Exploring Identity of Prospective Math and Science Teachers Through Reflections in Early Field Contexts

Lorelei R. Coddington[1] and Lauren H. Swanson[2]

Abstract
This qualitative study examined written reflections of nine prospective math and science teachers to explore the influence of contexts in early field experience on identity development and future career decisions. Prospective teachers' entrance essays, as well as weekly open-ended reflections and end-of-semester reflections on classroom experiences were collected and analyzed inductively. Coded analysis of these reflections revealed differences in classroom placement, temporality, and focus. Findings showed that even when prospective teachers had similar classroom placements, they negotiated the contexts differently. Results suggest that prospective teachers' normative and personal teacher identities can be shaped by context. Examining how personal identity coincides with or is in opposition to normative identity in a classroom context may shed light on critical points when prospective teachers are grappling with their ability to replicate elements of good teaching. Furthermore, reflections can provide insight into prospective teachers' placement of themselves, their potential teaching trajectories, as well as potential challenges to their developing identities.

Key Words: Identity; preservice teachers; mathematics education; science education; reflection

Introduction

There is a growing international interest in research examining teacher identity development during early stages of teacher preparation (e.g., Gallchóir, O'Flaherty, & Hinchion, 2018; Yuan, 2016). An early introduction to the classroom provides a window for future teachers to make sense of the classroom context and who they are becoming as teachers. Exposure to the classroom early in the teacher education experience is significant in developing teacher identity because the context confronts how preservice teachers are exposed to the ways of 'being' a teacher (Ruohotie-Lyhty & Moate, 2016; Timoštšuk & Ugaste, 2010).

Researchers have used preservice and novice teachers' narratives and reflections to explore how classroom contexts influence developing teacher identity (Gallchóir et al., 2018; Izadinia, 2015). Beginning teachers conceptualize the work of teaching by

[1] Corresponding Author: School of Education, Biola University, 13800 Biola Ave., La Mirada, CA, 90639, USA Email: lorelei.coddington@biola.edu Phone: 1-951-733-6147 https://orcid.org/0000-0001-8729-7190
[2] Department of Education & Child Development, Whittier College, 13406 Philadelphia St., Whittier, CA, USA Email: lswanson@whittier.edu Phone: 1-562-907-5029 https://orcid.org/0000-0001-8505-8751

how they place themselves within the professional community (e.g., Harlow & Cobb, 2014) and their perceptions of their interactions with mentor teachers (e.g., Izadinia, 2015; Mena, Garcia, Clarke, & Barkatsas, 2015). As Beijaard et al. (2004) concluded, "more attention should be paid to the role of context" (p. 126) as it relates to the interactions of the actors within the environment and subsequent teacher identity development. Researchers agree that teacher identity is negotiated, multifaceted, and influenced by context. Personal experiences within schools can impact beliefs about teaching, leadership, and practice in novice teachers' personal identity development (Flores & Day, 2006). Sociocultural contexts, social interactions, and participation in mentoring are also related to changes in teacher identity (e.g., Izadinia, 2015; Yuan & Lee, 2015). Some studies examine the influence of context through Wenger's (1998) communities of practice (CoP) framework, emphasizing the dynamic of professional relationships within teacher development contexts and their influence on identity (e,g., Beauchamp & Thomas, 2011; Harlow & Cobb, 2014). These studies highlight the importance of context and its influence on teacher identity in general ways (e.g., views and beliefs of teaching, belonging); however, there is a gap in our understanding of the role context plays in shaping identity during early teacher development (Beijaard et al., 2004; Izadinia, 2013). By examining identity within early field experience (EFE), researchers may gain insight into how classroom contexts influence prospective teachers' engagement in CoPs and leverage these experiences to influence career decisions and teaching trajectories.

Literature review and theoretical framework

Because it is believed that teacher identity and reflection go hand in hand (Dewey 1933; Schön 1983), teacher education programs worldwide have incorporated reflection as a critical component of both preservice (e.g., Arrastia, Rawls, Brinkerhoff, & Roehrig, 2014) and in-service training (Taylor, 2017). Research supports using reflection in developing preservice teachers' teaching abilities (Coffey, 2014), their understanding of the act of teaching (e.g., Ryken & Hamel, 2016), and their developing identities as future teachers (Izadinia, 2013). Reflection is seen as a window into identity development since reflective action promotes self-awareness and formulation of beliefs about self (Ruohotie-Lyhty & Moate, 2016; Sutherland, Howard, & Markauskaite, 2010).

Research on teacher identity has emerged over the past two decades, much of which examines identity during the beginning years of teaching (e.g., Schaeffer, 2013; Pillan, Beijaard, & Brok, 2013) or during student teaching (e.g., Beltman, Glass, Dinham, Chalk, & Nguyen, 2015). Less evident are studies examining teacher identity development in the early stages of teacher preparation (Löfström, Poom-Valickis, Hannula, & Mathews, 2010; Timoštšuk & Ugaste, 2010). Teacher identity is defined in various ways, though most studies agree that identity "is not a fixed attribute of a

person, but rather a relational phenomenon" (Beijaard et al. 2004, p. 108). Identity in teacher education can be related to personal beliefs as well as how teachers relate their own lives to their professional experiences and background (Löfström et al., 2010). The process of identity development is "negotiated through experience and the sense that is made of that experience" (Sachs, 2005, p. 15) as a "constantly evolving phenomenon" involving "both a person and a context" (Beauchamp & Thomas, 2009, p. 177). According to Beijaard et al. (2004), many studies have focused on the "personal" (p. 113) aspects of identity, such as identity through self-image or sub-identities, though little attention has been given to the context or "landscape" (p. 113) that shapes identity within social situations and interaction, especially in EFEs. Limited research exists to address the varied influence of context on the development of early-stage teacher identity (Beijaard et al., 2004; Izadinia, 2013).

