

Why do they stay? An exploratory analysis of identities and commitment factors associated with teaching retention in high-need school contexts

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Abstract

While the literature cites a number of examples for why STEM teachers leave high-need school (HNS) contexts, there are fewer studies that address why teachers stay. Through the examination of STEM teacher participants who accepted a scholarship to teach in HNSs, we sought to understand the aspects of their identities and social experiences that supported their commitment. Using a qualitative methodology and thematic analysis, we found teachers to enact researcher and social justice advocate identities that were supported by familial relationships with administrators, colleagues, and students. These factors support teachers not just to remain but to flourish amid highly demanding contexts.

Keywords: High-need school, teacher retention, science teacher, math teacher, social justice

Across the United States, there is disproportionate funding to public schools, leading to inequitable access to highly qualified teachers and rigorous curricula for students who are non-white and economically disadvantaged (Ingersoll & May, 2012). It has been well documented that underfunded and disadvantaged schools have difficulty recruiting and retaining teachers (Boyd et al., 2004; Boyd et al., 2011; Nguyen, 2021). These school contexts will be coined high-need schools throughout this manuscript and abbreviated as HNSs (Robert Noyce Teacher Scholarship Program Solicitation, 2020). Teacher attrition data indicate that teachers leave HNSs for a variety of reasons that include negative perceptions and assumptions about students within these schools and their behaviors (Tajalli & Garba, 2014; Thomas-Alexander & Harper, 2017), poor working conditions (Geiger & Pivovarov, 2018), administrative and teacher turnover (Tran & Dou, 2019), and high workload (Bettini et al., 2018). Substantially less research has captured why highly-qualified teachers may choose to enter and stay within these contexts.

The retention challenge for HNSs is even greater for critical shortage teaching areas, such as science and mathematics disciplines (Walker, 2019); individuals with preparation and training in these fields often acknowledge their ability to earn a high salary, have options and choice in the location and type of schools, and select courses that they are willing to teach (Jacob, 2007; McConnell, 2017; Monk, 2007). Science and mathematics teachers who enter HNSs often stay for less than three years and then transfer to schools with access to more resources and professional opportunities that serve students from higher socioeconomic backgrounds (Ingersoll, 2003; McConnell, 2017; Whipp & Geronime, 2017). While the literature cites a number of examples for why STEM teachers leave HNS contexts (Ingersoll & May, 2012), there are fewer studies that address why teachers stay.

This study extends the knowledge base on teacher retention by providing the experiences and perspectives of nine science and mathematics teachers who accepted the Robert Noyce Teacher Scholarship that financially supported their preparation to teach in a HNS. This scholarship program carries the stipulation that participants will teach within a high-need district for at least two years after graduation. Given that the scholarship's acceptance somewhat obligates teachers to commit to a HNS, we sought to learn from program alumni who chose to teach in a HNS and remained there past the repayment obligation stipulated in the scholarship. From an equity lens, we believe that it is critical to contribute to the work on how to identify teachers who are capable, persistent, and committed to justice for underserved populations.

Research Question

Our overarching research question guiding this study is: Why do Noyce scholars continue to teach in HNSs past their years of obligation to the scholarship? This question was delineated into two sub-questions: a) What pre-existing experiences and factors drew them into the role of teaching STEM in a HNS; b) What aspects of scholar's identities and social experiences in HNSs have supported their commitment and persistence in the field?

Literature Review

Through this literature review, we acknowledge that considering the converse of teacher attrition factors does not fully encompass the complex picture of why teachers choose to stay in HNSs (Ingersoll & May, 2012). Thus, we drew from theoretical and empirical findings in peer-reviewed studies on teacher education, in-service professional development, school social networks, and family and community engagement to conceptualize factors that solidified teachers' commitment.

Prior Experiences and Motivation to Consider High-need Schools

An individual's motivation to pursue and continue teaching STEM in a HNS is shaped by their lived experiences as a learner and teacher. Boyd et al. (2004) suggest that teachers may be drawn to contexts and communities to which they identify and are a part of, such as their hometown, and serve the next generation of learners as a mentor and teacher. Positive and negative experiences as a learner in STEM classrooms also shape teachers' motivation to develop strong relationships with students and make STEM accessible for diverse learners (Bulunuz & Jarrett, 2010). In a case study analysis of six STEM teacher candidates in a Noyce program, Author (2019) found that individuals who had experiences working in marginalized communities and viewed access to education as an issue of equity developed strong competence and commitment to teaching in a HNS. Teacher certification programs have been found to influence teachers' preparedness to navigate common challenges faced as a first year teacher, supporting their retention in the profession (Redding & Smith, 2016). Specifically, coursework in issues of educational equity and clinical experiences with HNS contexts (e.g., rural, suburban, and urban) developed their culturally responsive pedagogy and combatted their predetermined stereotypes of students, staff, and working climate (Moore, 2008; Sleeter, 2001). Further, teacher candidates reported that mastery experiences and mentorship from a highly-qualified mentor teacher were well-positioned to accept a teaching position in a similar context (Author, 2019; Ronfeldt, 2012).

