

**Preparing and Supporting Elementary Mathematics Specialists through
School-University-Community Partnerships**

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Abstract: Grounded in a close partnership between a university, school district, and non-profit organization, this 5-year mathematics professional development project involves 27 elementary teachers prepared and supported as Elementary Mathematics Specialists (EMSs). The project aims to develop EMSs who deliver ambitious mathematics instruction in their classrooms and serve as informal mathematics teacher leaders. They complete a university's K-5 Mathematics and Teacher Supporting & Coaching Endorsement programs and participate in Professional Learning Communities and individual mentoring. Described here are the partners, the project's components, and the ways in which the EMSs engaged in teacher leadership across Year 1. Central to the project is the school-university-community partnership, with the components supporting reciprocity with mutual benefits for all partners, such as high quality clinical experiences for teacher candidates, coaching for novice teachers, and engagement with families and caregivers.

KEYWORDS: elementary mathematics education, school-university-community partnerships, Elementary Mathematics Specialists, professional development, teacher education

NAPDS NINE ESSENTIALS ADDRESSED:

Essential 1: A professional development school (PDS) is a learning community guided by a comprehensive, articulated mission that is broader than the goals of any single partner, and that aims to advance equity, antiracism, and social justice within and among schools, colleges/universities, and their respective community and professional partners.

Essential 2: A PDS embraces the preparation of educators through clinical practice.

Essential 3: A PDS is a context for continuous professional learning and leading for all participants, guided by need and a spirit and practice of inquiry.

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Introduction

Described here is our 5-year professional development project focused on the preparation and support of 27 elementary teachers as Elementary Mathematics Specialists (EMSs) that is grounded in a close partnership between a university, school district, and non-profit organization. First, we describe the need for the project, conceptual framings related to the project's professional development and partnership, and the partners themselves. Then, we share information about the project's components, especially the professional development experiences, and how the project supports *reciprocity with mutual benefits* for all partners, with connections to the work of the EMSs during Year 1.

Need for the Project and Framings

International and national assessments indicate far too few students in the USA, especially those from underserved populations, are attaining high levels of mathematics learning (National Center for Education Statistics [NCES], 2019, 2021; Organization for Economic and Cooperative Development, 2020). Further, students have lost opportunities for learning mathematics due to the COVID-19 health pandemic, with educational disruptions and shifts caused by the pandemic highlighting and exacerbating existing inequalities in mathematics education, especially for students historically marginalized (Dorn et al., 2021; Lewis et al., 2021; NCTM, 2021). Specifically, studies have shown that while mathematics achievement was lower for all students, Black and Hispanic students in high-poverty schools were disproportionately impacted, particularly in the elementary grades. The mathematics education of students in the elementary grades is crucial, as the foundational mathematical understandings built in these early years support later success in mathematics during secondary education (Austin et al., 2020; Watts et al., 2015). These findings are deeply troubling, given the importance of students' mathematical capacity for success. This capacity provides them with: critical thinking skills needed to address complex problems, abilities to thrive as global citizens, and tools for meaningful participation in our country's functioning and economy (National Council of Teachers of Mathematics [NCTM], 2014, 2020; Partnership for 21st Century Learning, 2011).

Key to bettering the mathematics education of elementary students is increasing the effectiveness of their teachers. Accordingly, across the past decade there has been growing advocacy for Elementary Mathematics Specialists (EMSs), who are teachers, teacher leaders, or coaches with the expertise to support effective elementary mathematics instruction (Association of Mathematics Teacher Educators [AMTE], 2013a). The joint position of several prominent mathematics education organizations, such as AMTE and the National Council of Teachers of Mathematics (NCTM) (AMTE, 2013b/2022), contends that every elementary school have access to an EMS and that advanced specialist certification be offered via rigorous preparation programs. The importance of these professionals and their specialized preparation is increasingly apparent as 19 states and the District of Columbia have established routes for EMS licensure, certification, or endorsement, with 10 other states in the process of developing pathways (EMSs & Teacher

Leaders Project, 2022). Our state provides pathways for a K-5 Mathematics Endorsement (K-5 ME) and a Teacher Support & Coaching Endorsement (TSCE).