In this study, we examined identity in written reflections to explore how classroom contexts influenced the experiences of prospective math and science teachers (PTs) who were on the cusp of deciding whether to enter the teaching profession. We explored the following questions: 1) How do prospective teachers' reflections provide evidence of teacher identity development within a classroom context? 2) In what ways do early fieldwork contexts influence prospective teacher identity development and entry into teaching?

We drew on Wenger's (1998) communities of practice (CoP) and Cobb Gresalfi, and Hodge's (2009) conceptualization of normative and personal identity. Through Wenger's (1998) CoP model, we examined PTs' developing identities by how they negotiated their social experiences and situated themselves. Cobb et al.'s conception of normative and personal identity assisted us in understanding PTs' conceptions of 'being a good teacher.' For PTs in EFEs, classroom contexts provided novel opportunities to mutually engage in joint enterprise with both teachers and students in a new CoP while exploring notions of teaching competence.

According to Wenger, identity construction in a CoP is conceptualized as "experiencing," "doing," "belonging," and "becoming" (p. 5). Participation in a community is a central aspect of identity development, since "we not only produce our identities through the practices we engage in, but we also define ourselves through practices we do not engage in" (p. 160). Wenger explains identity as negotiated experience in which we use our interactions to define and reinterpret who we are, as community membership in which we use the familiar and unfamiliar to define ourselves, as a learning trajectory in which we use where we have been and where we are going to indicate who we are. In a CoP, members position themselves on either an inbound or peripheral trajectory; some moving toward membership while others position themselves on the edges of the community. We used Wenger's conceptualization of community to understand PTs' identity development through the temporality of their reflections and how they negotiated the placement of themselves within the context of the classroom.

Normative and personal identity are two analytical schemes we used to examine teacher identity (Cobb, et al., 2009; Johnson, Brown, Carlone, & Cuevas, 2011). Normative identity is the collectively perceived set of expectations for how individuals are considered competent within a determined context. For example, these could be the actions deemed as competent teacher behaviors in the math classroom as defined by the teachers within the CoP. Personal identity is represented by "how individuals develop as they participate in the practices" within the specified context (Gresalfi & Cobb, 2011, p. 274). Cobb et al.'s (2009) framework guided our analysis of PTs' written reflections to illuminate shared aspects of good teaching as determined by the CoP, while also examining personal identity through personally identified visions of good teaching.

Methodology

Research context

As part of a university-school partnership in the south-western United States, PTs explored a career in education prior to committing to a teacher credential program. PTs were paired with local high school math or science teachers and engaged in many classroom-related practices (e.g., planning, delivering instruction). Both teachers and PTs engaged together in over 100 hours of professional development (PD) split between a summer institute and three full-day follow-up sessions. The PD included exploring inquiry-based pedagogy as well as developing and planning math and science curriculum based on new national curricular standards. During this time, all participants also engaged in individual research experiences based on their content areas (e.g., math, physics. Although the high school teacher's research experiences were limited to the summer, the PTs carried out their research throughout the year. PTs also completed 60 hours of fieldwork in the high school teachers' classroom. Fieldwork was an assigned set of hours required across each semester during which PTs were to be present in their partner teacher's classroom. There were no specific requirements placed on PT involvement, though most PTs began by observing and then self-initiated further action as negotiated with the teacher. Both PTs and high school teachers could elect to complete a second year of the program. For a full program description, see Author (2016).

Participating high schools were located within the same district and served a student population primarily of Latino descent; however, each afforded the PTs different contexts to explore math and science education. Orange View students attended 50-minute classes each day while at Riverbend students attended three 120-minute periods. While both schools enrolled between 2,000-3,000 students, Riverbend experienced a decline in enrolment during 2013-2016 while Orange View did not. Finally, Orange View served a lower percentage of socioeconomically disadvantaged students.

Participants

A representative sample of participants was selected from across the three cohorts (n = 16 PTs); this sample was representative with respect to PTs' age, gender, ethnicity and subject area. All PTs in their final year of a bachelor degree during their first year of the program were included in this study and names listed here are pseudonyms (n = 9). We focused on PTs in their final year of college (Table 1) because they were closer to making decisions about their post-graduate pathway.

Table 1.
Undergraduate Participants

PT	Entry Year	Ethnicity	Undergraduate Major/Minor	Content Area Placement	Site Placement
Ana	2014	Asian/Pacific Islander & White	Engineering/ Film Studies	SDAIE Geometry Geometry	Orange View Riverbend
Amanda	2013	White	Math/ No Minor	SDAIE Geometry Honors Geometry	Orange View Riverbend
Brenda	2015	Hispanic	Biology/ French	Honors Biology Regular Biology	Riverbend
George	2013	White	Physics/Math	Physics	Orange View
Jose	2015	Hispanic	Chemistry/ No Minor	Chemistry	Orange View
Maliah	2014	Asian/Pacific Islander	Biology/ No Minor	Environmental Science	Orange View
Mark	2014	White	Biochemistry/ No Minor	Honors Biology	Riverbend
Maria	2013	Hispanic	Child Development/ Biology	Honors Biology SDAIE Biology	Riverbend
Tiffany	2015	White	Biology/ Psychology	Biology	Orange View

All participants reported experience tutoring and/or coaching prior to entering the program and cited these experiences as justification for considering a career in education. Aside from Amanda and Maria, none of the PTs had taken an education-related course; however, five had taken a class in child development.