Professional Identity and Teacher Retention

Teachers' concept of self changes over time, and with the support of peers, student affirmation, and professional learning experiences, teachers may grow from teacher novice to

teacher leader, one who is competent and confident in enacting systemic change (Ballantyne & Zhukov, 2017; Vaughn & Saul, 2013). A teacher's identity may influence their retention to persist and personally and professionally grow in high poverty schools (Beijaard et al., 2004; Olitsky et al., 2019). Scholars found successful teachers in HNSs to adapt content and pedagogy to meet the needs of and relevance to learners, actively seeking feedback and data to improve their instruction (Agarwal et al., 2010; Richter et al., 2019). For teachers who author identities of social justice (Boylan & Woolsey, 2015), professional validation hinges their critical analysis of culturally responsive pedagogy, trusting relationships, respect, empathy, and improving opportunities for marginalized students (Boylan, & Woolsey, 2015; Milner & Tenore, 2010; Schauer, 2018; Towers & Maguire, 2017; Vaughn & Saul, 2013). Moreover, persistent and successful teachers in HNSs are acutely aware of the similarities and differences between themselves and their students (Milner & Tenore, 2010), yet see their students as family and advocate for them inside and outside the classroom walls (Boucher, 2016). As the needs of students may be more significant in high poverty schools, researchers have identified that STEM teachers who have been retained in these schools derive a deep sense of personal gratification from their contribution as a STEM teacher to their communities (Freedman & Appleman, 2009; Goodpaster et al., 2018; Simon & Johnson, 2015; Sleeter, 2001). As teachers develop complex identities in HNS, they begin to see themselves as more than great teachers, but action researchers, leaders of justice in these spaces, and catalysts of systemic school-wide change (Boylan, & Woolsey, 2015; Vaughn & Saul, 2013).

The Role of Supportive Networks in Teacher Retention

Scholars have noted that healthy school culture and a collegial climate, as indicated by high levels of trust and community, are correlated with increased teacher retention (Miller &

Youngs, 2021; Simon & Johnson, 2015). Career decisions are frequently linked to social working conditions and teachers lean upon the deep and robust relationships with colleagues, developing a sense of family with them (Guarino et al., 2006; Miller & Youngs, 2021; Milner & Tenore, 2010, Nguyen, 2021). Administrative support is an essential part of teachers' efficacy and connectedness to their school, as administrators are uniquely positioned to impact teacher retention through their leadership and the development of school culture (Nguyen, 2021). Teachers look to their administrators for fairness and pedagogical guidance (Simon & Johnson, 2015) and actively seek support and validation from school leaders (Johnson & Birkeland, 2003; Soini et al., 2010). Kirchhoff & Lawrenz (2011) found that STEM teachers in HNSs who had strong administrative and colleague support at their schools could adapt to challenging situations and maintain positive perspectives. Despite the challenges of rural and urban high poverty schools, teachers have been found to persist within them by aligning their values with those of the school and community and using moments of struggle to deepen their relationships with students, colleagues, and administrators (Ballantyne & Zhukov, 2017; Day & Hong, 2016; Vaughn & Saul, 2013; Wray & Richmond, 2018).

Research Design

We used a qualitative research design and thematic analysis (Lincoln & Guba, 1985) to explore identity factors of participants and characteristics of the school environments that supported Noyce alumni scholars to continue teaching in HNSs. Participants were purposefully selected from a larger survey of 93 alumni scholars. In this survey, teachers were asked to detail their teaching careers comprehensively, from the year of matriculation from the Noyce program to the present. Sixty-seven alumni responded to this survey, and ten teachers who responded to the survey had been teaching in a HNS for more than two years, past their service obligation to

the grant. The first author, who is the Noyce project manager, and student recruiter for the Noyce project, cross-checked these ten survey responses with reports from our external evaluators over the past 12 years, that described where alumni scholars were currently teaching. When compared to evaluation reports, the survey accurately captured 100% of Noyce scholars (n=10) who remained in HNSs. The first author requested interviews from all ten alumni and received voluntary consent from nine individuals, who served as the focus of our analysis.

Participants

The nine participants of this study completed the Noyce Scholars program with a Master's Degree in Secondary Science or Mathematics Education between (2010-2016) and had a range of experiences teaching in HNSs, between [5 and 11 years]. Table 1 illustrates the demographics and experiences of our participants. All of our participants identified themselves as White (W) or Asian (A). All participants experienced similar 16 month preparation through the Noyce program. This included foundational coursework in educational equity issues, teaching methods, and guided field experiences with a cooperating teacher in a HNS. Specific to our Noyce program, scholars were compensated for participating in informal internships with students over the summer, attending local and national professional development conferences related to mathematics and science teaching, and visiting diverse HNS contexts where they reflect upon their interactions with teachers and students.

Table 1

Teacher Participants, Demographics, and Teaching Experience in HNSs

Pseudonyms	Gender	Race	Primary role(s)	Year in HNS	School context(s) taught
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Jake	M	W	High school science teacher and middle school math teacher	6	1 urban HNS in home city
Mark	M	W	High school science teacher, Leader	11	1 urban HNS in home city
Kristin	F	W	High school science teacher, volleyball & softball coach	8	1 rural HNS, in hometown
Eileen	F	W	High school science teacher, leader, field hockey coach	6	1 alternative HNS, in hometown
Kimberly	F	W	High school science teacher, field hockey coach	5	1 urban HNS
Riley	F	W	High school science teacher, Team Leader	6	Moved between 3 urban HNSs within the same district depending on where she was needed
Sasha	F	A	Middle school science teacher, Team leader	5	1 urban HNS
Scarlett	F	W	High school science teacher, leader, softball coach	7	1 suburban HNS
Olivia	F	W	High school math teacher, leader, cheerleading coach	7	Moved between three HNSs, two suburban, and one rural

Data Collection and Analysis

The primary data source used in this study was a semi-structured interview of participants who persisted in teaching STEM in a secondary HNS; we sought to allow opportunities for scholars to share stories and clarify how they internalized experiences related to their unique

contexts (Brinkmann & Kvale, 2015). We offered a broad range of open-ended questions that might allow them to share how they handle challenges, how they measure success, and what external supports and resources have shaped their sense of commitment. The interview was designed chronologically; the first section of the interview explored participants' early experiences to establish what drew them to teaching and working in a high-need setting. The next section explored how scholars characterized the experiences that bolstered their teaching identities in their schools and how they described success in their role as they navigated challenging factors well-documented in the literature on HNS contexts. The final section of the interview elicited the future commitments of our participants.

