Beyond Traditional Teacher Preparation: Value-add Experiences for Preservice Secondary Mathematics Teachers

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Received: 4 April 2020 Accepted: 21 August 2020

The current pool of highly qualified secondary mathematics teachers is woefully inadequate to address the needs of schools across the United States and other countries internationally. In STEM (Science, Technology, Engineering, Mathematics) areas, providing quality instruction in a changing world requires continuous change and innovation as programs prepare and train teachers. University teacher preparation programs wrestle with ways to provide wider professional experiences (WPE) within social learning environments called communities of practice (CoP). This qualitative study examines a university-led undergraduate scholarship program, aimed at recruiting, training, and retaining highly qualified secondary preservice mathematics teacher candidates. With increased exposure to mathematics content, mathematical teaching pedagogy, and community outreach beyond traditional preparation requirements, the goal of the study is to determine the immediate and potential value participants, undergraduate students, found engaging in a unique, CoP-based program. Findings reveal that participants concurrently reported both immediate and potential value in teaching experiences and ideas even when engaging in more mathematics or indirect teaching environments. Further, while mentoring is a key feature of the program, participants rarely identified mentoring or faculty support as an immediate or potential value although mentors were often the conduit for participants' engagement in WPE.

Keywords: teacher preparation · Mathematics education · communities of practice · value

Introduction

In recent decades, schools across the United States (U.S.) have experienced serious teacher shortages where districts are faced with the inability to fill positions with highly qualified teachers (Papay, Bacher-Hicks, Page, & Marinell, 2017)—particularly in mathematics and science classrooms (Feng & Sass, 2017). Similarly, the New South Wales Department of Education (2015) cites a consistent shortage of mathematics teachers compared to the current needs of schools as does the European Union (E.U.) (Eurydice, 2015). As a result, schools are left filling positions with inexperienced or underqualified teachers, increasing class sizes, and/or limiting class offerings (Ingersoll & Perda, 2010; Sutcher, Darling-Hammond, & Carver-Thomas, 2016). A variety of factors are potentially to blame for this current situation. Evidence shows that key contributors of the teacher shortage are: a) the decline in teacher preparation enrolments, b) a decline in secondary school enrolment in higher mathematics courses, c) an effort to return to pre-recession course offerings and class sizes, d) increasing student enrolment, and e) high teacher attrition. To address the decline in teacher preparation enrolments, programs in the U.S. and internationally are examining ways to not only attract undergraduates interested in STEM (Science, Technology, Engineering, and Mathematics) areas and teaching, but also prepare them to be well qualified contributors in high-demand fields like mathematics (Community Research and Development Information Service, 2015; Eurydice, 2015; Sutcher et al., 2016). For example, the National Science Foundation (NSF) offers millions in grant dollars annually through the Robert Noyce Teacher Scholarship program—one of these funded grants is highlighted in this article.

It is important to note that recruiting future mathematics teachers means taking a careful look at the mathematics experiences of current K-12 students. Despite the demand for a growing STEM workforce, according to the Programme for International Student Assessment (PISA, 2018), only 2.4% of students from countries participating in the Organisation for Economic Co-Operation and Development (2018) scored at the highest level of mathematics proficiency. Recruiting future mathematics teachers from an already depleted field of students who may be discouraged by mathematics requires changing the narrative—and experiences— around what it means to be a mathematics teacher.

Within the last decade, the National Council of Teachers of Mathematics (NCTM) further clarified eight characteristics of "effective" mathematics teaching and learning practices to increase K-12 student achievement (2014). Along with these practices, highly qualified teachers are expected to collaborate with one another on instructional issues and to provide high-quality, engaging learning experiences for all students (NCTM, 2018). University teacher preparation programs and mathematics departments are called to collaborate in order to develop preservice teachers who not only understand current research-informed instructional practices and have strong mathematics content knowledge, but also have first-hand experiences learning, teaching, and collaborating in student- centred environments (Chubb, 2012; Conference Board of Mathematical Sciences, 2016). In today's high stakes classrooms, school districts cannot wait for novice teachers to learn on the job. Teacher candidates need to be equipped with the knowledge, skills, and dispositions for teaching diverse students (Association of Mathematics Teacher Educators [AMTE], 2017; Australian Association of Mathematics Teachers [AAMT], 2006) so they can be successful in their first years of teaching and ultimately, remain in the field.

One possible avenue for structuring the development and improvement of preservice mathematics teacher preparation is through the formation of a community of practice (CoP). Similar to professional learning communities (PLC), or school-level structures for teacher collaboration within a common departments or grade-levels, universities have leveraged communities for decades to support undergraduate students on their degree path. Lenning and Ebbers (1999) cite a number of benefits for undergraduate students participating in learning communities, including improved grade point averages (GPAs), higher retention in college, and greater satisfaction with their institution and educational experiences. With research to support the use of communities to prepare high-quality, student-centred teachers (e.g., Van Zoest & Bohl, 2005), there is still more to learn about how undergraduate students engage within these communities and what they find immediately valuable as preservice teachers and potentially valuable as future mathematics educators.

This study is situated at a large, metropolitan university in the Midwestern United States, and examines a novel, preservice Noyce teacher scholarship program. Our NSF Noyce program provides undergraduate students with a dual mathematics-secondary education degree pathway while also engaging them in a CoP to develop their capacity as future teachers and potential teacher leaders. The main goal of this program is to strengthen and expand the pipeline for preparing preservice mathematics teachers to better meet the demands of local school districts, particularly in high need schools. Interns and Scholars are recruited out of both the mathematics and teacher education programs at the university, and selected based on their interests in STEM, teaching, GPA (Grade Point Average), and financial need. Interns and Scholars participate in a variety of personal and professional development activities to meet required scholarship/intern hours (e.g., mentoring, outreach, teaching assistantships). In this study, we aim to better understand preservice teachers' value perceptions as participants in the Noyce program, now and in the future to tailor our programs to prepare well-rounded teacher candidates who both possess content and pedagogical knowledge, but also a wealth of WPEs to prepare and retain them in the field of teaching. This work highlights the voices of undergraduate STEM students to inform the mathematics education field of programmatic components that students find most valuable in their ongoing development and career trajectories.

Literature Review

Mathematics Education

Mathematics education has been under a spotlight for decades. Simply put, teachers are teaching, but the majority of students—especially students of colour and those living in poverty— are not achieving based on standardised test measures in the U.S. This problem is especially evident at the secondary school level. Over 60% of graduates require non-credit, developmental mathematics coursework in college. Historically, only 20% of these students have gone on to graduate (Rutschow, Diamond, & Serna-Wallender, 2017). Internationally, mathematics educational researchers describe a core goal of mathematics education as "…meeting the needs of *all* students," highlighting the need to address equity issues in mathematics teaching and learning (English & Kirshner, 2016). Other nations have also seen challenges in recent years. Australian student enrolment in mathematics and science classes during year 12 has gone down proportionally (Chubb, 2012), and in 2009, the European Union (E.U.) developed a benchmark for basic mathematical skills in response to concerns about lagging student achievement on international surveys (European Commission, 2011).