Data sources

Similar to others (Ruohotie-Lyhty & Moate, 2016; Sutherland et al., 2010), we gathered PTs' written reflections as windows into developing teacher identity. PTs maintained logs of fieldwork hours and regularly reflected on program experiences; both were submitted as ungraded assignments in a one-unit seminar-style course. Each semester, PTs completed approximately 11 weekly reflections and a summative reflection. Weekly reflections asked PTs to describe their recent classroom experiences. End-of-semester prompts asked PTs to describe any connections between their research and teaching experiences as well as whether the program assisted them in thinking about their plans after college. We also reviewed PT application essays to understand PTs' rationale for participating in the program; their essays shared previous experiences that sparked PTs' interest in and prepared them for working in high school settings.

Finally, twenty-one semi-structured interviews were conducted with high school teachers once each semester. All teachers were asked the same core set of questions that targeted instructional practice as framed by review of classroom video and accompanying student work samples, as well as their experiences working with the PTs. Specifically, teachers were asked to describe what they had gained through the experiences with PTs, what challenges they experienced, how the teachers envisioned ongoing work with the PTs. Targeted follow-up questions were used to further probe and clarify teacher responses. All interviews were transcribed in their entirety. These data were used to explore lesson development and the nature of the teachers' and PTs' relationships. Previously, these data established the existence of a CoP (author, 2016) with evidence of shared learning through relationship (mutual engagement), a sense of shared accountability (joint enterprise), and negotiated meaning through shared discourse, tools, and values (shared repertoire; Wenger, 1998). We also used these interview data to triangulate findings further.

Data analysis

Informed by our knowledge of Wenger's (1998) CoP and identity development along with studies investigating identity and temporality of identity (Cobb et al., 2009; Urzúa & Vásquez, 2008), we examined both what PTs decided to reflect upon and how they did so, thus examining the totality of their written reflections. Using the sentence as our unit of analysis, we began independently analyzing one PT's entire set of weekly reflections, examining word choice, patterns, and themes (Patton, 2002). Jointly, we collaborated on codes, collapsing categories and identifying themes. We noticed the way language was used in relationship to self and mentor teachers. Many of the patterns paralleled temporal aspects of past, present, and future, reflecting Wenger's (1998) conceptualization of temporality in CoPs. Through this process we developed

an emergent set of codes that fell into three dimensions: Placement, Temporal, and Focus (Table 2). Frequencies were calculated for each code and analyzed for patterns.

Table 2.

Description of Coding by Dimension

Dimension	Element	Examples
Placement	**Distant**: Taking an observer stance. Setting one apart from class activities.	[Amanda, Spring 2014, Week 6] "**The teacher was leading them** in a lesson on volume and so was introducing new three-dimensional shapes and what they were called."
	Active: Discussing one's own actions and interactions within the classroom. Use of "I" "we" "me" "my" statements.	[George, Spring 2014, Week 1] "Instead of trying to answer their question and assuming they knew what the heck **I was** talking about **I would** simply point out the place in the book were (sic) the answer to their question is."
	Reflection: Statements indicating individual is making sense of classroom experiences. For example, use of "I wonder" or "I think" statements.	[Maria, Spring 2014, Week 3] "**I wonder** if there is any way that I could have helped stir more discussion and conversation among the students."
Temporal	**Future**: Statements that discuss future times and places.	[Jose, Fall 2015, Week 2] "We are hoping to implement this exploration of periodic table trends **this upcoming Tuesday**."
	Now: Statements regarding the lesson for that day/week.	[Maria, Fall 2013, Week 1] "While the students were working on this **I walked around** the classroom to see how the students were doing."
	General: Statements about the general state of the classroom, student learning, etc.	[Tiffany, Fall 2015, Week 10] "I am really bad with names so **this has been a struggle for me all semester**."
	Past: Statements that recall past memories of school learning or teaching experiences.	[George, Fall 2013, Week 1] "**I don't remember having trouble** with the things I helped them out with but everyone is different."

	Student Engagement: Included statements about level of high school student engagement in the class activities as well as statements about how the fellows engaged students in said activities.	[Ana, Fall 2014, Week 1] "However I also noticed that there were **several students who actively participated and several who did not**."
Focus	**Questions**: Statements focused on questioning on the part of teacher, high school students, or fellows.	[Brenda, Spring 2015, Week 9] "I assisted the students by clarifying **questions they had** about the article."
	Explanation: Statements regarding the act of explaining something. Such explanations can be teacher, fellow, or high school student generated.	[Amanda, Spring 2014, Week 7] "The teacher and I would point at that section of their data and ask them to tell us what it meant and as soon as **they explained it** they would see their own mistake."
	Student Thinking: Statements regarding high school students' thinking.	[Maliah, Fall 2014, Week 4] "I also ranked it as a type B activity, giving the students directions on what they need to accomplish, but **leaving enough ambiguity to allow them structure [*sic*] their own thinking** and be creative."