The first and second author conducted the interviews, each author conducting half of them. The first author had no prior interactions with any of the participants. The second author has been a co-investigator of the Noyce program for six years, and had advised and formally taught Kimberly and Sasha. To reduce interview bias, the first author interviewed Kimberly and Sasha, as well as Eileen, Olivia, and Riley. The second author interviewed Jake, Mark, Kristin, and Scarlett. We conducted and transcribed nine interviews via Zoom (approximately 1 hour each). Permissions were obtained from each participant to record the interview. Following the interviews, Zoom generated transcripts. Each author cleaned the transcripts of interviews that they did not conduct, allowing both authors to hear all interviews in their entirety.

It is important to note that both authors have experiences teaching STEM in HNSs. Thus, guided by our experiences and the review of the literature, we applied descriptive codes that spanned all the interview sections, that included *prior experiences and motivations, teaching roles, passions, successes, challenges, support systems, and commitment* (Corbin & Strauss, 2014). The authors individually coded the same transcripts weekly, and met closely thereafter to

compare codes. Our first round of coding generated 409 unique codes across the nine interview transcripts. These codes were discussed, fine-tuned, and collapsed into 54 codes that represented teachers' lived experiences and contextual factors that connected them to their career. Frequency analysis of these codes revealed that the most prevalent codes (i.e. coded for in at least 10 instances across all interviews) included *reason for retention, success measure, challenge, primary role, support factor, building relationships, teacher as scientist/researcher, essential identity, validation by self and others, ability to flourish in challenging circumstances, evolving perspective, and teacher preparation experiences*. Through constant discussion and peer debriefing, we engaged in the process of visually representing how the codes related to each other. From here, we delineated major themes across categories that forged connections between scholars' lived experiences, teaching identities, and ability to thrive or flourish in challenging circumstances (Miles & Huberman, 1994). We substantiated themes and axial codes with rich quotes found in our participants' stories (Creswell & Creswell, 2017). For example, one major theme we identified was that an essential part of teachers' identity was being a researcher. Our participants operationalize this teacher researcher identity as being *iterative in their practice, identifying problems, seeking out and implementing knowledge gained from professional learning experiences, applying feedback from peers and students, and adapting instruction or behavior management techniques*.

Results

Early Experiences and Preparation

The alumni Noyce scholars identified early experiences and interests that supported their desire to accept a teaching position in a HNS. We found that eight of our teachers shared a deep passion for their content that had been fostered by supportive experiences with a high school

teacher or college instructor. Noyce alumni felt passionate about engaging students in their content and creating science classrooms that K-12 students would remember. For example, Kimberly, a sixth-year Biology teacher in an urban school, reflected on her K-12 experiences:

Honestly, when I was in high school, I didn't really like science because I didn't really like my teachers. Once I got to college, my professors were amazing. . . I was like, why is this not in the secondary [i.e., high school] world?"

From their experiences as students themselves, our scholars specifically described teachers' memorable dispositions and "relationships that they built with students inside and outside of the classroom."

Five of our nine participants personally identified with being a student in a HNS or living within an underserved community. They held a connection and loyalty to students in similar communities and desired to provide meaningful learning experiences. For example, Kristin, a 9th-year science teacher, knew she "wanted to go back home, and work with those kids [she grew up with]." While Olivia, a 7th-year math teacher, did not want to go home, she desired to teach in a similar context and "help" students to realize their potential. Olivia selected a position within a rural HNS, because it was similar to the school that she attended with limited resources. She hoped to help similar students see their potential, expressing that here:

I care about that type of student- the student who doesn't necessarily have the easiest educational path, but still pushes through, that still makes it through, that still sees the value in education. I'm trying to help students realize that in themselves.

All nine of our scholars also cited the influence of teacher preparation and their Noyce programmatic experiences in shaping their attention to equity, social justice, and preparedness to teach in HNS contexts. Jake recalled a pivotal moment in one of his educational courses that

solidified his trajectory to seek out a job in a nearby city that had been steeped in a history of segregation.

I read in our Philosophical Foundations of Education course a book called *Five Miles Away a World Apart*, which looked at TJ versus Freeman in one of the [local urban school district]. . . It's something I hadn't thought about a lot. . . about inequity at that level before. That book made me feel called to [local urban city].

Specific to the Noyce program, scholars visited diverse HNS contexts that “really opened their eyes to what they can look like” and “got rid of some misconceptions.” Some scholars pointed to mentor teachers who supported them through student teaching in a HNS and motivated them to choose a similar career path.

I had a wonderful cooperating teacher . . . My student teaching experience is very similar to where I teach now . . . To me, the best thing to do to help you teach in high-need is to practice in a high-need setting. [Kimberly]

In summary, our participants identified that early experiences with engaging content, science teachers who modeled strong relationships with students, and teacher preparation experiences that developed their awareness, interest, and competence to teach in HNSs played a role in their pathway to pursue initial jobs within these contexts.

Teacher as Researcher Identity

We found all nine participants to embody a *teacher as researcher* identity, who iteratively refined their commitments to the profession, pedagogical content knowledge, and ability to navigate school and community norms. The notion of personal growth was prominently evidenced by how teachers described their professional identity as a teacher in a HNS. For example, two seventh-year teachers described their HNS as places in which they “grow every

year.” Jake, a high school teacher with multiple preparations in math and science classes, argued that students within his urban HNS provide him with an opportunity to refine his approach to teaching in learning continuously. He explains this through the following quote:

Teachers in high-need settings become good teachers faster because they have to. You have to be a good teacher because the kids won't learn without you being good at your job. ... Staying in that setting is the perfect place to develop better practices.