When considering the preparation of EMSs, AMTE's (2013a) *Standards for Elementary Mathematics Specialists* serves as a guide for programs, recommending a focus on: (a) content knowledge for teaching, including well-developed understandings of elementary mathematics (e.g., *specialized content knowledge*); (b) pedagogical knowledge for teaching, including learners and learning, teaching, and curriculum and assessment; and (c) leadership knowledge and skills. Programs should include a supervised internship working with a range of learners, including elementary students and teachers. Learning experiences should be embedded in practice, with meaningful connections and enactment within EMSs' classrooms, schools, and/or school districts (Reys et al., 2017). Our project's professional development, specifically the K-5 ME and TSCE programs, are grounded in these standards and recommendations.

This project involves several key partners, including a university, school district, and non-profit organization. The collaborative partnership is critical to the project's success, with the embedded components promoting the professional growth of all participants and ultimately purposing to improve students' learning and understandings of mathematics. Notably, robust school-university partnerships, such as Professional Development School (PDS) models, support *simultaneous renewal* (Goodlad, 1994) of all partners. This renewal is a process of partners concurrently changing, growing, and improving, with a focus on innovative, high leverage, research-based pedagogical practices (American Association of Colleges for Teacher Education [AACTE], 2018). Central to strong school-university partnerships is *reciprocity*, where there are mutual benefits for all involved stakeholders (National Association for Professional Development Schools [NAPDS], 2021), including K-12 teachers, university teacher candidates (henceforth called teacher candidates), K-12 students, K-12 school and district administrators, university faculty, and others. Partners share the work and benefit from the collaboration, experiencing reciprocity by collectively implementing new strategies and piloting new programs that result in enhanced classroom instruction, improved student learning, and better teacher preparation (Ricci et al., 2018). There is *shared responsibility* for the preparation of teacher candidates, the professional development of teachers, and K-12 student learning (AACTE, 2018; NAPDS, 2021). Related to this project, one aspect of professional learning of teachers emphasized within school-university partnerships is intentional opportunities for teachers' development of leadership capacity so they can productively influence others (NAPDS, 2021). All in all, when considering the collaborative partnership in this project, *reciprocity with mutual benefits* is an especially strong feature, along with *simultaneous renewal* and *shared responsibility* as strong aspects.

School-University-Community Partners

The project partners include Georgia State University (GSU), Gwinnett County Public Schools (GCPS), and Corners Outreach (Corners). The Leadership Team collectively guides project implementation and is composed of four university faculty, the project's program director, two school district liaisons, and one non-profit liaison.

GSU is an urban, minority-serving research university graduating over 300 new teachers each year. Located in Atlanta, Georgia, GSU has a lengthy history of strong partnerships with local school districts, many of which serve students who are living in poverty, racially and ethnically diverse, and have been historically marginalized and underserved in mathematics education. Over time, GSU has closely partnered with GCPS in a number of ways, including through PDS models.

In this project, the Department of Early Childhood and Elementary Education (ECEE) provides two graduate-level endorsements: K-5 ME and TSCE (described in a subsequent section). In addition, the project's teacher candidates are completing the department's undergraduate elementary teacher preparation program. The undergraduate program places approximately 150 teacher candidates each semester in schools across metro Atlanta for clinical experiences. Of these teacher candidates, 75% are from underrepresented groups (non-White) in the teaching profession, 61% are eligible for the federally funded Pell grant program that supports students with exceptional financial need, and 31% are first generation college attenders. The quality of the program is evidenced by retention data indicating 91% of graduates remain in the teaching profession after 5 years.

ECEE's undergraduate elementary teacher preparation program aims to develop teacher candidates as knowledgeable, competent, agentic, and caring educators within the complexity and diversity of educational settings. The program emphasizes the connection of coursework with clinical experiences and research-based practices for instruction of diverse learners in urban school contexts. There is a focus on classroom instruction that values and leverages the varying academic, cultural, and linguistic backgrounds of children as well as their lived experiences in families and communities. Teacher candidates participate in clinical experiences across the 4 semesters of the program, including a yearlong student teaching residency, with strong coaching and mentoring provided throughout. The clinical experiences are designed to meet requirements for working with children across grade levels and ability/exceptionality as well as ensure culturally diverse classroom placements. Across these experiences, each teacher candidate is assigned a university coach who promotes self-directed thinking and action on a consistent basis, and along with the classroom mentor teacher, provides support and feedback on the teacher candidate's strengths and areas for growth.