The first dimension, placement, characterized how the PTs situated themselves within the classroom with respect to other class members (teachers and students) and to the activities unfolding; we found these to be distant, active, or reflective in nature. Similar to research on temporality in identity development (e.g., Urzúa & Vásquez, 2008), we attended to PTs' use of time as our second dimension, temporal. While other researchers focused their analysis on participants' past or future statements as evidence of identity development (Arrastia et al., 2014; Conway, 2001), we distinguished when PTs were speaking about past, present, and future events. Included in this section was a "general" category signifying a less defined temporal nature (e.g., "all semester"). The third dimension related to the statement focus, which we found related to Cobb et al.'s (2009) conception of normative identity. We began by looking for patterns and repetition of words and ideas in the reflections (Patton 2002), analyzing what PTs were attending to as aspects of 'good teaching' experienced through their classroom and mentor teacher interactions. From these, we identified four categories used consistently across all reflections: student engagement, questions, explanation, and student

thinking. We found comparable categories in the literature (Fletcher & Luft, 2011; Timoštšuk & Ugaste, 2010).

Once we identified a stable set of codes, we jointly coded one-third of the reflections, representing three participants' work. All disagreements were discussed until resolved (Patton, 2002). Independently, we coded the remaining weekly reflections, meeting to review our coding and to reach consensus on any discrepancies. Once coding was completed for all PTs, we began to look across the data for similarities and differences in how PTs perceived classroom experiences and interactions. Some PTs situated themselves more actively than others in the classroom context, which we interpreted as evidence of possible teacher identities and trajectories within the CoP (Wenger, 1998). We then compared this analysis to our review of PTs' application essays. We also reviewed teacher interview data to identify commonalities between PTs' and high school mentor teachers' views on their joint enterprise of co-planning and co-implementing lessons. Finally, we analyzed how PTs reflected upon their classroom experiences as represented by the presence of the codes, examining differences between PTs who pursued a teaching credential after graduation and those who chose other career trajectories.

Findings

Upon completion of the yearlong program, all of the PTs acknowledged that their classroom experiences informed their post-graduation plans. Tiffany, Maliah, Brenda, Jose, and Ana planned to pursue careers other than teaching. Amanda, Mark, Maria, and George indicated their intention to enroll in a credential program, and did so after graduating. To identify influences for these career decisions, we first discuss the focus of PTs' weekly reflections as connected to their normative and personal identities. We then draw from across PTs' application essays, weekly and end-of-semester essays, and finally, teacher interviews in order to detail how PTs negotiated their classroom experiences within a CoP.

The six PTs included in Table 3 shared classroom contexts: Amanda and Ana worked with the same high school teachers and designed curriculum for use in the same classroom setting (SDAIE Geometry). Mark and Brenda both worked in an Honors Biology classroom with the same teacher. George and Maliah worked with the same teacher, though in different subject areas (Physics and Environmental Science, respectively). Three PTs, Tiffany, Jose, and Maria, were partnered with different teachers in classroom contexts representing different content areas; therefore, these PTs were not placed in a pairing. Still, data from these participants' is used to support discussion of general findings, particularly those regarding career trajectories.

Across all nine sets of PT reflections, regardless of pairings, we identified that PTs were focused on student learning through their focus on student thinking, engagement, and questioning, though to varying degrees. Further, while PTs' attention was

focused on their more proximal classroom experiences, PTs drew connections across time frames, as will be discussed in our second set of findings. By placing PTs with shared classroom contexts in pairs, we examined their placement and interactions in the classroom, as evidence of identity negotiation. For example, while George routinely discussed his own interactions with students and referenced lessons co-planned with the classroom teacher, Maliah's reflections commented on the teacher's actions as opposed to her own. Her reflections included comments like, "Mr. Michaels had an interactive lecture about soil in which the students had to fill in blanks and follow along with a worksheet. I thought this was very productive, as it forces the students to take notes and be attentive for the entirety of the lecture. [Fall 2014]. In this representative reflection, Maliah situates herself as an observer of classroom interactions; Maliah's reflections reveal a passive self-perception which highlights the distance between herself and the other individuals in the classroom, consistently placing herself on the periphery of the classroom.

Pairing revealed how PTs consumed similar classroom contexts in different ways as they negotiated their experiences and development of identity. To support our discussion of how PTs' normative and personal identities were revealed through weekly reflection, we present findings associated with the remaining two pairs of PTs: Amanda and Ana followed by Mark and Brenda. Excerpts from these PTs' application essays and teacher interviews are included to provide additional context.

Table 3.

Prospective Teacher Classroom Pairings in the Same Context

PT	Temporal (%)				Placement (%)			Focus (%)			
	Future	Now	General	Past	Active	Distant	Reflective	Student Engagement	Questions	Explanation	Student Thinking
Pair 1											
Amanda	0.00	96.49	2.63	0.88	28.95	47.37	23.68	38.78	16.33	10.20	34.69
Ana	4.27	84.67	9.15	1.83	17.07	39.63	43.30	16.67	11.67	15.00	56.67
Pair 2											
George	2.88	74.1	20.86	2.16	42.86	10.00	47.14	15.79	35.53	7.89	40.79
Maliah	7.58	86.36	5.30	0.76	17.05	42.80	40.15	37.70	39.34	4.93	18.03
Pair 3											
Brenda	1.10	87.91	2.20	8.79	32.42	55.49	12.09	13.95	19.77	18.60	47.68
Mark	2.03	85.8	6.38	5.80	43.48	36.52	20.00	12.75	23.49	16.78	46.98

Identity revealed through weekly reflection

Despite differing in length and level of detail, weekly reflections documented that PTs regularly attended to student engagement, student thinking, the questions they and

their students posed during class, and how concepts were explained. Routine discussion of these topics reveals that PTs viewed actions such as monitoring student engagement in a task as good teaching, evidence of normative identity (Gresalfi & Cobb, 2011). Of particular note was the prevalence of the code for student thinking. With the exceptions of Jose and Maliah, the majority of each PTs' reflections included at least one comment coded as student thinking, meaning PTs regularly attended student thinking without prompting. In the following example, we explore conceptions of good teaching (student engagement, student thinking, and questions) as noted in Ana and Amanda's reflections and highlight additional evidence of growing self-perceptions.