While the teachers' growth was regularly assessed by administrators, all nine participants emphasized their own critical assessments of their work. Our scholars detailed how they enjoyed reforming their instruction and how they used a research-based mindset to develop observable hypotheses in their classrooms, try new strategies, and change their course based on the outcomes and needs of students. For example, Jake uses his scientific approach of analyzing his instruction, and claimed, “I think that my classes and lessons have gone from pretty bad to very good. I think it comes with a willingness to reform constantly.”

We found that seven of our teachers opened themselves up to constructive and critical feedback from their students while managing their pride and maintaining positive perspectives. Eleventh-year science teacher Mark shared that he “listens to colleagues and students”, and candidly states: “I try not to over inflate my own sense of self-importance. . . [and] understand my role within the greater scheme of things.” Seventh-year math teacher Olivia reflected upon how data collected from her students shapes her practice:

I do an exit survey every year. I asked the kids to be honest with me. I take the constructive criticisms and the feedback that I get from my students to heart. It definitely hurts my feelings a little bit, but once I was able to separate myself from it, I was like, these kids actually have a lot of really good points.

All nine teacher participants sought opportunities to grow in their teaching competence and practice by participating in a myriad of professional development opportunities that included advancing their learning on equity and social justice, pedagogical content knowledge, authentic learning, data analysis, exceptional students, and leadership. Our participants expanded their pedagogical content knowledge by often adding additional science disciplinary and mathematics endorsements (e.g., Riley and John), and pursuing National Board Certification (Scarlett).

Our findings indicate these teachers who persist in HNSs beyond their Noyce obligation have a teaching identity aligned to a *teacher as researcher*. They approach their work as researchers would, with the intent to learn, improve, and measure the success of their specifically designed interventions. They take this ongoing iterative approach with their penchant for formal professional development, their desire for feedback from their students on their strategies for building relationships, and their fascination with their content and context.

Teacher as Advocate for Social Justice

Our participants demonstrated advocacy for social justice within their classrooms, schools, and educational system. All nine teachers positioned themselves to support and advocate for students in multiple spaces and roles inside and outside of school, including coaching sports, sponsoring clubs, leading extracurricular activities, and serving as mentors and social justice role models for colleagues. Often, they did this by building relationships with students based on honesty, trust, and vulnerability. Scarlett shared that her students see her true self every day. She goes further to explain, “I think that the vulnerability that comes with that allows them to be able to establish relationships with me so that we can move through all of this stuff together.”

Teachers Scarlett and Olivia identified their classrooms as places that provided “safety,” “comfort,” “a quiet place,” and a “place to open up.” Eileen, a sixth-year science teacher, shared,

“We have to be not only a teacher, we have to be a friend, a therapist, a parent... that’s what I love the most is the relationship... the connection piece that is available.” Teachers successfully advocated for their students, even to the point of changing the school’s curriculum offerings to add elective courses for their students. For example, Kristin diligently advocated for her school to add an oceanography class to prepare students for careers immediately after high school; she noted many of her students will “work on the water”. Our teachers shared sentiments that teaching in HNSs was an “opportunity” and a “privilege” to “watch students grow and explore,” and “guide them in a positive direction.”

Our teachers illustrated their commitment to professional learning and growth in their understanding of equity and social justice. Sixth-year science teacher Eileen took classes toward certification as a teacher for equity and social justice and hoped to bring this knowledge to her colleagues. She reflected on her coursework: “Teaching is a political act. Many people think, as teachers, we’re supposed to be neutral. Being neutral is a political statement because we’re perpetuating current systems.” Kimberly provided another example of a desire to support her students with disabilities. She evidences an understanding of her role in this advocacy when stating, “I feel I need to educate myself in order to help those students a little bit more... because the students are obviously just as deserving as other students.”

There were exceptional cases where our participants expressed that their relationships with their students surpassed teaching, respect, and advocacy. In these critical moments, teachers stood in solidarity with their students and shared stories of deep emotional attachment to them. Olivia served as a cheerleading coach and recalled when a student did not have anyone to drive her home after an event. Laden with emotion, Olivia recalls waiting with her student late into the night until she decided to drive her home. She recounts this story here:

I remember [my student] getting emotional halfway on the drive back to her house because she said the prior year she had gotten stuck at the high school one night because the coach hadn't taken her. She didn't know the way [home] in the dark. She didn't feel comfortable walking, so she just sat on the steps of the high school until morning and then walked home. That broke my heart because I would never leave a kid.

Our teachers shared reflections and actions that demonstrated their growth and commitment to educating students in the name of social justice. These teachers believe that their students need their ethic of care, their students deserve their teaching expertise, and that their students have their utmost respect. They often demonstrated this identity through critical moments of solidarity, long-term commitments to their respective schools, and advocacy for their students' needs.

Community Network

Eight of the nine teachers highlighted their interdependence on their colleagues for professional mentoring and emotional support, as they named them their “closest friends,” “family,” “people who looked out for each other,” and cited them often as the reason they stay in their specific HNS. Mark captured this sentiment most profoundly when stating,

As long as I can keep this group of colleagues with me, at least the majority of them, I'll keep on doing this forever. I really appreciate how rare it is to find yourself in a group of people that you really enjoy working with who also are very good at what they do. . . I don't think that I would give that up for anything.

For many, these relationships extended to their administrators. Eight of the nine teachers narrated respect for their administrators' organizational management and vision for the school,

valued their trust and confidence, and looked to them for opportunities to grow professionally as leaders within their school and district. Kimberly explained:

Once I made that relationship with my department head, I felt everything shifted because I knew she was on my side. I knew she had good ideas to help me. She would be there whenever I needed her. Honestly, that is what's kept me at [school name], are the relationships that I've made with my coworkers or now my administrators.

Scarlett offered gratitude and respect towards her administrator for his validation and constructive feedback. She recalled a recent observation that her principal did of her teaching. Following the observation, the principal shared detailed data and suggestions for improvement to Scarlett. She noted her appreciation for this feedback, as it made her aware of specific actions that she could take to improve her teaching craft.