A variety of factors must be considered, and stakeholders engaged to better serve all students in mathematics (Chubb, 2012; NCTM, 2018; Stiff & Johnson, 2011). Further, with a depleted pool of students exiting secondary schools with the mathematical skills deemed college and career ready, we face challenges in recruiting and retaining future STEM teachers and professionals interested and qualified to meet 21st century needs. Mathematics education leaders at the international level have advocated for a shift in *what* students need to know mathematically and *how* they demonstrate understanding. A range of international reports (AAMT, 2006; Eurydice, 2015; Kilpatrick, Swafford, & Findell, 2001; NCTM 2000; 2014) advocate for a shift in preK-12 mathematics from focusing on rote memorization of tasks and procedures to promoting a balance with conceptual understanding. Although the Trends International Mathematics and Science Study (TIMSS) highlights the international use of teaching practices such as relating mathematics to everyday life, problem based learning, and active learning and critical thinking, memorization is still cited as a commonly used (albeit less frequently than the others) approach (Eurydice, 2015). In more recent years, the development of the content standards (e.g., Common Core State Standards for Mathematics) provide teachers with rigorous guidelines to implement these mathematics concepts and practices. As a result, many teachers are being required to teach in ways that are often very different from how they may have learned or previously taught mathematics.

In 2014, the National Council of Teachers of Mathematics (NCTM) published *Principles to Actions,* which identifies eight research-based instructional practices, that when implemented in positive learning environments, can increase student achievement. The practices provide a framework for the look and feel of mathematics teaching and learning and includes a more balanced perspective on procedural fluency and conceptual understanding (NCTM, 2014). With a more clearly defined vision for mathematics research and practice framing how we prepare and support teachers, attention continues to focus on how best practices in mathematics education translate into common practice in K-12 schools across various settings.

Mathematics Teacher Preparation

The instructional shifts in K-12 mathematics education have caused a ripple effect in teacher preparation programs. The Association of Mathematics Teachers Educators (AMTE, 2017) identify five standards for effective programs preparing beginning mathematics teachers. They include opportunities to learn both mathematics content and pedagogy, opportunities to learn to teach mathematics, opportunities to learn in clinical settings, establishment of partnerships, and intentional efforts to recruit and retain teacher candidates.

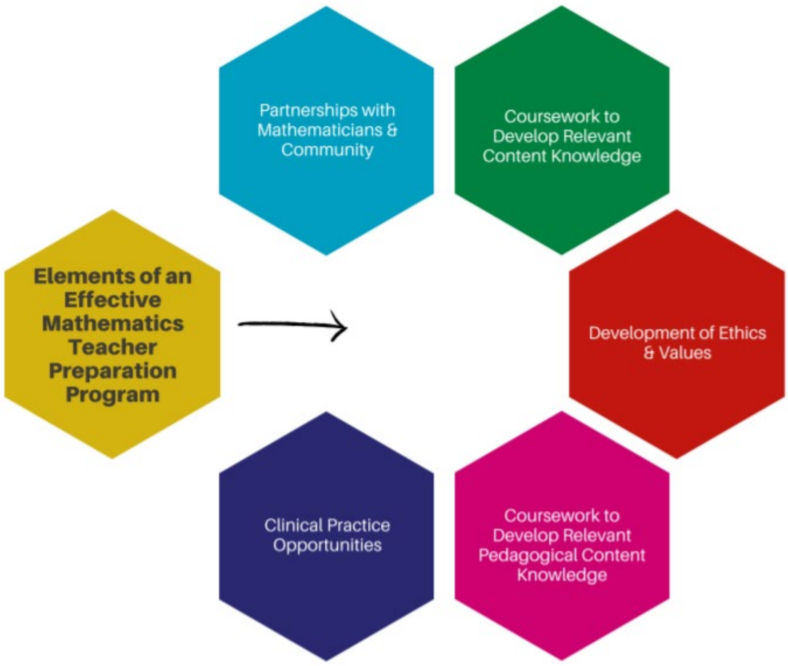

Figure 1. Elements of Effective Mathematics Programs (Adapted from AMTE, 2017).

The AMTE standards mirror those of other international counterparts, such as the Australian Institute for Teaching and School Leadership (AITSL), which developed Australian Professional Standards for Teachers (2011) that focus on three domains: Professional knowledge, Professional Practice, and Professional Engagement. These domains encompass similar goals as the AMTE standards and seek to unify the elements of teacher preparation that are needed to meet the call for improved student achievement for all learners.

A plethora of research supports that while mathematical content knowledge is the centre of learning to teach mathematics, it is not sufficient to ensure effective teaching (AMTE, 2017; Ball, Thames, & Phelps, 2008; Hill, Rowan, & Ball, 2005; Shulman, 1986). Along with strong mathematical content knowledge below, at, and above the expected levels preservice teachers will likely teach (Hodge, Gerberry, Moss, & Staples, 2010) preservice teachers need to understand appropriate instructional strategies specific to mathematics content (e.g., Ball et al., 2008; Shulman, 1987). Further, teachers who receive less pedagogical training are more likely to leave teaching—especially in mathematics and science (Ingersoll, Merrill, & May, 2012). Along with undergraduate teaching preparation to ensure teachers are ready day one countries like Finland, Singapore, Australia and Canada also have well-structured systems in place to support ongoing learning and opportunities for teacher advancement in their educational careers (Darling-Hammond et al., 2017).

Teachers often replicate teaching practices they experienced as learners, such as traditional teacher-centred lecture, or using multiple examples with minimal student interaction (Darling-Hammond, 2006; Feiman-Nemser, 1983; Lortie, 1975; Olseon & Hora, 2014). Therefore, research recommends that preservice teachers experience learning mathematics within instructional frameworks similar to those in which they are expected to teach (Ferrini-Mundy & Findell, 2001; Sowder, 2007). There remains a need for secondary mathematics teacher preparation programs to explicitly model teaching methodologies and provide access to relevant experiences where preservice teachers can develop effective instructional knowledge and skills (Cochran-Smith & Villegas, 2016).

Field and wider-professional experiences

Access to quality field experiences is another key element of preservice teacher preparation. These hands-on experiences allow preservice teachers to implement mathematical and teaching practices with K-16 students and peers where they are able to reflect about the process of mathematical and pedagogical meaning-making as they translate their understanding to their own practice (Rieger, Radcliffe, & Doepker, 2013). On campus, this requires opportunities for preservice teachers to participate in active learning classrooms (Shieh, Chang, & Tang, 2010), moving away from passive learning habits, especially in STEM coursework. During field experience placements, there must be "significantly more—and more deliberate—opportunities for novices to practice the interactive work of instruction" (Ball & Forzani, 2009, p. 503). This allows preservice teachers the opportunity to apply previous learning from coursework to practice.

Many teacher preparation programs also include community-based learning to help preservice teachers learn how to access the community, learn about the community's assets, and make connections with key stakeholders (e.g., Noel, 2006; Sleeter, 2018). Coined "wider professional experiences" (WPE), these wide-ranging field experiences in settings other than schools and classrooms, in combination with critical reflection, are found to support preservice teachers' preparedness to work within school communities and with children (Darling-Hammond & Bransford, 2005). Through these WPE, preservice teachers learn to navigate the network of educators and community influences that will impact their role as a teacher (Sleeter, 2018). Additional interactions with educational and mathematics stakeholders and students allows preservice teachers opportunities to gain valuable insight into the world around them and how students think and what they find confusing, interesting, or motivating (Ball et al., 2008).