Located in metro Atlanta, GCPS is the largest school system in Georgia, serving more than 180,000 students. GCPS has been recognized as one of the nation's top urban school districts. It has 80 elementary schools, and the project's recruitment efforts had concentrated on the highest need elementary schools in the district, as determined by the federally-funded free and reduced lunch program rates. This project's 27 elementary teachers work in 22 of the schools, which serve 91% students of color, with the largest populations being 44% Hispanic and 36% Black; 69% of students are eligible for the federally-funded free and reduced lunch program. The teachers self-describe as 24 females and 3 males, with 70% self-identifying as persons of color (41% Black, 7% Hispanic, 7% Asian, 7% Hispanic/White, 4% Hispanic/Black, 4% Black/White). The average age is 39 years (range of 28-62 years), and 30% speak a language other than English. They are a highly educated group, with 100% having a master's degree and 33% holding an educational specialist degree. Further, they are experienced teachers, on average having 10.5 years of teaching experience (range of 5-22 years). Teaching positions vary widely and include: three kindergarten, one first grade, two second grade, five third grade, one fourth grade, seven fifth grade, four STEM/Math Specials, one English to Speakers of Other Languages, one Special Education, one Early Intervention Program, and one Accelerated Content. Of these participants, two teach in Dual Language Immersion settings, including Spanish (2nd grade) and French (5th grade). Within these differing grade levels and foci, all teach mathematics, including some for part of the day and some for all of the day. Notably, this group of participants represents the diversity of teachers from which students learn mathematics in elementary schools.

Corners centers on the success of children as a change element in breaking cycles of poverty and has two main programs: (a) Corners Academy, dedicated to improving high school graduation rates through educational assistance, mentoring, and tutoring; and (b) Corners Industries, dedicated to improving career opportunities for underemployed parents. This project focuses on the work of Corners Academy, specifically supporting the after-school tutoring program provided to elementary students in GCPS. Currently, more than 500 elementary students are enrolled in the program. Corners Academy partners directly with teachers, reading specialists, and counselors at Title 1 elementary schools to create individualized tutoring plans for each student. It employs a multi-generational approach to raising education scores for students, meeting with parents, helping parents to better connect with the school through translation and transportation, and offering classes to parents to expand their own knowledge and education. Additionally, while serving populations that experience food insecurity, each student who attends the after-school tutoring program receives a daily snack.

Project Components

Overview

The project involves 27 elementary teachers in high-need, urban schools, who are prepared and supported as EMSs through completion of K-5 ME and TSCE programs. They are provided additional support through a Professional Learning Community and individual mentoring. Undergirded by the collaborative partnership, project goals include the development of EMSs who deliver effective and equitable mathematics instruction and serve as mathematics teacher leaders in a variety of ways, such as coaching teacher candidates, providing professional development to their peer teachers, mentoring novice teachers at their school sites, supporting the non-profit's after-school tutoring program, and engaging in community connections that promote key relationships and shared responsibility for students' learning. The project also aims to promote equity and access in mathematics education, support teacher retention in high-need schools, and situate teacher candidates in a hiring pipeline. Across the 5 years, the EMSs' primary responsibility is teaching students, thus their role as a mathematics teacher leader is an informal one. As the EMSs serve as a "more knowledgeable other" for a community of practice within a school, influencing teachers and the school's mathematics program as a whole (Campbell & Malkus, 2014), students should ultimately benefit by having improved mathematics learning experiences within the classrooms of both the EMSs and the teachers with whom they work.

Participant Selection

The teachers were selected to participate in the project based on criteria that identified them as successful, experienced teachers of mathematics with interest in and aptitude for teacher leadership. To be considered for the project, applicants submitted a variety of documents, including a resume, goals statement, letter of recommendation from a school administrator (that in part addressed student achievement in mathematics of the applicant), transcripts (minimum of 3.0 graduate GPA required), state-mandated teacher effectiveness score (minimum of proficient required), and a standardized test score focusing on mathematics. The Selection Team was composed of three university faculty, the project's program director, and two school district liaisons, who conducted small group interviews with the applicants and thoroughly reviewed the application materials. These reviews focused on meritorious professional achievement, academic accomplishment, knowledge of mathematics, commitment to teaching mathematics, and evidence

of/desire for teacher leadership. These criteria, plus consideration of race and ethnicity, gender, grade level, and school site with the aim of assuring participation of underrepresented groups and diverse school sites and grade levels, informed the selection of the 27 teachers in the project.