Most notably, though, were seven of the nine teachers' stories and perceptions of their full integration with students and families in the community. For teachers like Kristin, she wanted to "go back home" and "be with friends and family." Several teachers bought homes in the community where they taught; Mark shared, "I really wanted to ingrain myself more in this community. I felt really strongly about teaching in the city that I was living in." Teachers assumed roles that gave them notoriety and respect with students and parents outside of the walls of their science and mathematics classrooms. Five of our teachers shared that they also coached one or more sports. The teachers characterized relationships with students outside of their classrooms as ones which "fill that part of what [they] want from [their] life, and how [they] want to make their mark on this planet," and solidifies their commitments to continue working within their context. Kimberly, for example, began coaching junior varsity field hockey in her

first year in her urban high school. She reflects on her role as coach and integration to the school community:

I'm connected to the students at the school with coaching . . . It brings me closer to my community because I'm reaching out to other field hockey programs close to us . . . That connection to the field hockey team makes me a better teacher within my building because I do have that connection. . . It's one other thing, other than teaching, that makes me want to stay.

The relationships teachers develop in extra-curricular roles create familial “loyalty,” where our teachers can not imagine disappointing their students. When asked why she continues to teach in her current school, Scarlett explained:

[I have a] weird loyalty that I hold on to, part of my personality that I don't want to leave. . . Because even as I was thinking about [leaving] and going to another school in our district, I was like ‘what am I going to say to all my softball girls?’ What am I going to say to all those kids who are going to expect to see me next year? That started to get at me.

In stark contrast to all of our other alumni, Riley had been moved involuntarily through three HNSs in her first five years of teaching, at times split teaching between two HNSs. She reflected that she was “good at starting over” but conveyed a need for the rich community our other alumni had found. She explained:

One area I would like to grow in is staying in one place for more than two years and developing more long-term relationships, professional working relationships with colleagues, and then watching students go through all four grades. The most I've ever seen is I've had students two years in a row, sometimes, in chemistry, then in physics.

Through Riley's contrasting narrative, it became clear that the supportive community she sought to "place roots down" is ultimately essential for her to stay within her HNS. In its absence, Riley instead found her essential community network outside of her school(s) building, within the broader district. While she maintained a passion for her students, she ultimately lacked the interdependence, professional mentoring, and emotional support from colleagues within her school building that might have otherwise anchored her to her specific high poverty school setting, as it had for our other alumni. Riley shares that she recently submitted applications for an administrative endorsement and hopes to develop her leadership skills more fully in curriculum design.

Our teachers' commitment to their schools is derived from their relationships with the community inside and outside of teaching. They looked to their colleagues and leadership team as support networks and respected their guidance and mentorship. Teachers saw themselves as valuable assets to students in coaching relationships and extended themselves to be mentors to novice teachers and teacher candidates. Their school is an integral part of the community in which they live, and their interactions with members of this community solidify commitments to teaching.

Ability to Flourish

Our scholars confronted issues that make working in HNSs challenging, including navigating an overwhelming workload, enduring organizational politics, establishing positive classroom climates, and standing in solidarity with students, colleagues, and their community through trauma. As our scholars reflect upon their challenges, we find they universally narrate stories of hopefulness, growth, and an ability to flourish or persist with grace.

The teachers spend an immense amount of time dedicated to their work. Eight of the nine scholars are acutely aware of this challenge, and as Mark admits that even after ten years of teaching, “I work hard. I’m still one of the first people at the school every morning and one of the last people to leave.” As participants reflected on their work-life balance, there were moments where they compared themselves to their colleagues in non-HNSs and questioned their “ability to say no” to assume more roles and responsibilities in their context. Sasha states:

I sometimes think it would be nice maybe if we didn't have to be working from 7 am until 10 pm Sundays and calling parents for four hours after school because their students were not really doing what they needed to be doing or managing all these different behaviors in the way that we are.

Yet, all teachers pointed to their students as reasons for being drawn back into their work.

Because their schools are often difficult to staff, our scholars persist in their high-need settings while preparing and teaching several different classes during the same semester. There was a noticeable absence of complaint as they each shared what they teach. For example, Scarlett shared that she would be teaching sections of Biology, advanced placement and honors-level chemistry, and an anatomy and physiology course next school year. Riley worked between two different high school buildings across town. Administrative turnover presented challenges and political tensions in five of the nine participants’ schools. In these instances, our participants evidenced their ability to be thoughtful, empathize with the challenges administrators face, and form collegial alliances that allowed them to flourish. Mark recalled a frustrating experience after which he needed to find a way to renegotiate his commitment to his school:

Not quite seeing eye to eye with administrative teams, both building level and central division level is always really challenging for me. . .I think what has always gotten me

over those issues is being able to vent to a few trusted colleagues and then use their feedback... to bring my focus back to what's really important and what is within my circle of influence.

Again, scholars drew upon their familial networks with colleagues to overcome challenges and gain perspectives of situations.

One pedagogical challenge that all nine scholars discussed was specific to establishing positive classroom climates with students and navigating confrontational instances with parents. Our findings indicate that scholars like Jake, Eileen, and Riley quickly learned to recognize their responsibility for cultivating stronger relationships with their students. For example, these teachers had experiences where students did not like them or were not behaving well. They described taking ownership of these situations and reconsidering their relationship-building approaches with individual students. Jake demonstrated his responsibility and iterative approach to classroom management while reflecting on a time that he invited a friend from the military to speak to his class that had challenged his confidence to manage the classroom effectively:

[My friend] shows up in military fatigues, military boots. He looked really intimidating. The kids are just silent and polite ... It really checked my narrative. It's really easy early on to think, oh, these kids are bad. ... Seeing them, how night and day they were by having this dude in a military uniform in the classroom, how they were perfect. [I realized] I need to have the ability to get the same response out of them because they were happier that day. In a controlled classroom, the kids are happier and honestly more creative and better thinkers. It was an important realization because if the narrative is that the kids are rude and stupid and bad, then that's an unfixable narrative. The answer is to

get better kids and leave the district. I think that was an early glimpse into the reality that the problem wasn't the kids. The problem was me.

