

Enacting Role Identities: Insights Into Mathematics Graduate Students' Professional Identity Development

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This study examined the professional identity development of six mathematics graduate students by exploring how they enacted and constructed meanings around five role identities: teacher, researcher, mathematician, mentor, and peer. Drawing on role identity theory, I highlighted the socially mediated nature of identity formation and the ways it was shaped by program structures, departmental cultures, and disciplinary expectations. Findings indicated that while graduate students identified the roles of teacher and researcher as most central to becoming mathematics faculty, the program offered more formalized opportunities for teaching than for research, suggesting an imbalance in preparation. This work contributes to understanding the liminal space between graduate student and professor, where multiple roles are navigated. The study points to the need for graduate programs to intentionally design structures that expand opportunities for development as researchers, mentoring, and community building.

Keywords: Graduate Students, Professional Identity, Role Identity

Recent scholarship on graduate students' professional identity development underscores the importance and impact of disciplinary and departmental contexts (Solari & Ortega, 2020; Tran et al., 2011). Graduate students' immersion in their fields can shape how they understand academic work (Clarke et al., 2013; Colbeck, 2008), with discipline-based cultures serving as a primary source of identity development and formation (Anderson & Louis, 1994; Clarke et al., 2013). In mathematics, the absence of laboratory work and the emphases on abstraction, correctness, and rigor (Gutierrez, 2017; Herzig, 2004) may uniquely shape students' roles and self-conceptions. While many experiences, such as teaching and research, are common across graduate programs, the meanings attached to these roles are shaped by departmental, sociohistorical, and personal contexts. Given that graduate students are deeply embedded within undergraduate mathematics education, understanding their multiple roles and identifying best practices to support their identity development has notable implications for postsecondary mathematics.

Across many mathematics departments, graduate students are often at the front lines of interacting with and supporting undergraduate students, meaning that their roles can directly influence undergraduate learning experiences, departmental climates, and students' sense of belonging in mathematics (e.g., Olarte et al., 2024; Herzig, 2004). Graduate students' pathways into faculty careers also mean that how they come to see themselves during graduate school has long-term implications for the practices, values, and representations that shape undergraduate mathematics education. Given the fragmentation of higher education and evolving institutional expectations (Nixon, 2006), graduate students' enactments and understanding of their roles may diverge from historical notions of the professoriate, raising questions about how graduate programs equip students for faculty careers (Austin & McDaniels, 2006; Zhang & Wang, 2024). In this study, I adopt a role identity perspective to examine how mathematics graduate students developed their professional identities through enacting and interpreting multiple roles, exploring which became most salient and how disciplinary and departmental contexts shaped these processes. The study is guided by the following research question: How did mathematics graduate students enact and make sense of their role identities as prospective faculty?

To examine graduate students' professional identity development, I draw on identity theory (Burke, 2003; Stryker, 1968; Zhang & Wang, 2024) and role identity theory (Colbeck, 2008; McCall & Simmons, 1978; Jazvac-Martek, 2009). These perspectives, aligned with sociocultural views of identity development, acknowledge the salience of others and context in shaping identity formation. Identity theory frames the “self” as constructed through performing activities and behaviors, while also emphasizing the meanings and expectations associated with the roles that individuals perform. Zhang and Wang (2024) wrote, “In identity theory, the core of an identity is the categorization of the self as an occupant of a role, and the incorporation, into the self, of the meanings and expectations associated with that role and its performance” (p. 353). For graduate students, navigating various roles such as teacher and researcher during graduate education contributes to their evolving professional identities as prospective faculty.

Role identity theory especially emphasizes how graduate students' internalized meanings of roles are shaped by social interactions, institutional contexts, and personal beliefs and values (McCall, 2003; Olarte & Street, 2025). Graduate students enact multiple roles such as researcher (Davis & Lester, 2016), teacher (Beisiegel & Simmt, 2012), and mentor (Brown & Sheerin, 2008), depending on situational demands, creating a salience hierarchy in which some roles become more central to their professional selves (Stryker, 1968; Zhang & Wang, 2024). When roles are affirmed through sustained enactment, peer recognition, or institutional validation, they stabilize and may anchor as enduring dimensions of identity. Alternatively, when affirmation is absent or roles conflict with personal commitments, tensions arise that disrupt identity development (e.g., Austin & McDaniels, 2006; Herzig, 2004). These negotiations underscore that professional identity is not a fixed construct but a continual process of (re)construction across multiple, and sometimes conflicting, role identities (Bale & Anderson, 2022; Olarte et al., 2024; Winstone & Moore, 2017). Understanding how graduate students navigate these dynamics provides insight into the interplay of personal, disciplinary, and institutional factors shaping their preparation for faculty careers. Figure 1 below visualizes this perspective and process of professional identity development through sustained and negotiated role enactments.