Mentoring

Along with field experiences and WPE, preservice teacher mentoring is another program component to help students understand the complexity of teaching, both in general and specific to mathematics teaching and learning. For example, in working with K-16 students and with the guidance of mentor teachers and course instructors, preservice teachers are able to recognise the need for mathematical concepts to be unpacked for both conceptual and procedural understanding (Adler & Davis, 2006; Ball & Bass, 2003). This requires not only the ability to explain mathematical concepts using multiple representations, but also leveraging a number of instructional tools necessary based on the teacher's mathematics pedagogical knowledge (Ball et al., 2008). It also includes preservice teachers' ability to press students to clarify and extend their reasoning, resulting in deeper conceptual understanding (Franke, Turrou, & Webb, 2011). However, preservice teachers are traditionally trained to focus on students' errors and misconceptions in order to correct them (Jilk, 2016) rather than engaging students in deeper thinking. With a call for increased critical thinking and multiple solution pathways in secondary mathematics, preservice teachers need to engage in critical conversations about how real classroom settings and student needs. These reflective opportunities allow preservice teachers to plan for their role in leading mathematical discussions, modeling, and technology integration, to name a few (NCTM, 2018).

To support reflection and ongoing learning, strong faculty mentoring is a proven practice in teacher education programs, especially for STEM students' success (Marshall, McGee, McLaren, & Veal, 2011). Mentored teachers are more likely to translate their undergraduate learning to future practice through the reflective process with their peers and knowledgeable faculty. Mentoring also allows undergraduate students to holistically interpret their experiences and how they might be impactful for their future personal and professional lives (Meyers & Arnold, 2016). However, creating space and time for faculty-student conversations in teacher education can be challenging. Mentoring interactions must be intentional and meet both the professional and the personal needs of the undergraduate students (Jacobi, 1991; Murdock, Stripanovic, & Lucas, 2013) where they are able to reflect on their role in student success.

Reflective practice

Reflection through personal introspection, writing, and conversations, helps undergraduate students believe they have the power and capability to be successful (Mascle, 2013). In self-reflection, such as journaling, students are able to mentally and emotionally engage with recent experiences (Kolb, 1984; Proudman, 1992). Further, self-reflection is a "valuable learning tool that could enhance student's performance, attitudes, and self-efficacy" (Leggette et al., 2012, p. 3). With the support of a knowledgeable mentor and/or supportive peer, reflective opportunities have the ability to concurrently reveal and enhance students' knowledge (Oakes, Franke, Quartz, & Rogers, 2002) and prepare preservice teachers to think systematically about their practice in order to learn from experience (National Board of Professional Teaching Standards, 2016).

Theoretical and Conceptual Frameworks

We frame this article to a large extent around the concept of communities of practice (CoP). CoP are groups of people who share common learning goals and collaborate to find ways to improve their practice through regular interactions (Wenger, 1998). Within this definition, three key components emerge: domain (a shared concern/interest/goal), community (regular interaction), and practice (learning how to do the domain better). In CoP, people share their understandings concerning "what they are doing and what that means in their lives and for their communities" (Lave & Wenger 1991, p. 98). Particularly, STEM related CoP are found to increase teachers' a) understanding of mathematics and science content, b) use of research-based teaching methods, and c) ability to engage learners using diverse modalities (National Commission on Teaching America's Future, 2011). Similarly, a meta-analysis of research around learning communities across all levels and subjects of schooling found that they build shared values and goals, create collective responsibility, include self-directed reflection in stable settings, and provide strong leadership support (National Commission on Teaching and America's Future, 2011).

Due to the ongoing and complex nature of our work with undergraduate students, we used situated learning theory (Lave & Wenger, 1991; Wenger, 1998) as the theoretical perspective of this study. Lave and Wenger's (1991) situated theory of learning anticipates the expansive meaning of learning when "learning" is considered an innate element of social participation in a group or organization. Learning is not considered to solely occur in a teacher/pupil environment where understanding is gained through transfer—rather, situated learning theory positions learning as a process of moving "toward full participation in the sociocultural practices of a community" (Lave & Wenger, 1991, p. 29). Traditionally, learning is associated with "schooling," however situated learning theory links learning more synonymously with the term "meaning-making" (Lave & Wenger, 1991). Further, learning is considered a dynamic process that is influenced by and influences the individuals, structures, and understandings of a community or network as they interact. Engaged individuals not only learn within a community, but they reshape the social organisation of a community with their membership (Lave & Wenger, 1991; Wenger, 1998; Wenger, Trayner, & De Laat, 2011).

Social learning environments involve a variety of complex contexts that have reoccurring cycles of interaction. Within this program, undergraduate students engage and collaborate numerous times throughout each week in formally organised program activities and through other coursework or social gatherings. To understand the social learning that emerges within these types of dynamic communities, we ground our research in Wenger, Trayner, and De Laat's Value Framework (2011) defining cycles of value creation—which flow from "immediate value" to "transformative value" (see Figure 2).

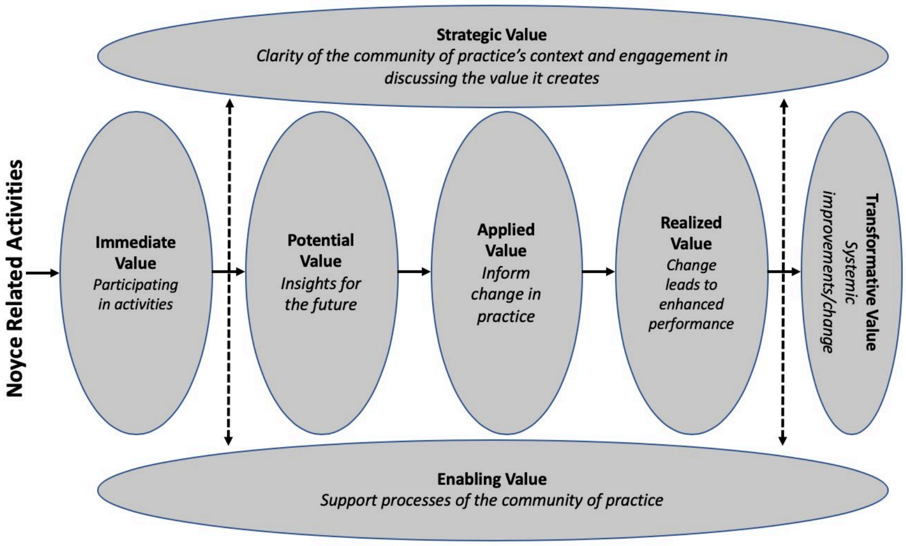

Figure 2. Seven Types of Value, adapted from Wenger-Trayner and Wenger-Trayner (2014) with permission.

The authors note that, "while there are causal relationships between the various cycles, it is important not to assume a hierarchy of levels or a simple causal chain" (p. 21). Instead, learning in communities is understood to be "a dynamic process in which producing and applying knowledge are tightly intertwined and often indistinguishable" (p. 21). Furthermore, one cycle does not necessarily lead to the next and the importance of the various cycles will differ for different stakeholders. The types of value created within the CoP are supported (or challenged) by contextual value factors that can be categorised as "strategic value" and "enabling value". They add another layer of complexity to understand how participants find value within a community. Thus, this value framework is designed to interrogate various types and sources of data to develop a compelling picture of how a community provides value to participants. In this study, the community of interest consists of undergraduate students interested in secondary mathematics education participating with faculty, peers, and the educational community within a university scholarship program.