Jake draws upon his desire for growth and researcher identity to improve his strategies for cultivating a positive classroom climate. These moments of challenge, instead of driving our teachers away, gave them perspective. Riley thoughtfully shared, “If you're persistent, you are positive, you keep reaching out, [students] usually come back to you, and you can work something out.”

All nine scholars also recognized that their students learn most effectively when a secure, supportive relationship is established between them. Classroom management in high-need contexts has its share of challenges, but our scholars flourish in these settings by taking the time to effectively build relationships with their students so that their minds can be open to the learning that needs to occur. Olivia believes that her time spent on relationship building has strongly contributed to the successes of her students and herself. She thoughtfully sums up this sentiment in the following:

If I didn't have those relationships, if I didn't work really hard in building those, ... on getting to know my kids, ... what's important to them, remembering that there's one who plays basketball, this one's in volleyball. If I didn't take all of those things into account, I wouldn't have the respect that I have in the room. If you don't have respect, the kids aren't going to listen to you. ... If I didn't have relationships with my students, there's no way anyone would pay attention in math class because it's math. 90% of my students are literally in that class because they needed to graduate.

Four of the nine scholars shared accounts of working in communities that experience tragic loss. Teachers were faced with losing students to violence and drew upon familial

relationships with students and colleagues to move forward in grief. They approach these times with care, concern, and a firm student-centeredness manifested in sensitivity and flexibility. Olivia shared her ability to persevere while experiencing grief with her school community, recognizing her importance to embody stability and support for her students:

I recognize that there are things that you can't always change. My second year I had a cheerleader die in an accidental shooting. That completely wrecked my entire squad. It wrecked the whole school. I had a conversation with her 24 hours before she died. She had torn her Achilles, had had surgery, had finally caught up all of her grades. She was passing every single class. She said, 'I definitely think college is an option for me now. Coach, you'd be proud of me.' . . . Then the next day, she was gone. Those are definitely things that can break you as a teacher. I think that those are also the things that have pushed me to stay as a teacher in a high-need school because those kids need the support. They need stability. They need someone who cares.

These teachers stand in solidarity with their students and lean on administrators and colleagues, whom they call family, through the most challenging times, allowing those experiences to reaffirm their commitment to their students and profession.

Success and Validation

Our scholars measured their successes and obtained validation through various feedback from administrators, colleagues, students, standardized test scores, various awards of recognition, and invitations to leadership positions. Mark illustrated earlier that he uses multiple data points to determine his success level and describes how he knows he is successful:

I mean I can't lie. . . as evil in some ways as the [standardized] tests are, it was so validating that for the first two years in a row, every single one of my kids passed the middle school science [test]. It really made me feel I was doing a good job. . . I have really, really good relationships with my students. . . At the end of the day, whenever I give satisfaction surveys, the results are always extremely positive. Most of my student teachers have done really well in their placements beyond my classroom. That gives me the sense that the strategies that I am giving them are having a positive impact outside of my classroom. Then, I listen to feedback from my colleagues and my peers, which is almost always positive.

Most saliently, eight of the nine scholars relied on their students' validation to fuel their purpose and commitment to teaching. Teachers used "satisfaction surveys" and activities such as "a letter to my future self" to understand how students view their experiences. Olivia describes how she uses feedback to renew her purpose and her commitment to teaching in high-need settings here:

I have a box of all of the cards and letters that I've gotten from any of my students over the past six years. If I ever get to a point where I feel I'm getting a little bit closer to, "why am I doing this?" and being frustrated, I sit down and read those letters. Because those are, that's why I do this. This is why I became a teacher. This is why I will continue to be a teacher.

At times our scholars interpreted success from unsolicited positive interactions with their past students "who still come back", and who show teachers like Kimberly that "they're going to go out into the world and do really amazing things."

While feedback from all sources is essential, eight of the nine scholars found the administrators' feedback unique and meaningful, whether publicly or privately. Scarlett describes an informal remark from her administrator at a faculty meeting which she remembers fondly:

My principal said, 'I think I see [Scarlett] at literally every school event that we have.

The fact that she's committed to being part of the school and the community speaks worlds about what her classroom is like.' That was one way of knowing [I am successful] or being recognized.

Our scholars set out to make a difference in their students' lives, and one way they accomplish this is by increasing students' competence in STEM. They see the effect that passing the standardized assessments have on student confidence, and so they strive to lift their students to achieve these heights. Kristin describes the transformation she has experienced with some of her students:

You know, seeing that joy. That pure joy on their face when they're like, I hate science.

I'm not good at it. Then maybe by the end of the year, they pass that [benchmark test].

They're like, wow, maybe I can do this. Seeing that growth, seeing them, year after year, come back and say wow, you know this was a great class.

Our research also shows that while "unnecessary," our scholars found recognition in the form of awards validating. They work hard and hold themselves to high standards for their students' benefit, their school family, and they are proud to have their efforts and successes acknowledged. Mark reflects on his awards:

A couple of years ago, I think it was 2018; I achieved National Board Certification. That same year, I received an Award for Excellence in Teaching. Those two are the primary

things in the recent past. In my third year of teaching, I was in the top 10 teachers for [city] public schools. That was a big deal.