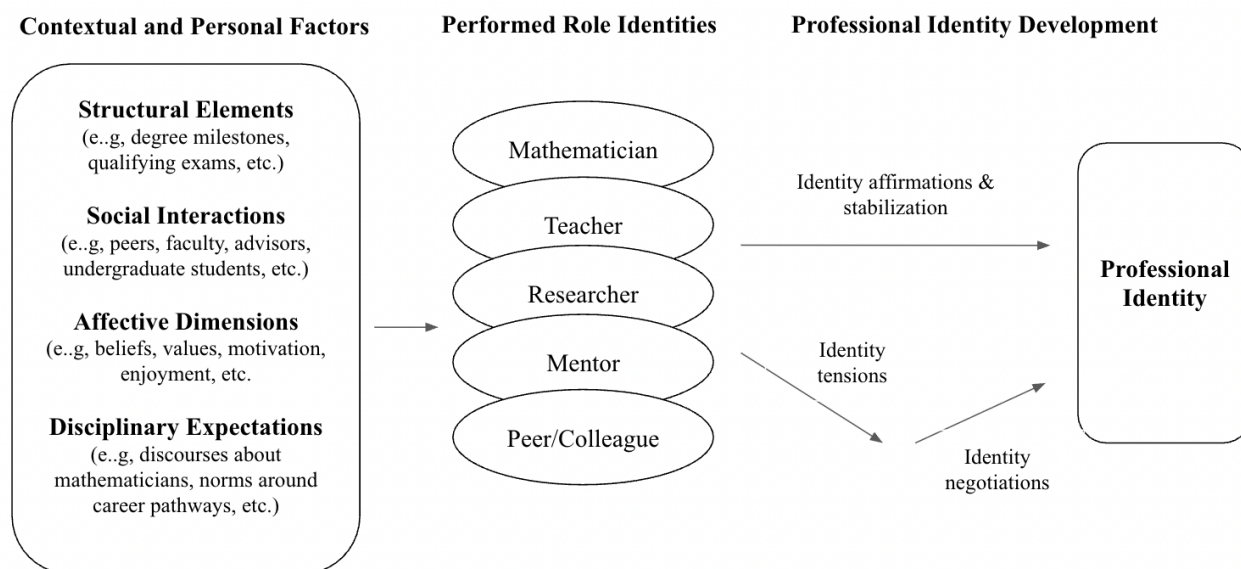


Figure 1. A Process of Professional Identity Development in Graduate Mathematics Education

Method

I employed a thematic analysis approach (Miles et al., 2020) that combined inductive and deductive approaches to examine the role identities that emerged from participants' narratives of graduate education.

Context and Participants

This study was conducted at Spruce University (pseudonym), a large, research-intensive university in the West Coast of the United States. The mathematics department at Spruce University confers graduate degrees (i.e., Master's and PhD) in applied and theoretical mathematics and completion of the doctoral program is expected to take about 5-6 years. The first two years of the program involves completing program requirements and graduate-level sequences for three content areas (e.g., Algebra, Analysis, etc.). Students take comprehensive exams (i.e., qualifying exams) for each area after the required coursework. After fulfilling these three area requirements, doctoral students select a focal research area, secure a dissertation advisor, and take an oral examination given by their respective doctoral committees to discern if the student can reasonably complete a dissertation on their proposed topic. This marks advancement to candidacy. At Spruce University, doctoral students are expected to advance to candidacy within four years of starting their graduate studies. The final milestone is to successfully conduct research and write and defend their dissertation.