Part of the goal of our Noyce Scholarship program is to develop a sense of community for undergraduate students, as well as to provide them with extended experiences beyond those of the traditional teacher preparation programs. Ultimately, we hope to recruit and retain a more diverse pool of mathematics teacher candidates to serve in high needs schools The value framework is an important tool to help us not only understand which program components are most impactful on participants' learning, but also track over time how students' values shift or evolve through participation.

Methodology

Methods

This study examines the immediate and potential value participants revealed through their experiences as Noyce Interns and Scholars during the 2018-2019 school year. Merriam describes the role of qualitative research as "...understanding how people interpret their experiences, how they construct their worlds and what meaning they attribute to their experiences" (2009, p. 5). Understanding how participants communicate value (or lack thereof) in their Noyce experiences involves collecting rich, descriptive data (Yin, 2018) and uncovering unanticipated concepts of value from our participants (Charmaz, 2008). Qualitative research lends itself to applied research environments like this where it is possible to investigate site-specific conditions to inform and potentially make recommendations to the field (McEwan & McEwan, 2003) and effect change (Merriam & Tisdell, 2016).

Participants completed weekly online journal reflections for 15 weeks each semester as a part of their required hours in the Noyce program. Participants were asked to respond to the same open-ended prompts, providing them opportunities to detail descriptions of their experiences and self-perceived value of these experiences. The consistency of online journaling afforded us the opportunity to examine each participant's reflections over the course of multiple semesters as well as to examine multiple participants' responses across a single week. This section outlines study participants, the online journal prompts, and the methods of qualitative data analysis we used to examine participant reflections and emerging patterns.

Research Context and Participants

This study is situated at a large, Midwestern urban university in the U.S. Participants for the Noyce internship and scholarship program are recruited at the start of each autumn and spring semester during the five-year grant funding period, beginning in Autumn 2014. In the program, "Interns" are defined as undergraduate students, typically first and second year students, who have a potential interest in STEM and STEM education. Internships are intended to be a pipeline for students who develop an interest in mathematics education to apply for a scholarship in the first and second years of their undergraduate program. "Scholars" are defined as third and fourth year (upper-level) undergraduate students who complete a dual degree program through the mathematics and teacher education department. Both Scholars and Interns are paired and collaborate with a faculty mentors strategically selected to support individual students based on a variety of factors (e.g., interests, background). Mentors help Scholars and Interns set goals and organise their individualised activity plans. For example, they can serve as learning assistants in mathematics courses or conduct research with their mentor. The participants also self-select to engage in a range of mathematics and teaching activities weekly to meet programmatic requirements. These activities include events hosted on campus, as well as in local K-12 schools and STEM community. Participants report in weekly in face to face meetings with their mentors as well as through written reflections what they are doing and what they are learning about mathematics and/or teaching through these activities. Upon graduating, Scholars commit to teaching in a high needs secondary school for two years per year of program participation.

This study includes participants from the Autumn 2018, Spring 2019, and Autumn 2019 participant pool. A total of 16 Interns and 10 Scholars across the three semesters participated in writing reflections. It is important to note that participants were not necessarily the same from semester to semester during data collection, but there was also overlap. Due to the structure of the program, some participants engaged for multiple semesters, and even transitioned from internships to scholarships. As a part of their internship or scholarship contract, all participants agreed to complete weekly journals for their personal reflection and to be used for program research and evaluation. Additionally, all participants and faculty mentors are given pseudonyms to protect the anonymity of their responses for reporting purposes. Participant responses do not impact students' eligibility or standing in the Noyce program. Total participation for each semester highlighted in this study is illustrated in Table 1.

Table 1
Summary of Participants' Demographic Data

Semester	Number of Noyce Interns		Number of Noyce Scholars	
Autumn 2018	Male = 4	Age 17-25 = 8	Male = 1	Age 17-25 = 4
	Female = 5	Age 26-35 = 1	Female = 4	Age 26-35 = 0
	Total n = 9		Total n = 5	Age 36+ = 1
Spring 2019	Male = 3	Age 17-25 = 9	Male = 3	Age 17-25 = 4
	Female = 6	Age 26-35 = 0	Female = 2	Age 26-35 = 1
	Total n = 9		Total n = 5	
Autumn 2019	Male = 2	Age 17-25 = 5	Male = 2	Age 17-25 = 4
	Female = 3	Age 26-35 = 0	Female = 3	Age 26-35 = 1
	Total n = 5		Total n = 5	

Instrumentation

To develop preservice teachers as effective future teachers, research indicates that more structured and intentional opportunities for reflection need to be built into teacher preparation programs (Rieger et al., 2013). Over the course of three, 15-week academic semesters, a total of 38 Scholars and Interns completed weekly journal reflections. Also included in the data set are a Spring 2019 and Autumn 2019 end-of-semester reflection that Scholars completed (a total of ten final reflections). Initially, the journal prompts were more open ended in nature. Through the end of Spring 2019, the prompts were as follows:

"Noyce Scholars and Interns are to reflect on their experiences and hours dedicated to becoming better teachers and learners of mathematics. Please take time to genuinely reflect on what you have accomplished during your Noyce hours this past week.
Expectations of reflection:

1. Professionally written (complete sentences, punctuation, grammar, etc.). Also remember that all peers and faculty can see your posts. If you have sensitive topics/concerns, those should be discussed privately and in person with your faculty mentor.
2. Reflective- Include what you learned, questions you have, or implications for the future ALONG with the basic description of activities. All reflections should be in-depth and thoughtful.
3. Reflections are documented as complete or incomplete each week. Reflections should be completed for the week by each Sunday at midnight."

In Autumn 2019, the leadership team, comprised of mathematics and teacher education faculty members, re-evaluated the clarity of expectations for the journal reflections. Some reflections read more as a list of completed activities rather than a reflective narrative describing participant learning and experiences. The team revised the prompts (below) to more explicitly focus participant journaling on deeper reflection thinking about current and potential future implications:

1. *Briefly* describe one or more of your activities this week
2. What was something you learned or gained from your activities this week that is valuable to you:
    (a) as a CURRENT student? (Note: this could be related to school or your own personal life)
    (b) in your future work as a teacher/mathematician?
3. What do you wish would/could have gone better? How could your peers or Noyce faculty help support you in the future?
4. Other questions or comments

In addition to weekly journals, participants completed an end of semester reflection. The research team leveraged this additional data source as a means to triangulate findings during our analysis. The semester-end journal included the following prompts:

1. What is your 1-minute elevator speech [a synopsis that could be given in a brief amount of time, such as when riding an elevator together] about the Noyce program? How would you describe this program to an incoming freshman or what would you tell a family member if they asked "What have you been up to in college?"
2. What is your most memorable Noyce experience this past semester/year? Why do you think it stands out?
3. What is the best thing about the Noyce program?
4. What is something that you think would improve the Noyce program for students?
5. What is your ultimate goal or outcome you hope for yourself after being engaged with the Noyce Program?