Despite our scholars' work being driven by a more profound sense of purpose and commitment, we found that all nine of our scholars enjoyed the recognition of their contributions to their community and that these expressions of recognition were significant. In the absence of validation, teachers can find themselves unsure of their impact, unsure if they are achieving living out their values, which are central to their work in HNSs. Eileen was candid in her response to the question, "How do you know you're actually successful?" She replied:

Oh, I don't. ... historically, our goal has been to get our kids to graduation. We have done that in a way that I do not think is helpful for our students. We found that when they graduate, they are still incarcerated, they are still dying, and they are still unemployed. As hard as we tried, we did not see success... It's complicated. I don't know that I'm ever successful.

Eileen provided a sharply contrasting narrative of success as a classroom teacher, which may have affected her shifting vision for her career. Her lack of success, in her mind, in her role as a classroom teacher, paired with her deep passion for connecting with students, may have opened her mind to possibly being more successful in making a difference in the lives of students from the role of administrator. She explained:

I'm very interested in being in a high-need school. I don't necessarily know how much longer I will be teaching. I love being with students connecting with them... I like that connection, and I like helping them learn... I am moving towards a path of getting my administrative certificate in leadership. I'm really trying to be intentional about making sure that that path does not take me away from the work that I love. That's working with

students, helping teachers be better prepared to teach in a high-need setting. Those two things are really exciting to me... Does that mean that I'm going to be an administrator in a high-need school? That would be great. I do wish to remain in a high need setting.

When not through formal awards or informal experiences with students and colleagues, eight of the nine scholars were recognized through invitations to leadership positions, which validates their identity as a professional. These leadership positions deepen their roots in their specific high-need context, deepening their commitment to teaching as well. Frequently these leadership roles position our scholars to share their developing expertise with others and collaborate with professionals in their buildings and districts. Riley, for example, consistently worked with district administrators to revise physics curricula and assessments. This recognition validates our scholars and provides them another avenue to make a difference in students' lives. Sasha reflects on the many hats she gladly wears in support of her students and school community:

I get to guide our science department as the lead science teacher. ... Another thing that I really enjoy doing is leading the school improvement committee.... the opportunity to present different sessions and be a mentor, be nominated for those leadership roles in order to help others learn those same skills, or learn what I've been able to implement that was successful. I think that's an important recognition and one I appreciate because I can then share what's been successful for me with others so they can achieve that same success.

Feedback is central to these teachers' professional growth, for both refining their practice and affirming what it is they are doing that works.

Discussion

A teacher's identity is formed and continually shaped by their experiences and context, including those before they were teachers (Ballantyne & Zhukov, 2017; Beijaard et al., 2004; Boyd et al., 2004). Our alumni had experiences in their formative years, which predisposed them to develop their teacher identities into the social justice advocate (Boylan & Woolsey, 2015), the teacher-researcher (Richter et al., 2019), and flourishing teacher. These formative experiences varied greatly among our participants but are all pre-preparation experiences related to their development of resilience, iterative growth and development, and concern for equity (Ballantyne & Zhukov, 2017; Schauer, 2018). During their teacher preparation programming, these alumni further strengthened their identities leading them to choose to teach in HNSs, often driven by their social justice advocacy (Boylan & Woolsey, 2015) and buffered or supported by their iterative or investigative natures and their ability to flourish (Ballantyne & Zhukov, 2017).

Once in their respective HNS, most of our alumni began to experience success and validation and build their community network. They were validated through various feedback forms on their successes, made possible through their strong preparation and prior life experiences (Nguyen, 2021). While there were (and likely still are) challenging aspects of their roles, those experiences served as social cement for our teachers, deepening their community networks to the level of "family" and "closest friends" (Miller & Youngs, 2021). This climate of support and validation drives our social justice advocates and teacher-researchers to continue learning and growing in service to their school family (Nguyen, 2021; Richter et al., 2019). They actively seek out new learning and professional development, which, in turn, leads to their success and position within their school and community family (Rzejak et al., 2014; Schauer, 2018).

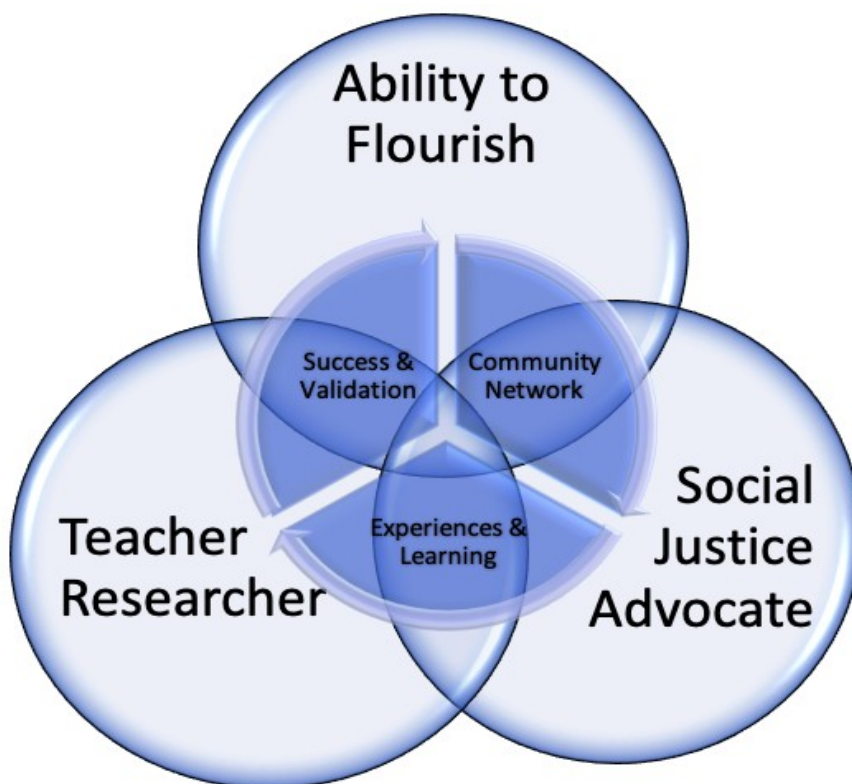
Our model's internal and contextual factors found in Figure 1 are the experiences and context necessary for the development and sustaining of the combined identities of teacher-researcher, social justice advocate, and the ability to flourish (Ballantyne & Zhukov, 2017; Boylan & Woolsey, 2015). The interplay of these factors and identities within a specific HNS represents an initial exploratory model of STEM teachers who maintain their commitment. Both Riley and Eileen provide narratives illustrating the breakdown of the model from different vantage points. Riley involuntarily uprooted quite often, lacked the depth of the community network within her school building. Despite all other factors and identities intact, Riley considers leaving the classroom to serve students in HNSs from the district level through her passion for curriculum and assessment. It is likely possible she sees potential for a stable community network from that role (Kraft et al., 2016; Miller & Youngs, 2021). Eileen perceived a lack of clearly defined and evident success, perhaps lacks sufficient validation of her work in her role as a classroom teacher. Despite all other factors and identities intact, Eileen is considering leaving the classroom to serve students in HNSs from the role of administrator. It could be possible that she sees an opportunity to have a greater impact and more success from that role.