I employed a convenience sampling (Miles et al., 2020) to recruit graduate students in the mathematics department at Spruce University in Spring 2023. 16 doctoral students completed a survey that elicited self-described or self-selected academic information (e.g., year in program, prior education, etc.), inclusive demographic information (e.g., gender, race, etc.), and career aspirations information. Then, purposeful sampling (Yin, 2016) was used to recruit students who indicated that they had considered or were actively pursuing careers as mathematics faculty. This study focuses on the six students who participated in an interview about their experiences. Their brief profiles are provided in Table 1 below.

Table 1. Participant Profiles

Participant	Year in Program	Gender	Race	Research area
Connor	3 rd	Male/Masculine	White/Caucasian	Data-driven methods of learning dynamical systems
Kayla	1 st	Female/Feminine	White/Caucasian	Geometric group theory, combinatorial group theory
Kendall	5 th	Female/Feminine	White/Caucasian	Topology
Landon	2 nd	Male/Masculine	White/Caucasian	Quantum topology
Martin	1 st	Genderqueer/ Genderfluid	Latinx/Chicanx	Applied mathematics and math bio
Morgan	5 th	Female/Feminine	White/Caucasian	Low-dimensional topology

Data Collection and Analysis

Data collection occurred within a 60-minute semi-structured interview (Rubin & Rubin, 2011), conducted over Zoom, about their experiences in graduate school, their understanding of the mathematics professoriate, the kind of faculty they hoped to be in the future, and key features of doctoral education. Some questions from this semi-structured interview included: (a) In what ways have you seen yourself as a mathematics professor or faculty while in graduate school?; (b) What aspects of your graduate education have most contributed to your development as a professional in higher education mathematics?; and (c) Tell me about your relationships with your peers in graduate school. Guided by Saldaña's (2013) system of open coding, I conducted multiple rounds of coding that involved close reading of the transcripts to identify emergent themes, actions, and meanings participants associated with their roles. In the first round, I coded for the roles and responsibilities participants reported enacting, such as serving as teaching assistants, collaborating with faculty on research, and engaging in mathematical work. The analysis was informed by existing literature identifying common graduate student roles (e.g., teacher, researcher, mentor), which served as sensitizing concepts. Codes were then organized into broader categories that reflected salient role identities and the contexts in which they were enacted, stabilized, or challenged. Using constant comparison (Miles et al., 2020), I examined similarities and differences in how participants enacted and made meaning of their roles, for instance, seeing teaching as both delivering mathematics content and supporting students' broader development. This process culminated in thematic findings that illuminated how graduate students enacted role identities during graduate school.

Findings

Participants' reflections of their experiences revealed five notable role identities that could qualitatively be organized in a salience hierarchy (Stryker, 1968; Zhang & Wang, 2024) based on the frequency and depth of their reflections on these role identities. I found that their identities as teachers and researchers were more central to their broader professional identities (See Figure 2).

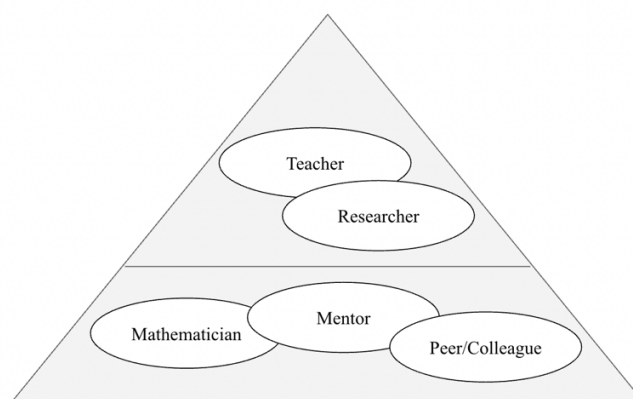


Figure 2. Participants' Salience Hierarchy of Role Identities

Teacher

The role identity participants most often enacted, and often most enjoyed, was that of *teacher*. All served as teaching assistants at Spruce University, with some, like Kayla and Morgan, also teaching as instructors of record at prior institutions, experiences that solidified this role identity. Teaching was not only central to how they envisioned the work of mathematics faculty but also a primary motivator for pursuing faculty careers. As Kayla shared, "I think I've