Ana and Amanda

Ana and Amanda's application essays shared multiple elements. First, they centered on memorable high school math teachers. Ana said this individual "confirmed" her notion that high school teaching was "worthwhile," and talked about the math teacher's rapport with students and ability to foster critical thinking. Amanda wrote that her own high school math teacher was the "role model for what [she] aim[ed] to be as a high school math teacher in the near future." Second, both PTs described how they reflected on classroom experiences. Ana recalled experiences from elementary school when she analyzed her teacher's behavior and "[thought] of how [she] would do things differently or the same if [she] were a teacher." Amanda cited her experience observing in a high school classroom as part of a college education course, "It is a great opportunity to get to observe a high school class, and since I was simply in the background I could analyze every side of situations." Finally, both discussed their experiences tutoring other students. The most pronounced difference was how they spoke about a possible career in teaching. Ana wrote, "I know that this [fellowship] will be a great opportunity for me to gain experience and to learn about what being a teacher really means." Whereas Amanda, expressing more certainty in her career trajectory, wrote: "Through all of these experiences it has become increasingly clear to me that I have a serious desire to continue to pursue a career in math education."

Ana attended to student thinking more often with her reflections than Amanda (Table 3). In contrast, Amanda focused almost equally on student engagement and student thinking; she also focused slightly more on questioning. In the following excerpt, Ana framed her analysis of a student's ideas around the Standards for Mathematical Practice, used in the United States to guide the instruction of mathematics as part of the Common Core State Standards for Mathematics (NGA, CCSSO, 2010).

We begin with an extended example of Ana's attention to student thinking:

1   *... As I was going around the classroom offering help, one of the students asked me to*
2   *check his reasoning regarding one of the angle relationships. He said, "[angle] 4 is equal*
3   *to [angle] 5, right? Because 4 corresponds to 8, and 5 and 8 are vertical." In my head I*
4   *thought, "Yes! Exactly!" because I saw this student applying [Standards for Mathematical*
5   *Practice] #7 and #3: "Make use of structure" and "Construct viable arguments." Rather*
6   *than using the fact that 4 and 5 are alternate interior angles to reason that they are equal-*
7   *which is the more obvious answer that most other students were using – he was able to*
8   *make connections between different parts of the parallel lines and make an argument that*
9   *is just as viable. It was pretty cool to see a student making this sort of connection because*
10   *maybe the definition of alternate interior angles doesn't make much sense to him, yet he*
11   *can still come to a plausible conclusion by using other facts he does understand about the*
12   *structure of parallel lines and their transversal. [Fall 2014]*

Ana described her place in the classroom (line 1), noting that a student asked her to check his reasoning. This interaction, a form of identity negotiation, spurs her detailed recollection of the student's thinking. Ana describes her excitement over the student's connections (line 4) and identifies and unpacks the student's alternative reasoning (lines 4-12). In this way, Ana appears to be using her interaction to negotiate the experience of what it is like to be a teacher. This focus underscores Ana's developing perspective on qualities of good teaching and connects to her entrance essay which highlights a math teacher who promoted critical thinking.

Ana's application essay also highlights her own high school math teacher's ability to build rapport with students. In other reflections, Ana comments on her own challenges making connections to students, a self-identified area of struggle. One reflection in particular highlighted her struggle to respond to a student who did not want her help since she could not speak Spanish, the student's primary language. Thus, rapport with students appeared to be an important aspect of Ana's view of community membership in the classroom context.

While Amanda is not as attentive to student thinking as Ana, Amanda reflects on her classroom interactions at a macroscopic level, electing to discuss her goals for her interactions with students (lines 4-7). These instances demonstrate Amanda's use of interactions to interpret teaching and her negotiation of the shared community value of promoting student thinking.

1   *This week at Orange View High School I was basically helping to facilitate in class group work*
2   *on problem sets in a note packet, and then an additional activity. In instances like these I simply*
3   *walk around while students are learning and make sure everyone is on task and answer any*
4   *questions that arise as best I can. My goal is to not simply provide the answers for the students,*
5   *but to encourage them to think and then comprehend by their own efforts. This idea is much*
6   *harder to put into practice than it may seem, but I feel like the goal keeps me aware of what I*
7   *want the students to get out of the experience. [Fall 2013]*

In her application essay, Amanda wrote that looking at "every side" of classroom situations was important to her; perhaps this is why she tends to include comments in her reflection that touch upon multiple aspects of a classroom, including a focus on questioning (line 4). These instances demonstrate Amanda's use of interactions to interpret teaching within the CoP.