Data Analysis Process

We utilised a value framework (Wenger et al., 2011; Wenger-Trayner & Wenger-Trayner, 2014) as an anchor to develop a priori parent codes for each of the five types of value within the value cycle. We used descriptive coding (Saldana, 2016) to develop the sub-codes for each of these parent codes, as our sub-codes focus on the “topic” not the “content” of the passages (Miles, Huberman, & Saldaña, 2014). We also cataloged contextual factors of value in terms of strategic and enabling value present through the structures of the Noyce scholarship program and activities. After reading a representative sample of journal entries, as well as participant activity logs, we developed nested sub-codes (Gibbs, 2007; Miles et al., 2014) to interrogate whether participants perceived value related to teaching, mathematics, understanding how students learn, etc. For example, to ensure validity, we identified seven immediate and six potential value nested sub-codes to ensure we were able to pinpoint unique perceptions from participants.

The resulting codebook captured illustrative examples of each parent and sub-code to improve the stability of subsequent coding (see Appendix A). For reliability, we coded all journal entries together, engaging in discussions to ensure codes were applied consistently throughout the analysis process. As we coded, we created analytic memos to catalog emerging patterns in the data that helped us “interpret how the individual components of the study weave together” (Saldaña, 2016, p. 48). We identified overarching themes using a constant comparison model to distinguish one theme from another to most accurately depict the experiences and perspectives of the participants (Corbin & Strauss, 2008).

For the purpose of this article, we narrowed our focus to examine only "Immediate Value" and "Potential Value" parent codes (see Figure 3). We coded very few instances of applied value and no instances of realised or transformative value in our data.

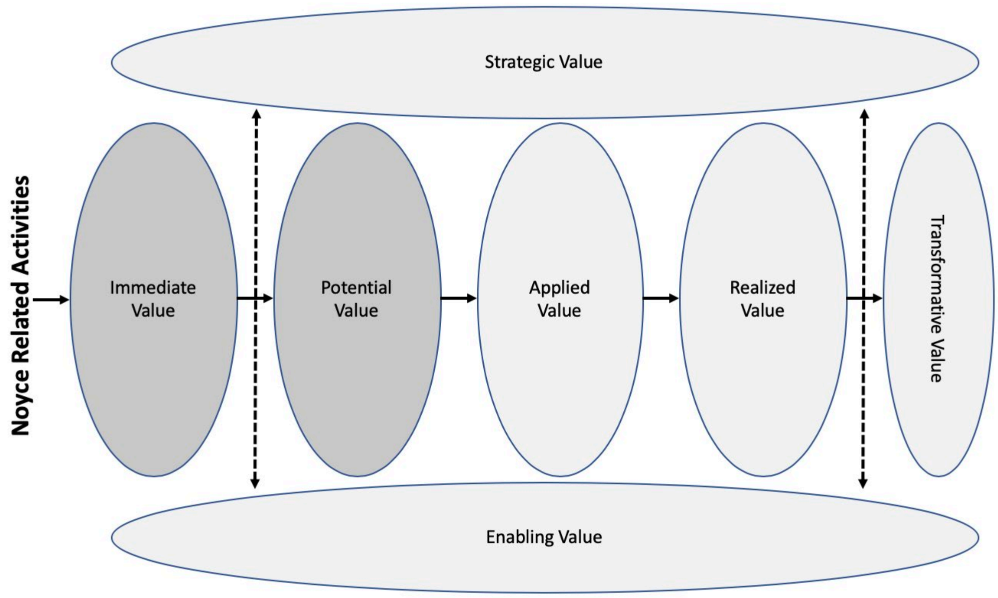

Figure 3. Examining the immediate and potential value of participating in a scholarship program.

We coded passages within the journal entries with the appropriate sub-code for value, and then dual coded (Miles et al., 2014) where appropriate when evidence of strategic and enabling supports were present that may have facilitated participants' sense of immediate or potential value in the activity. After coding and highlighting themes, we ran several matrix queries using NVivo software to examine the interactions between "immediate value" and "potential value" reported by participants, as well as the interactions between these value types and the underlying enabling and strategic contextual factors that were present in these interactions. We also ran coding queries to examine in further detail the extent to which program structures and faculty provided support structures to enhance the perceived immediate and potential value of program experiences for participants. We highlight several key findings in the following section.

Results

Where the Present Meets the Future

As we began our synthesis and analysis of data, we first focused on participants' perceptions of immediate and potential value separately. Through their Noyce program engagement, data revealed participants had novel teaching ideas, in general, and with respect to understanding learners and new ways of looking at mathematics through a teaching lens. Participants also connected with a unique group of peers and the broader community through opportunities often not accessible to the average preservice teacher candidate. While these sub-codes identified noteworthy data and insights as we continue to reflect about our program, the intersection of immediate and potential value parent codes, and their respective sub-codes, revealed immense density in a particular area.

Overall, the most saturated coding intersection occurred as participants simultaneously identified immediate and potential value from teaching activities. As they engaged in immediate teaching opportunities in a variety of settings, participants experienced novel teaching ideas with future implications. In many of these instances, participants shared how they learned vicariously from peers in similar roles:

> In being a TA [teaching assistant], I realize I have to really know every step to working out problems. When students asked for help during class, I often caught myself from just telling them the answer. I thought back to when [a former Scholar] was my TA in Calculus and how he really encouraged me to learn the steps and be more independent with Calculus. Therefore, I have to step back and let the students be more confident in their work. [Intern 1]

This Intern immediately understood the importance of having a deep understanding of mathematics procedurally and conceptually (Ball, et al., 2008; Schulman, 1986). The participant recognised the importance in assisting students by prompting ideas or strategies rather than merely telling them answers. The participant's recollection of her prior experiences taking Calculus also allowed her to see value in how she had been supported and how it might inform her future interactions with students in her current role in the program and also as a potential teacher.

As new participants enter the program, they often have the opportunity to select different activities to support their mathematics and teaching development. Along with serving as an undergraduate mathematics teaching assistant with their mentor, Interns and Scholars have the opportunity to tutor one-on-one with other undergraduate students. Participants often found value not only in these experiences, but also in observing and collaborating with other CoP peers:

> I also got to watch one of the Praxis [Initial Teacher Competency Mathematics Examination] tutoring sessions, and they seem like something I'd like to do when I have the time. I'm glad I watched instead of trying to teach because I got to see some different methods of helping a person reach the right answer, some that I may not have thought of had I just jumped right in. [Intern 2]

This reflection highlights the value participants placed on having a variety of ways to engage in the program to immediately reflect on how teaching mathematics goes beyond jumping in with the knowledge acquired. Similar to the comment above and similarly coded remarks, these experiences afforded participants the opportunity to see mathematics teaching and learning from a new lens (Sleeter, 2018). Rather than purely focusing on the mathematics content in the moment as a learner, they were able to view experiences with a broader lens, focusing on prior academic experiences and implications for future practice.

> I also helped out with [an outreach event] on Saturday...I worked the math puzzles table with [an Intern]… She was great with the kids and I feel like I picked up a few tricks from her while she was interacting with them. [Scholar 1]

Framed in an outreach event rather than a college classroom, experiences such as the one above provided participants the opportunity to interact with children. The undertones of this comment express that interacting with children was not always a natural skill for these dual mathematics and secondary education majors (Rieger et al., 2013). This Scholar, a non-traditional student with previous work in industry, expressed immediate value in not only seeing how children interact with mathematics, but also how educators interact with children.