always known that I've wanted to teach, like that has been an unquestionable thing,” while Kendall explained, “I still really love [teaching], and I don’t want to stop. That’s part of the reason why I want to pursue a career as a professor.” Participants emphasized that positive classroom moments and relationships with students helped them see teaching as more than content delivery, but also about humanizing mathematics and supporting students’ broader development. Kayla, for instance, described wanting to “make mathematics a more welcoming community” and be the kind of professor who both teaches math and “makes a difference in someone’s life.” Similarly, Connor said his goal was to be “approachable,” while Kendall emphasized guiding students “in more of an emotional sense and a math sense.” Many participants distinguished TA positions and instructor-of-record opportunities, with the latter providing greater agency and autonomy that deepened their sense of selves as teachers. As Morgan explained, “Sometimes over the summer, you’re able to teach your own class, [and] that probably helps the most of preparing me to be a math faculty member.” Overall, teaching was the role through which participants felt most connected to their career aspirations, grounding their professional identities in both pedagogical practice and relational commitments to students.

Researcher

For all participants, the *researcher* role identity, characterized by curiosity, agency, and independence, was understood as equally central to the professoriate as teaching. Many explicitly articulated the faculty role as a dual responsibility: teaching *and* contributing to the field through research. Morgan captured this duality, noting that being a math professor “means that you get to teach students pretty much during the whole school year,” while also contributing through “researching and publishing papers.” Kendall described research as “really hard, but super fun” while Landon particularly valued the freedom “to study whatever you want... and think about interesting problems all day long.” Yet, unlike the role identity of teacher, which was formally structured early through TA positions, the formal path into conducting mathematics research was more fragmented, often depending on student initiative or chance faculty support. Kendall reflected on how a professor she “cold called” during her first year became a supportive mentor who “never made me feel stupid,” and Connor shared how presenting in a faculty member’s class led to a serendipitous advising relationship. Such mentorship and scholarly community were pivotal in affirming students’ researcher identities, with Morgan emphasizing that “my advisor is super great... just a really good mentor.” Across their accounts, being a researcher was not simply about producing results but about cultivating values of persistence, creativity, and collaboration, qualities that both grounded their sense of self in graduate school and shaped how they imagined themselves contributing to the field as future faculty.

Mathematician

While connected to teaching and research, the role identity of *mathematician* carried distinct meanings, often tied more to the process of engaging with mathematics than to producing publishable results. Participants characterized being a mathematician as involving deep thinking, intellectual exploration, and a love of learning mathematics for its own sake. Landon expressed this sentiment, saying, “I guess doing math seems like a really enjoyable way to use my brain’s processing power, and I guess I kind of fit in, in that sense.” Many participants said they saw themselves as “math persons” even before graduate school. Successes during their undergraduate years sparked curiosity and enjoyment that motivated them to pursue advanced study. Landon reflected, “There was never any doubt in my mind that I was going to study math, and taking college level math classes certainly didn’t do anything to dissuade me from studying math.” They

also associated being a mathematician with qualities like persistence, curiosity, and determination, especially in facing difficult problems without immediate solutions. Kendall noted, “I guess I don’t give up very easily. That helps with being a mathematician....A lot of it is determination and resilience.” This role identity was most often enacted during coursework, grappling with advanced concepts, and navigating qualifying exams, which became experiences that both prompted and challenged their identities as mathematicians. The qualifying exams, in particular, caused significant challenges and self-doubt. Several participants described this period as the most difficult time of their graduate careers. Morgan recalled, “It was definitely the qualifying exams. That’s the only time where I’ve slightly wavered on, ‘Is this [career] right for me?’ That was the only time.” These moments of uncertainty resulted in tensions with their mathematician identities, which were not grounded in research output but in a sustained connection to the discipline through learning and shared participation in mathematics.

Mentor

The *mentor* role identity captured how participants positioned themselves in relation to undergraduates, often describing mentorship as deeply fulfilling and distinct from teaching or research. Kendall shared, “Being a mentor to undergrads has always been a lot of fun... you basically get to be an advisor to them in some sense,” while Landon framed it as “a great way to pay that forward in some sense and make that experience good for other people.” Their approaches to mentorship were shaped by their own educational journeys, with many aiming to provide the support they had received, or wished they had, through structured opportunities like Directed Reading Programs (DRPs) and Research Experiences for Undergraduates (REUs). Landon described mentoring undergraduates in an REU as his “favorite thing to ever happen in math,” and Morgan similarly shared that mentoring through a DRP and an REU affirmed her belief that “being a professor would be good.” Notably, for the three women-identifying participants, mentorship also deeply intersected with gender identities and personal values. Kayla emphasized showing care and compassion to counter stereotypes of mathematicians as distant, while Kendall aspired to “be a woman in a field where I can make a trail for future girls.” She shared that this commitment “was in the back of my mind for a lot of the time.” Beyond formal programs, participants also viewed office hours and casual conversations as spaces where they could support students academically, emotionally, and personally. These meaningful interactions anchored their mentor identities and underscored the role of mentorship in shaping both their professional trajectories and more inclusive visions of undergraduate mathematics education.

