough notes) and Alex could participate by making oral observations for Evan to write down. (STEM camp reflection)

Elicitor and Engager of Student ideas

Before the camp, Ms. Dana centered student ideas. She highlighted the importance of eliciting student ideas and finding out what they know. In her plant lesson example, Ms. Dana shared, "before you start ... just asking them what they already know about plants and if they can name those [plant] parts ... maybe have them draw or write things on the board, and sort of activate that background knowledge" (Pre-camp interview). Notably, Ms. Dana situated this practice at the start of a learning experience to "activate" students' background knowledge.

Ms. Dana's post camp reflective positioning additionally emphasized the value of eliciting student ideas during a learning experience, not just at the start. She identified questions as an important tool for eliciting and engaging student ideas. She reflected, "if [students] didn't do it outright, you had to ask them some questions and get them going. But once they opened up to the idea that I wasn't going to leave them until they told me something" (Post-camp interview). Here, Ms. Dana is also recognizing how the expectations she sets affect the ways in which students engage and share their thinking as they do science.

Investigator of What Works

Ms. Dana's positioning described a reflective and investigative STEM teacher. Her positioning emphasis, however, shifted to include both a student-learning perspective and a teacher-learning perspective. She provided opportunities for students to investigate science and began testing different pedagogical techniques and observing their effects on student learning. Before the camp, Ms. Dana focused herself on supporting student learning when they make observations, do experiments, and figure out their own conclusions. After the camp, she referenced the importance of "researching" strategies to support student needs and described what she would do "next time" (STEM camp reflection). For example, she shared,

Alex was unwilling to [observe] and only wanted to participate through the actual hands-on portions of the activity. Therefore [role taking], though meeting the needs of both students in terms of active participation, was ineffective instructionally for Alex. He still was not willing to engage ... I still have some reflecting (and possibly researching) to do on how to address similar situations in the future in order to be more effective with students similar to Alex. (STEM camp reflections)

Ms. Dana's positioning as an investigator was intentional in TE self-improvement. To address challenges that she experienced during the camp, Ms. Dana drew on strategies she learned about in her courses, including having "some group discussions before they [students] go

to whole class" to "get the students that are quieter to have some speaking time" (Post-camp interview).

Discussion and Implications

The STEM camp experience which occurred at the very beginning of the TE program provided PTs the opportunity to operationalize their ideas of good STEM teaching with authentic activities in a classroom with real students (Putnam & Borko, 2000). We see PTs' positionings of effective STEM teaching move from general ideas before the camp to specific examples and strategies that they can use after the camp. These findings add to the current research findings regarding PTs' experience of consistency and contradictory in developing their teacher identities (e.g., Chung-Parsons & Bailey, 2019). The STEM camp supported PTs' teacher identity development as novice teachers by providing in-the-moment mentoring and post-teaching reflective opportunities - thinking about what works and what does not, trying different approaches, doing research, and testing. The multiple positioning shifts that PTs represented in their reflexive narratives suggest that given appropriate mentorship, the PTs could leverage students' diverse thinking and learning needs to promote their overall learning early in their program. The findings are consistent with Miller and Fuller's (2006) claims that PTs' self-reflection on their assumptions of teaching and student learning was beneficial for them to develop culturally responsive pedagogy. Such aspects of teacher identity development echo Shulman and Shulman's (2004) call for reflective practitioners and answer the current call for culturally competent teacher educators (e.g., community awareness in Dani & Harrison, 2021; curriculum design in Gay, 2018). Fostering prospective STEM teachers' identity development necessitates providing authentic, meaningful, enactive, and reflective opportunities.

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