> On Monday I spent the day with a former Scholar at her school. It was interesting to see a teacher's whole day from start to finish. Her school does block schedule so we had three classes (all geometry) and a plan period. I had planned on just observing for all three classes, but her first class of the day was very inquisitive, so I started walking around the room and helping students. It felt great to help students in a real school situation. I was surprised to see the differences between her three classes... I still wanted to interact with them so I just asked them questions about their lives and school work. Eventually a few of them opened up and started asking for help. [Scholar 1]

Along with outreach events, this Scholar, along with many others, had the opportunity to see teaching in practice in secondary school buildings. This participant identified immediate value in understanding how an average day of work might look in a school, from a teacher's perspective. Access to this classroom reveal how the structure of school days may not always mirror the prior experiences or expectations preservice teachers have about what school "looks like". For example, this participant noted the daily structure. Block scheduling is a series of different scheduling formats used in some secondary schools in the U.S. where, instead of students attending seven to nine 40- to 50-minute classes daily, class periods meet for longer periods of time (e.g. 90 or 120 minutes) and for fewer days of the week, for example. Along with the managerial functions and structures of teaching, the participant also found a way to integrate into the classroom to help "real" students and foster positive interactions. Lived experiences in the classroom allowed participants to further engage with the K-12 networks in their local community.

Whether working as a teaching assistant or tutor, serving at community outreach events, or observing in classrooms, participants found that not only were these experiences helpful in the moment, they simultaneously reflected on the future implications and value of their "wider professional experiences" (Darling-Hammond & Bransford, 2005). Within social learning environments like this community, vicarious learning, or "learning mediated through modeled attainment" (Bandura, 1997, p. 86), is an important source of students' belief in their own ability to accomplish a task—in this case, teach. Social comparisons provide a safe space for students to take risks and experience new opportunities without risk of failure. As preservice teachers, participants identified and made connections between present experiences and potentially useful insights to store away for the near future and beyond.

The Invisible Value of Faculty and Mentoring

In our initial queries into participants' immediate and potential value, we found little to no evidence that Interns and Scholars engaged in conversations with their mentors that led to participants having insights about potential teaching ideas. The same was true for participants engaging in teaching activities and making connections to their mentor. We coded only two instances of participants describing conversations with faculty members that resulted in them thinking about teaching in a new way. For example, one Intern wrote,

> I ended up making up for that with an extended meeting with Dr. Smith[1] over COBOL [Common Business-Oriented Language, a computing program]; we began final editing, and have made it about a quarter of the way through. Dr. Smith continues to find points that I hadn't considered when making the lessons, and it's continued to help me realize how much I should simplify and

[1] All names have been changed

> over-explain rather than under-explain and assume the people reading the lesson will understand. [Intern 2]

Participants rarely made direct comments about faculty members that were coded with any type of value. This was particularly true when examining our immediate and potential value categories. This was a surprising result, as faculty mentorship was a central component in the scholarship program, added and expanded upon throughout the five-year grant (Hodge, Gerberry, Moss, & Staples, 2019). As such, we anticipated participants would report on how these faculty connections helped them to build capacity and imagined they would find these interactions valuable.

This led to a follow up question regarding whether faculty mentors were in fact *not* having any influence on participants' perceived value, or if this value could be determined another way. In our second matrix query, we noticed that the strategic contextual factor of "required hours" had moderately strong interactions with both the "Immediate Value: Teaching Activity" code and the "Potential Value: Novel Teaching Idea" code. Noyce Interns and Scholars engaged in a number of ongoing activities with their mentors as part of their "required hours" for the program, sometimes working as learning assistants or tutors in their mentor's course, other times helping to organise events or develop resources with their mentor. The following provides an example of a participant finding immediate value in a teaching activity:

> I am still working in Dr. Adams' class as a learning assistant. I really enjoy working with the students and I find that it challenges me to be able to think on my feet. I continue to gain confidence in my calculus skills. I am also baffled by how easy it is for a student to look like they know the material when they really have no clue what is going on. It is challenging to identify those students and to make it a priority to engage them in the learning process. I am excited to learn more about how to do this. [Scholar 2]

Here, the Scholar expressed learning about things teachers do in the moment, such as being prepared to "think on your feet," and finding ways to effectively formatively assess student understanding during the lesson. The participant did not directly state that they found value in working with their mentor, but the mentor provided access to a mathematics teaching opportunity, affording the participant the chance to engage in a meaningful value creation interaction.

Despite the fact that participants often reported finding immediate or potential value engaging in teaching activities that were part of their required hours, they did not always attribute these experiences to the role that faculty mentors played in terms of providing pathways to these value-rich experiences. In other words, interactions with faculty mentors were not identified as the root cause of perceived value, even if they may have acted as "invisible" contextual support by promoting opportunities for value creation to exist.

Value in Teaching Through Mathematics-centred Activities

We were surprised by our first two findings, where the interaction between immediate and potential was much higher for teaching than mathematics activities. To better understand this, we ran coding queries that initially looked at all instances of immediate or potential value to compare the overall instances for each category. The counts suggest that participants substantially found more teaching than mathematical value in the activities they participated in, especially required activities. While many activities are directly mathematics-centred activities (e.g., teaching assistant in mathematics course, mathematics tutoring), there are also required and non-required activities that are not centred directly on mathematics such as outreach events focused on interdisciplinary STEM education activities (e.g., robotics, coding). As we investigated the relationships between teaching and mathematics value, we were interested in the context in which teaching and mathematical value surfaced and potentially why. Contextually, for required activities done regularly and often in conjunction with their mentor, immediate (21/23 instances) and potential (20/28 instances) value were found in mathematics-centred activities; however the mathematics was not the primary emphasis of student focus—the value mentioned by participants was on teaching instead.

One participant who worked as a learning assistant in an undergraduate mathematics course began to recognise that teaching mathematics requires more than just knowing mathematical content. In one reflection journal entry, Scholar 2 remarked, "As a teacher, I learned the importance of being very comfortable with the material to be the most equipped to help your students grasp it."

Other participants who engaged as learning assistants or mathematics tutors made similar comments, suggesting that while they were comfortable with their knowledge of the mathematics, they were finding teaching value because they were beginning to develop new knowledge sets, such as "Specialised Content Knowledge" and "Pedagogical Content Knowledge" (Ball et al., 2008). This was even true of Interns who had not yet taken any formal education courses or officially declared interest in pursuing an education major. The Intern below, had the opportunity to assist her mentor with a Mathematics for Elementary Teachers course in the Mathematics Department and stated:

> The main idea I got from the class is how students should know WHY they are doing something before we just teach them a rule and then it sticks with them for the rest of their lives without them understanding the why. It makes the lesson so much more meaningful when you know the way we learn the rule for example: when multiplying, we drop a 0; we also "carry the one". I think that this would carry with me throughout my possible career as a mathematician because this was really a valuable lesson!! [Intern 3]

Despite a lack of previous exposure to any traditional "teacher preparation" courses, this participant found value in learning that there are specific pedagogical aspects to teaching mathematics that teachers incorporate to make mathematics meaningful for learners (NCTM, 2014). Though a variety of activities were centred on mathematics directly, a substantial proportion of value surfaced about teaching and understanding learners.