Peer

Participants primarily enacted the role identity of *peer* through relationships with fellow graduate students, centering this identity on mutual support, peer mentorship, and advocacy. Grounded in values of collegiality and community, this role was often the most significant source of belonging in graduate school. Kendall summarized this sentiment: “I feel a sense of belonging in the field, but only because of the other graduate students, I feel a sense of belonging in my graduate students at Spruce.” Rather than stemming from formal institutional structures, participants described informal spaces and social activities as essential to cultivating academic and emotional support. Connor shared, “Things like game night that we run have been really helpful in actually meeting friends in the math department. I was invited to go climbing with a couple of the math department people.” These relationships then made it easier to ask each other for academic help, discuss challenges, and feel connected. For some, community was forged through shared identities. Morgan, for example, described bonding with a close group of women-

identifying graduate students, while Landon reflected on early social moments like playing video games and getting pizza with peers that helped ease his transition into graduate school. Peer mentorship across cohorts was another important facet of this role identity. Kendall noted how observing senior students navigate the job market helped her understand and anticipate future steps in her career: “Watching them, like older grad students, decide what to do and watch them apply to postdocs... Talking to older graduate students, talking to graduate students in my year and below, because you're all navigating the same career trajectories.” This exchange of knowledge, support, and empathy was reciprocal and sustaining.

Discussion

Throughout graduate school, students deeply engage in learning, teaching, research, and academic life, while concurrently developing an understanding of themselves and the profession’s values, norms, and practices (Clarke et al., 2013; Tierney & Rhoads, 1993; Trede et al., 2011). Participants’ reflections revealed how their role identities were informed by program milestones, social interactions, personal commitments and affective dimensions, and the broader disciplinary expectations of higher education mathematics. Drawing on sociocultural perspectives of professional identity and role identity theories, I found five role identities that mathematics graduate students enacted: teacher, researcher, mathematician, mentor, and peer. While prior work has studied roles such as teacher (e.g., Deshler et al., 2015; Winstone & Moore, 2017) and researcher (Davis & Lester, 2016), the present work adds to this literature by examining how mathematics graduate students develop their professional identities within a specific departmental and disciplinary context. The findings revealed some of the meanings students associated with their roles, the ways departmental and institutional norms shaped professional identity development, and how pivotal doctoral program experiences impacted the salience of these identities. Interestingly, participants identified the roles of teacher and researcher as most central to what it means to be a mathematics professor, suggesting these dimensions were more strongly anchored (Mockler, 2011) and higher in their salience hierarchies (Stryker, 1968; Zhang & Wang, 2024). As Morgan noted, these were the “two aspects of being a math professor.” Their prevalence indicates that Spruce University emphasized teaching and research as the most important roles for doctoral students, though the program’s structure afforded more formal opportunities for teaching and fewer structured opportunities for research, creating an imbalance in preparation for the two salient roles communicated as essential for mathematics faculty.

Implications and Conclusion

This study offers both theoretical and practical implications for understanding professional identity development and preparing graduate students for faculty careers in mathematics by examining how students enacted and constructed meanings around five role identities. This work contributes to broader conversations about the multifaceted and dynamic nature of professional identity formation in graduate school (Clarke et al., 2013; Solari & Ortega, 2020; Trede et al., 2012). Moreover, the identification of critical experiences that support or hinder role enactments (Jazvac-Martek, 2009) points to the need for graduate programs to intentionally design structures, policies, and practices that expand opportunities for early research development, mentoring, pedagogical development, and community building. Ultimately, attending to graduate students’ role identities provides valuable insights into how we might better support their growth within mathematics departments and the broader academic profession.

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