In both excerpts, the PTs actively placed themselves within the classroom; however, Amanda more often actively placed herself within the classroom than Ana (Table 3) when looking across all reflections. When the high school teachers discussed their interactions with the PTs during interviews, they spoke of Amanda's rapport with the students. At first, one of the math teachers commented on how she wished Amanda would be more pro-active saying, "I think there were times when I wish Amanda and [another PT] would jump in more and like just make themselves engaged [with the students]." However, by the end of the year, both math teachers with whom Amanda worked commented on the rapport she had built with the students. The same teacher who wished for more engagement from Amanda praised her for her willingness to share her passion for math with students. The other math teacher also praised Amanda's rapport with students, noting that her own students saw Amanda as a "resource" and "felt comfortable" asking Amanda for help. Amanda's increased interaction and mutual engagement, as noted by the teachers, not only demonstrates growth in Amanda's teacher identity but also reveals how her interactions shifted across time indicating a trajectory of increased and active participation in the CoP.

The high school teachers also noted aspects of Ana's teaching that needed improvement. For example, one noted Ana needed assistance asking questions of students, "And the newer [PTs, including Ana] didn't know sort of what to do and what's sort of nice is they're mixed in class so they can see the [other PT's] who have been through a year – see how they work in the class, see what type of questions they ask." The other high school math teacher brought up Ana's initial rapport with students, saying "I think she just looks at them [the students] like, what are you doing with your life? So, I think she's trying to like – it is culture shock for her." It must be remembered that Ana did not spend much time in her reflections on questioning. Further, Ana shared her own perceived struggles with developing rapport with students.

Mark and Brenda
While PTs often switched stances in temporality in a given reflection, within each PT pairing, the PT whose reflections included more actively coded segments ultimately entered the teaching profession, as evidenced by the pairing of Mark and Brenda. Mark and Brenda worked with the same biology teacher at Riverbend high school during different program years; Mark entered the program a year prior to Brenda. Analysis of their reflections revealed that, in general, they attended to the same types of tasks in the classroom and both focused on that week's lesson (temporal dimension). However, Mark placed himself in an active role more often than Brenda (Table 3).

Both PTs' applications indicated that they were undecided about their post-graduation plans. In their personal essays, Mark and Brenda discussed experiences working with younger students. Mark had more experience through his work with secondary and post-secondary students. In his essay, Mark seemed to express his teaching iden-

tity with statements like, "Teaching comes naturally to me. The classroom environment is comforting as well." This identity continued to develop while he worked in the classroom, negotiating his relationship with students and attitudes towards them, as evidenced in the excerpt below.

1   *On Thursday, our activity was still in progress … Unfortunately, these students are more*
2   *focused on how to put a presentation together (since we have not provided them a template*
3   *or an example). Another alignment issue is that my students do not seem to realize that data does*
4   *not speak for itself. As I circled the classroom and pop[ped] into each group to gauge progress*
5   *and redirect them during questionable moments, I encouraged them to talk about similarities*
6   *and differences that they observed as they draw their data on the poster… I have tried to*
7   *maintain a positive, encouraging attitude considering the transition for them is hard to become*
8   *accustomed to and especially at an age where everything they know about themselves and*
9   *The world seems to be in transition. [Fall 2014]*

This reflection exemplifies Mark's consistent documentation of his active involvement in lessons; his word choice illuminates the type of relationship he sought to develop with students. marking his inbound trajectory into the CoP. Mark describes himself as a collaborator by using "our" (line 1) and as someone who interacts directly with students (lines 5-6). Indeed, Mark often referred to the students as "my students" (line 3) indicating his self-perception as a teacher. Further, he identifies the need to be aware of his own attitude (lines 7-8) as well as thinking about trajectories of student learning and what is developmentally appropriate (lines 8-10). This type of writing showcases Mark's sense of a good teacher's actions, evidence of normative identity development (Gresalfi & Cobb, 2011). This also reflects Mark's use of relationships in defining his own personal identity within the classroom.

In contrast to Mark, Brenda's essay was more similar to Ana's noting that Brenda thought program participation would allow her to "explore a career as a biology educator." Further, Brenda's essay and early weekly reflections did not include comments reflecting perceptions of herself as a teacher. Below, Brenda comments on her lack of confidence in lesson planning.

1   *[The classroom teacher] has asked us to come up with various worksheets. My first one, I was so*
2   *ashamed, because the questions I had come up with were what I was taught. Essentially, I went*
3   *back to old teaching methods. Working with [another PT] has helped me a little more as to what*
4   *I have to do. However, I still feel like I lack the ability to plan a lesson, or a worksheet that doesn't*
5   *just give them the answers. [Fall 2015]*

Brenda's feelings of shame (line 2) indicate her view of lesson planning as a central task of teaching and one she finds difficult. Further, as Brenda recognized her lesson exhibited "old teaching methods" (line 3) it challenged her own personal teacher identity, providing a window into how Brenda perceived her identity in relationship to normative practices of good teaching. This reflection's tone suggests that Brenda placed herself outside of what she would consider good teaching, thus using the challenges of group membership to define herself.

Brenda's views on her lesson planning are particularly important as the classroom teacher asked all the PTs with whom he worked to plan and implement lessons. Mark advocated for the opportunity to design and implement his own biology unit, to which the cooperating teacher agreed. Like Mark, Brenda had the opportunity to lead the class within her first semester in the classroom and by the eighth week, she had implemented a self-designed activity. The classroom teacher was pleased to have both PTs in his class; however, the classroom teacher positively commented on Mark's proactivity. The classroom teacher appreciated Mark self-advocating to lesson plan: "[Mark's] really owning his position of I trust you, so if you have something to say, something to do, go for it. You don't have to wait for me to ask you or instruct you to do something" (Spring 2015). The classroom teacher wanted the PTs to feel comfortable trying out instructional materials, strategies, and techniques in the classroom classroom and the degree of trust expressed demonstrates mutual accountability.