Discussion and Future Directions

Preparing preservice teachers for their evolving roles in a changing, technological world is a complex task. With limited time to prepare and recruit future teachers, determining the most valuable experiences for students based on content, pedagogy, and understanding of learners is crucial to both formal teacher preparation and supporting programs. The purpose of this study was to examine the experiences of undergraduate students participating in a STEM pathway university program to become secondary mathematics teachers. Our goal specifically was to determine which aspects of the Intern and Scholarship program participants found most valuable using a value framework (Wenger et al., 2014) to inform not only our own program foci, but others' as well. In this paper, we focus on what undergraduate students self-reported as immediately or potentially valuable in terms of teaching, mathematics, and learning.

Our findings showed that program participants overwhelmingly found both immediate and potential value related to teaching in many of their engaged activities related to the program, even those not centred on teaching explicitly (Darling-Hammond & Bransford, 2005). These activities included formal teaching opportunities, such as being a learning assistant for an undergraduate mathematics course or tutoring program, as well as informal teaching opportunities, like hosting STEM events at the university or volunteering at community and local K-12 school STEM events. For many of the students, these experiences occurred prior to their formal field experiences and for Interns, before fully committing to a career as a STEM teacher. Through reflection, students revealed increased awareness of teaching and learning to inform the moment and also their future career choices and development Access to these expanded opportunities afford students an array of rich opportunities outside of typical clinical practice and field experiences to help develop this knowledge (AMTE, 2017). Providing students with diverse and hands-on opportunities where they can experience teaching and STEM environments early in their undergraduate careers through WPEs (Darling-Hammond & Bransford, 2005; Sleeter, 2018) has potential broader impacts in terms of affording different avenues to support preservice teacher recruitment and retention efforts.

Along with immediate and potential value in teaching, students also described “a-has" about the types of knowledge and planning that goes into successfully working with learners. They developed an awareness of the idea that explaining mathematical and STEM related concepts requires specialised content and pedagogical knowledge, as well as new knowledge about learners in terms of how to engage and anticipate developmentally-appropriate activities and explanations (Ball et al., 2008; Schulman, 1986). Regardless of setting or the field they ultimately pursue, providing undergraduate students with access to develop their communication and interpersonal skills are valued aspects of the general workforce and essential in educational contexts.

We anticipated that participants would find value in working with faculty mentors as a unique feature of our Noyce Scholarship program. Over the past five years, we have made tremendous revisions to the mentoring structure and pairings based on research and practice (Hodge, et al., 2019). Revisions include purposeful faculty-student pairings, goal setting, and more recently, the development of a mentoring handbook. We were surprised to find that participants seldom, if ever, reported finding immediate or potential value in ways that directly related to working with their faculty mentor. Instead we discovered that oftentimes faculty mentors acted as gatekeepers to opportunities where participants found both immediate and potential teaching value. For example, mentors often required Interns and Scholars to complete required hours that involved working as learning assistants for their mathematics courses or providing mathematics tutoring support. These opportunities resulted in participants developing a sense of specialised content knowledge and pedagogical knowledge for teaching (Ball et al., 2008; Schulman, 1986), which were our highest reported intersections of immediate and potential value.

This finding illuminates an area of continued focus and attention for our program and also similar programs at our university and beyond related to undergraduate student development. Undergraduate mentoring literature consistently points to students’ preference on mentoring practices that foster deep student-faculty relationships and honor their individual characteristics and strengths (Jacobi, 1991; Murdock, et al., 2013). These include regular meetings, trustworthiness, capacity to network to the broader community (Lopatto, 2004; Mekolichick & Gibbs, 2012), and social-emotional support (Mekolichick & Gibbs, 2012; Showman, Cat, Cook, Holloway, & Wittman, 2013). While “gatekeeping” or encouraging our students to engage in a broader community network through WPE is an important component, many other opportunities are potentially being missed to support students—at least consistently among all mentor-mentee pairs. Within our data, faculty mentors were essentially “invisible” layers of support for students. We are interested in how this finding supports or offers recommendations for our programs and others interested in developing undergraduate leaders through distributed leadership models, but also maximus the impact of quality faculty mentoring on student development.

Discovering that students found the most value related to teaching, even when engaging in mathematics-centred activities is a finding that our research team also wants to investigate further. We anticipated that students would describe finding value in learning about mathematics and teaching fairly equally, however we found that they overwhelmingly focused on what they were learning about teaching. Our Scholars were all pursuing dual degrees in both mathematics and secondary education, meaning they were required to take additional mathematics courses themselves. At the time of the study, all students had completed more mathematics or STEM-related content courses than teacher preparation/pedagogical courses. While strong content knowledge is essential for teachers (AMTE, 2017; Ball et al., 2008; Schulman, 1986), some of the top countries in preparing teachers (e.g., Finland, Singapore) emphasise early field experiences and mentorship prior to admission to recruit, support and retain the strongest teaching pool possible (Barber & Mourshed, 2007). In the context of our program, the reverse was often true for participants. One future goal of our project is to better understand whether the arrangement of participants' coursework (e.g., pedagogical methods coursework earlier in programs) in any way influences the types of value they report finding in their WPEs.

Overall, our results show that these participants found both immediate and potential value in their program experiences, especially in the area of teaching. In our examination of student value, we have been able to understand better which programmatic experiences students find value participating in, and what type of value they gain. Although participants did not report finding applied, realised, or transformative data through their WPEs in the program, we hypothesise that this makes sense with the fact that they are in the early stages of a teacher preparation program, and thus have not had opportunities to apply their learnings yet. Continued tracking and analysis of participants' values as they progress through the completion of their undergraduate coursework and into the field of education to examine this conjecture further is part of the future work of a newly awarded second NSF Robert Noyce Scholarship grant award at our university. As we and other STEM education programs work to recruit, retain and develop more qualified teachers in areas such as mathematics, further examination of students themselves in terms of what experiences matter is a key factor to investigate. If the goal of these programs is to recruit and retain highly qualified candidates, we must better understand what programs can do to attract such candidates and provide enhanced learning opportunities that not only increase their knowledge of teaching and mathematics, but also their understanding of what engagement in K-12 STEM education looks like. Further, these understandings can complement the implementation of clear standards and practices expected from university teacher preparation programs and state credentialing agencies, to ensure aspiring STEM teachers are prepared for the realities of their future teaching career.

Acknowledgements

The material described herein is based upon work supported by the National Science Foundation under grant no. DUE-143976. We would like to thank the leadership team members for collaboration on this project and for providing ongoing mentorship to our students, including: [leadership team members]. We also thank all of our student participants and our collaborators at the local school districts and non-profit organisations.