A STEM teacher who stays committed to teaching in HNSs possesses three identities or aspects of identities displayed in the large outer bubbles, each related to or shaped by the contextual factors and experiences of these teachers in the inner wheel. For our scholars, the teacher-researcher identity is most likely influenced by direct learning (knowledge acquisition), experiences, successes, and validations (Richter et al., 2019). The presence of a strong community network provides indirect support for that identity element to develop. The social justice identity is most likely influenced by direct learning (knowledge acquisition), experiences, and a deep familial community network (Boylan & Woolsey, 2015). Further, the validation and

success perceived by our teachers provide peripheral support for that identity to be enacted (Boylan & Woolsey, 2015; Nguyen, 2021). Finally, the ability to flourish is most likely influenced by the successes, validations, and a strong community network (Day & Hong, 2016; Miller & Youngs, 2021); whereas, the teachers' learning (knowledge acquisition) and experiences indirectly support teachers' persistence and resilience within their context (Ballantyne & Zhukov, 2017; Clara, 2017).

Figure 1

Factors Influencing Retention for Teachers in High-needs School Contexts



Conclusions and Implications

It is often the case that science and mathematics teachers who move into HNSs remain for less than three years (Ingersoll, 2003; McConnell, 2017; Whipp & Geronime, 2017). Our research suggests that the combined identities of the teacher as researcher and teacher for social

justice are sustained by familial relationships with administrators, colleagues, and students, allowing our scholars to flourish in their HNS settings. In response, state and district educational policy makers could examine systemic approaches for facilitating community networks that foster validation, support, and retention of STEM teachers. The findings from this study suggest a need for administrators to consider that either a perceived lack of success or a perceived lack of an in-building community network can lead exceptional teachers to seek alternative other avenues to make a difference in their communities.

Policymakers at the state, district, and school levels can address STEM teacher retention in HNSs in a few ways. First, despite it being labor-intensive, schools and districts could consider implementing an information-rich, decentralized interview process which Liu and Johnson (2006) hypothesized to be effective in making suitable matches between teachers and schools. These findings also suggest a need for early-career mentoring and induction support, to hamper turnover (Ronfeldt & McQueen, 2017). Mentor teachers with expertise in related subjects, common collaborative instructional planning time, and support from outside the school or district positively relate to teacher retention (Smith & Ingersoll, 2004). Second, the combined identities of the teacher as researcher and teacher for social justice can be leveraged within teacher-selected professional development opportunities with vital support from leaders of HNS, forefronting the fulfilling work that teachers are committed to. This can be implemented by engaging teachers in equity-focused issues and supporting them to ideate and implement effective solutions (teacher as researcher) in their pursuit of justice (teacher as social justice advocate). Third, building administrators looking to increase STEM teacher retention in their HNS may find it helpful to focus on building a supportive community among their faculty and defining and celebrating successes with each teacher. Building and fostering trust, respect, and

care among and between teachers and administrators could create an environment where teachers not just remain but flourish amid highly demanding and challenging contexts.

Our findings also have implications for teacher educators. Preparation programs should include opportunities for undergraduate and graduate students to develop their professional identities as researchers, social justice advocates, and ability to flourish. This may include engaging teacher candidates in professional development, engaging in iterative action research, practicing culturally responsive approaches, and navigating scenarios of political and student-related challenges. In addition, our findings indicate that these teachers' identity and experiences shaped their commitment to teaching STEM, and teaching within a HNS. These same identities and experiences led them to science or math disciplines and shaped their approach to teaching and curriculum reform (Drake, 2006). The teachers in the study who experienced success within their classroom described their experiences positively, exhibiting efficacy in their pedagogical content knowledge (Drake et al., 2001). Our teachers' instances of successful teaching and learning fostered their desire to continue evolving their practice and enact their teacher-researcher identities. Teacher preparation programs could consider using the teacher-researcher approach to scaffold building understanding and thoughtfully designing instructional strategies for students within HNSs.

Our nine participants' stories present a counter-narrative to the often deficit portrayal of teachers, students, and working conditions in HNSs. In fact, for our scholars, these contexts were grounds for personal and professional growth in teaching and advocacy, shaping who they are and whom they hope to become. We recognize that this study relied upon first-person accounts of teachers' experiences and had little direct knowledge of teachers' working climate. However, our findings provide exploratory evidence of the association between HNS science and math

teachers' identity and context and their commitment to stay in that teaching position. We see potential for future research to explore how identities and contexts shaped our other alumni scholar's decisions to leave the profession and how this compares to those here who stayed.

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