Both PT pairings highlight the influence of the classroom context on developing self-perceptions as teachers and views of good teaching. Even within the same classroom context, PTs reflected temporally in different ways and held varied perceptions of themselves as teachers. These reflections also provide evidence of developing normative and personal identity. Moreover, PTs' written reflections demonstrated trajectories moving either toward or away from classroom involvement and beliefs about themselves as teachers, providing further evidence of identity negotiation.

Career trajectories informed by classroom experience

Analysis of weekly reflections revealed that PTs connected to their past and present selves while projecting into the future as they reflected on classroom interactions, such as the four categories described above. Unsurprisingly, PTs' reflections for a given week focused mostly on that week's interactions since they were asked to do so in the prompt. Across all reflections, including PTs who were not included in a pairing, 82.86% of the statements were coded as temporally "now," meaning they highlighted a single lesson or activity. However, PTs still drew connections between the week's lesson and their own learning as well as possible future interactions, though the latter was less frequent. For example, Maria's reflections connected moments across time.

1 *I went around the classroom to help guide the students in thinking about and searching for the*
2 *answer in their notes. The students had their notes as a resource to answer the worksheets.*
3 *Many would ask, "Is this right?" I encouraged them to use their notes to help them out. When they asked*
4 *me if their answers were correct, I asked them where they got that information, whether it was*
5 *correct or not. As we talked about during the summer workshop training, it is important according*
6 *the standards and our discussions, that the students connect their answers to the evidence in*
7 *the text. Therefore, in order to do this, I encouraged them to check back in their text and show*
8 *me what guided them to think that. ... I did my best during the lab to guide the lab groups to*
9 *think about what the tests and their results meant for the overall picture. For my own research,*
10 *I constantly have to do the same thing. After taking a step in my research whether it was with*

11   *literary research or some experiments, I worked with my mentor to think, "Okay so what does this*
12   *mean and how does this guide what I will do next?" During this class period I asked questions*
13   *to get them to look back at procedures and notes to see what each test meant. I hope that as I*
14   *continue to model this for the students that they can start asking themselves these questions.*
15   *[Fall 2013]*

Maria connects her experience working with students to a previous training (lines 5-7) as a means to justify her instructional approach. Maria then compares her experiences assisting students during a lab exercise with her own research experiences (lines 10-13). Maria explains the purpose of her questioning: to have students think about the process of conducting an investigation and the importance of data analysis (lines 13-14). She concludes her reflection with a desire to continue working with students on questioning (lines 14-16). Maria's writings routinely demonstrated temporal fluidity as she connected her classroom experiences to previous learning, general comments about teaching, and her future career as a teacher. She also expresses confidence in teaching by "doing her best" and seeing herself as a guide for students. As such, she demonstrates a trajectory of growth as a teacher by both providing rationale for her current practice, developing confidence, as well as acknowledging her hopes for the future.

Analysis of end-of-semester reflections revealed how PTs drew from their experiences. For example, in his fall end-of-semester reflection, Jose described his joy in reaching students. He wrote, "From day one I loved being in the classroom and I thoroughly enjoyed the sense of fulfillment that came each day after leaving the classroom and feeling as though I may have made an impact, even if minor, in a student's day, experience in learning, and particularly with chemistry." In her reflection, Tiffany highlighted community: "This program created a very unique sense of community. I found myself among a diverse group of individuals who all had one common thread: the desire to be life-long learners. Being in a dynamic environment among self-motivated and directed individuals is a necessity in any career I choose." In both of these statements, the PTs express positive engagement and a sense of belonging to the community through a common purpose.

However, even when PTs recognized the value of their experiences, it did not always lead to an immediate career choice in education. While in their end-of semester reflections, Maria and Amanda wrote about classroom participation as confirming their desire to become teachers, the remaining PTs' applications indicated less certainty about a career in education. As Ana's and Brenda's examples show, these PTs were "considering" teaching as a possible future career. In some cases, PTs used wording that suggested teaching was never their "top" career choice. Phrases including "participating in this program hasn't really changed my plan…" (Ana, Fall 2015), "I still plan to pursue my original dream" (Maliah, Spring 2015), and "nursing remains my strongest career option" (Brenda, Fall 2015) indicate that these PTs had in mind ca-

reers other than teaching prior to working in the high school classroom. Ana noted that part of her plan was to become an engineer and then pursue teaching as a possible second career. Jose and Maliah also noted that teaching could be a potential future career. Brenda was pleased to realize she could indeed be a teacher, even though she wanted to pursue a different career. Both Tiffany and Brenda saw the potential to transfer skills and knowledge from their classroom experiences to future careers outside of teaching. These beliefs underscore mutual benefit in the CoP, even though Tiffany and Brenda did not have inbound trajectories toward teaching as a career.

In the cases of George and Mark, classroom experiences solidified their interest in a teaching career. While Mark wrote in his fall end-of semester reflection about his hesitancy to pursue a teaching credential, by spring he indicated he would enroll in a credential program upon graduation. Like Mark, George entered the program interested but not yet committed to pursuing teaching. By the end of fall, George decided to become a science teacher, which was affirmed in his spring reflection, "I had so much fun this last year that I do not want for it to end." This statement shows George's perception of teaching as enjoyable by his wish for it to continue.