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Appendix

Codebook Sample for Immediate and Potential Value

CODE and Subcode	**Definition**	**Representative Examples**
VALUE	"Refers to the importance, worth, or usefulness" [of participation] (Wenger-Trayner, Wenger-Trayner, Cameron, Eryigit-Madzwamuse, & Hart, 2017).	
Immediate Value	**Interest in and awareness of mathematics education related opportunities. Reasons for participating in activities as expressed by Noyce participants.**	
Understanding Learners	Description of attending an event that helps participant develop awareness of or interest in ideas related to how students learn.	It is very interesting to see some the students thought processes on how to solve for certain math problems because it is vastly different about how I would approach the problem.
Mathematics Activities	Description of attending an event focused on mathematics. This may lead to a participant reflecting on mathematical concepts/connections (may be dual coded Applied Value).	This week I finished reading my book “Things to Make and Do in the Fourth Dimension” by Matt Parker which was an interesting parallel to what I’m learning in my Abstract math class! Both talked about different kinds of infinite sets and demonstrated Cantor’s proof which was super interesting.
Teaching Activities	Description of attending an event that helped participant develop awareness of or interest in an idea related to teaching practices/pedagogy (may be dual coded Applied Value).	I am beginning to feel more confident when tutoring. This week a student at [a community college] complimented me on how well I explain math concepts to her and I was so honored. I sometimes feel like I do not do a good job at explaining things sometimes so I was so glad to hear that I’m doing okay!
Networking/Social Activities	Description of attending an event that helped participant develop social network, either with peers, faculty, or other community members.	Candice and I had the opportunity to work and talk with two teachers during one of the sessions. It was a great chance to see their way of thinking as experienced teachers, as well as a chance to ask them questions, such as what is one thing they wished they would have known as new teachers. I definitely want to attend this conference again in the future as I think it is a great opportunity not only for professional development,

		but to interact and learn from other educators.
Required Activities	Description of attending an event or participating in an activity due to an expectation on the part of the participant's faculty mentor. The driving focus is pleasing/appeasing the mentor, rather than perceived value by/for the participant.	During this two-week period, we also had the CRT training with Dr. Abraham. We talked about 15 things we can do in the classroom in order to help build relationships and foster a positive environment in the math classroom. Over the break we have a paper that we are going to be working on, where we evaluate the different videos from Kanopy and see how they implement different things that create that environment.
Mentor Advice	In the moment support/advice for student.	In my meeting with Dr. Adams, we had a very good discussion. Right now I'm considering changing my major. However I feel at a crossroads because a lot of different clubs and organizations I am under are really pushing me to be an engineer. When I told her about the issue, and how I was feeling like I have to remain in a major I did not like, she talked about her experiences through college. I feel like through the conversation Dr. Adams and I had, we are closer and we understand each other better. She really provided the assurance I needed in saying I really have to do what I want to do.
Potential Value	**Sense of connection/belonging in the community. Level of connectedness among members (shared resources, number/type of collaborations). Connecting ideas/concepts learned through participating in activities to mathematics, teaching, and learning.**	

Connection with Faculty	**Note: Not current Noyce-assigned mentor. Connection with faculty, which could include but is not limited to, faculty who serve on the Noyce leadership team and are mentors to other participants, as well as GAs, office staff, and other faculty who coordinate and attend outreach events/activities. Often are more broadly made statements, rather than those specific to actions (applied) or changes at the programmatic level (transformational).	The second activity for this week was doing the Math Club Bake Sale. Candice and I met the night before and baked everything that we wanted to have. I think that this bake sale went way better than the last bake sale. We sold almost everything! A large part of that had to do with Dr. Haskins bringing TWO of his classes down and getting them all something! It's cool to see how supportive all the mentors are with everything that the students put on!
Connection with Mentor	Connections with assigned faculty mentor(s), via weekly meetings, shared work, etc. Often are broadly made statements, rather than those specifics to actions (applied) or changes at the programmatic level (transformational).	Although my schedule was very hectic, I found all of these things rewarding. I enjoy using my gifts to help others. I am thankful that I have an awesome mentor, Nick, who continually helps me with staying in the loop of current events. I am also very pleased to be an Intern of Dr. Adams. She is great at helping me understand everything and lets me know everything that's going on with math events and Calculus I class.
Connection with Noyce Peers	Connections with other current/former/future Noyce participants (Interns, Scholars), which could include but is not limited to: collaborating on/attending events together, weekly meetings, social outings, social media/text communications, etc. Often are more broadly made statements, rather than those specifics to actions (applied) or changes at the programmatic level (transformational).	I also helped out with Lights On on Saturday. We had three tables that were math puzzles, space shuttle tiles, and an augmented reality Mars rover. I worked the math puzzles table with Martina. I have known Martina since last summer, but this was the first time I've ever really worked with her on anything. She was great with the kids and I feel like I picked up a few tricks from her while she was interacting with them. I had a lot of fun helping them work through the puzzles!
Connection with Community Members	Connections with members of the local/regional/national STEM community, including but not limited to: K-12 education, local businesses, and other outreach programs. Often are more broadly made statements, rather than those specifics to actions (applied) or changes at the programmatic level (transformational).	Tutoring at St. James has helped me realise that I'm a role model for the students there. It's also been a wonderful experience to better connect with the teachers and administration in the building. Reviewing old algebra/geometry/pre-calculus concepts has also been very helpful! It helps me with my own work as a student, but it also allows me to work on getting better

		at explaining/understanding different concepts.
Novel Math Idea	Describes new idea, connection, concept related to doing mathematics. This could include new strategies for solving problems, seeing connections between concepts in a new way, or developing an appreciation/new way of thinking about mathematics as a result of participating in an activity. This is an idea, NOT an action.	At the conference, one of the workshops that I really enjoyed was one that talked about the use of algebra tiles to teach factoring, distribution, "FOIL", and completing the square. Although I had already used algebra tikes and had an idea how to use them, this workshop presented lots of new tips and information that will help me later incorporate these in to my classroom better. In this same workshop I also learned a new way of factoring, which is essentially the same I've always done, except organised in a big X form that allows the student to represent it differently and even think of it like solving a riddle. I certainly got out of this talk that I can certainly apply later on
Novel Teaching Idea	Describes new idea, connection, or strategy related to teaching. This could include new teaching strategies and pedagogical practices the participant is considering or has seen in in practice (related to general teaching practice, teaching mathematics, classroom management, etc.). This is an idea, NOT an action.	Last week most of my time was spent in Dr. Mancuso's Intro to Abstract Math class. This is my first in class teaching experience and it has been exciting to help students with problems and then to see them have an 'ah-ha' moment when they first get a concept. Dr. Mancuso's class is an IBL class and it is very interesting to see how students approach problems. The IBL approach is rewarding to not only the students but to myself because even though I am familiar with all the concepts, each student brings a unique perspective to the problems and it helps me realise that there is always more than one way to solve a problem.
Novel Idea about Learners	Describes new idea, connection about being a learner. This is an idea, NOT an action.	I had a positive experience with a student this last week. One of the navigators came up to me and mentioned that a student was having trouble dividing fractions. She didn't want to raise her hand and ask for help, and the only help she wanted me to do, was to sit by her and watch her work problems. I sat next to her and

	watched her try to solve some problems. I started to give her little hints or told her to look at a previous question she solved correctly and look at how she solved the problem. Within a very short period of time, I believe she trusted me, and allowed me to actually help her. We worked on some word problems together. I had her doing extra word problems and by the end, she was solving word problems on her own. What fascinated me, was watching her multiply numbers. It would take her a long time to multiply 2 numbers together. I also noticed that she would use her fingers and whisper to herself when she was multiplying. I know that in the future she will be comfortable raising her hand and asking for help, since she was asking for my help on adding and subtracting fractions.

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