Discussion

This study explored math and science prospective teachers' reflections in early fieldwork contexts in relationship to teacher identity development and resulting career decisions. Results from the PTs' reflections demonstrated negotiation of personal identity and normative identity development around four aspects of good teaching. Findings also suggested that, even when PTs' classroom experiences occurred in the same context with the same mentor teacher, PTs negotiated these experiences uniquely. Further, the same classroom context did not yield the same ending trajectory, as seen in the pairings of both Amanda and Ana as well as Brenda and Mark. Within each pairing, PTs who more often placed themselves actively within the classroom context were on an inbound trajectory toward teaching and did indeed enter a teaching program. Reflections also varied temporally, with fewer PTs reflecting on their future selves as teachers.

Normative identity

Common among PTs was a developing normative teacher identity around four different foci related to good teaching derived from classroom context: student engagement, questioning, developing explanations, and student thinking. All nine PTs reflected across these areas, which we believe provides evidence of normative identity development, thus extending Gresalfi and Cobb's work (2011). Classroom contexts are complex and for PTs to have identified similar foci of effective teaching demonstrated evidence of classroom context shaping identity based on the normative practice across teachers. Furthermore, PTs routinely highlighted student thinking in their reflections

and appeared to identify this focus as important to their personal teaching identity. We find this interesting, as a long-established theoretical framework on teacher identity formation discounts pre-service teachers' ability to focus on student thinking in this early stage (Conway & Clark, 2003; Fuller & Brown, 1975).

Challenges to identity development

PTs' reflections gave evidence of challenges to personal identity formation. One challenge was the internal incongruity evidenced in Brenda's struggle between what she identified as good teaching (normative identity) and her frustration around being unable to enact the desired practice (personal identity). Dissonance of this kind could lead PTs to frustration creating barriers to viewing themselves as teachers. Brenda did not choose to pursue teaching and perhaps this dissonance influenced her decision making. This adds to our growing understanding of dissonance in teacher identity formation (Gallchóir et al., 2018; Hong, 2010; Pearce & Morrison, 2011) and challenges to identity development in fieldwork placements (Yuan, 2016).

A second challenge was that even though the temporality evident in the PTs' reflections was varied, reflection was less frequent about PTs' future selves. According to identity development theory (Wenger, 1998; Schön, 1983) a part of shaping one's identity includes envisioning oneself in the future. Maria reflected across all three temporal dimensions regularly and also pursued a career in teaching after her program involvement. Using Wenger's theoretical perspective, evidence of temporal reflection in Maria's case (past, present, and future) suggested her inbound trajectory toward becoming a member of the CoP in the development of her teacher identity. Early reflections on teaching and learning contexts may provide clues to understanding how PTs negotiate the experiences within the classroom and their future paths as teachers. Moreover, prompting PTs and preservice teachers to reflect on their future work as teachers in the early stages of fieldwork may assist in PTs envisioning themselves as teachers and may enhance early teacher identity development and entrance into teaching.

Placement and career decisions

Our findings indicated that PTs who reflected more actively in each pair moved toward teaching. This participation (active) and non-participation (distant) provided insight into their developing teacher identities. For example, Maliah placed herself distantly in the classroom context while George took an active stance; both PTs' experiences were with the same high school teacher, though teaching different subject areas. However, the reasons for the differences in career outcomes are unclear, since the context for each pairing was the same. Similarly, even though teacher education programs strive to select excellent field placements for classroom experience, these contexts may not be consumed the same way by individuals. Additional factors may be at play which may influence teacher identity trajectories as they relate to the context and should be

further examined using a larger sample size. Interestingly, two PTs who were unsure about their future careers and also placed themselves actively in the classroom context, Mark and George, selected to enter a credentialing program after graduation.

It is also worth noting that PTs who stated in their entry essays a desire to become teachers, stayed true to that trajectory and entered a credentialing program. Teacher educators might examine similar reflective stances in early entrance essays or in reflective statements to assess positive interest and potential inbound trajectories at the onset of program application. These findings support other research suggesting possible early indicators of pursuing a teaching career (Löfström et al., 2010).

Conclusion

In this study, prospective math and science teachers' early fieldwork reflections provided evidence of negotiation of teacher identity resulting in varied career decisions, All PTs' highlighted normative identity development around four aspects of good teaching: student engagement, questioning, developing explanations, and student thinking. Furthermore, findings suggest that even though PTs experienced the same fieldwork context, they negotiated the experience differently, resulting in varied career trajectories. Those PTs who placed themselves more actively in each classroom pairing resulted in choosing to become teachers. Challenges to teacher identity development were identified in relationship to failed enactment of desired normative teaching practice and PTs' limited ability to envision themselves as future teachers. Findings suggest early-stage teachers need structured opportunities in their teacher education program to reflect on visions of their future selves as teachers, since this appears to occur less naturally and may lead to early development of identity and entrance to the field of teaching.

Limitations and future research

Consistent exposure to the same classroom context in early practice enhances teacher identity development and builds conceptual understanding of good teaching; however, the small number of PTs could have constrained our ability to identify all potential aspects of good teaching influencing PTs' normative identity development. With a larger number of participants, additional foci may be identified and allow us to further test the connections we found between a PT's active role with the classroom, their understanding of what constitutes good teaching, and their post-graduation decisions. More research is needed to investigate how the elements of classroom contexts as well as interactions with a mentor teacher and students may influence a PT's personal identity. Examining how personal identity coincides with or is in opposition to normative identity in a classroom context may shed light on critical points when PTs are grappling with their ability to replicate elements of good teaching.

Acknowledgements

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