Professional Development

In the project, the EMSs are prepared and supported through completion of K-5 ME and TSCE programs during the first 2 years, along with participation in Professional Learning Communities (PLCs) and individual mentoring for the entire 5 years. See Table 1 for elements aimed at preparing and supporting the EMSs, along with the timeline. The endorsement programs include four elementary mathematics content courses integrating pedagogy, one course focusing on teacher leadership and coaching, and two internship courses, with one focusing on mathematics and the other coaching. Overall goals of both programs (AMTE, 2013a, 2017) are development of: effective and equitable mathematics instructional practices (NCTM, 2014, 2020); deep and broad knowledge of elementary mathematics, including *specialized content knowledge* (i.e., “mathematical knowledge needed to perform the recurrent tasks of teaching mathematics to students” [Ball et al., 2008, p. 399]); productive mathematical beliefs and professional agency; and teacher leader capabilities, including coaching skills. Note that due to the COVID-19 health pandemic, all project elements thus far have occurred virtually, with all class sessions, PLCs, and meetings occurring online and synchronously.

Table 1

Timeline and Project Elements Aimed at Preparing and Supporting EMSs

Year 1		Year 2			Years 3-5
Fall 2020	Spring 2021	Summer 2021	Fall 2021	Spring 2022	
1 TSCE course (Teacher Leadership & Coaching)	1 K-5 ME course (Number & Operations)	1 K-5 ME course (Data Analysis & Probability, 2-week summer institute)	1 K-5 ME course (Algebra & Rational Number) and 1 TSCE course (the Internship)	2 K-5 ME courses (Geometry & Measurement and the Internship)	
PLC and Mentoring	PLC and Mentoring		PLC and Mentoring	PLC and Mentoring	PLC and Mentoring

K-5 ME. In the K-5 ME program, the development of effective and equitable instructional practices focuses on learner-centered, responsive instruction (Carpenter et al., 2015; Jacobs & Empson, 2016) and the eight mathematics teaching practices in NCTM’s *Principles to Actions* (NCTM, 2014). These include: (a) selection and implementation of instructional tasks with high levels of cognitive demand; (b) use of multiple representations and tools; (c) promotion of problem solving and reasoning, explanation and justification, and connections and applications typical of *standards-based learning environments*; and (d) use of children’s thinking and understandings to guide instruction. There is explicit emphasis on equity-based, identity-affirming pedagogy, including fostering of practices that provide access, support, and challenge in learning rigorous mathematics for every student (AMTE, 2017, 2022). EMSs learn about planning for and enacting instruction that leverages children’s mathematical, cultural, and linguistic resources/strengths, while nurturing positive student identity in mathematics (Aguirre et al., 2013; AMTE, 2017, 2022;

Bartell et al., 2017; NCTM, 2020, 2021). Learning during class sessions occurs through: (a) active engagement in and analysis of the mathematics in the elementary curriculum, especially through cognitively demanding instructional tasks; (b) study of children's thinking and learning via video clips and written work samples; (c) examination of classroom practice via video clips and written teaching cases; and (d) scrutiny of the research base on elementary mathematics education and of critical aspects of equity and access with connections to classroom practice and schools (e.g., culturally responsive teaching, instruction for multilingual learners, and mathematics as a lens for understanding, critiquing, and changing the world). There is a substantial focus on the professional development materials from *Cognitively Guided Instruction* (e.g., Carpenter et al., 2015) and *Developing Mathematical Ideas* (e.g., Shifter et al., 2018).

In the K-5 ME program, key assignments include six clinical-style interviews of children's understandings of mathematical concepts, with three focusing on number and operations, two emphasizing equality and relational thinking, and one focusing on geometry and measurement. These interviews involve significant analysis, including instructional decisions with justification. Another assignment includes selecting, adapting, or generating, analyzing, and solving cognitively-demanding instructional tasks spanning grades K-5 and aligned with the concepts of each course (10 per course, 40 total). The Task Analysis Guide in the *Five Practices for Orchestrating Productive Mathematical Discussions* (Smith & Stein, 2018) is used for examination of cognitive demand of tasks. A portion of these instructional tasks must evidence connections to children's *funds of knowledge* related to their community, culture, language, lived experiences, and interests (Aguirre et al., 2013; Bartell, 2011, 2017; Civil, 2007), along with mathematics as a lens for understanding, critiquing, and changing the world. EMSs also complete an in-depth data design, collection, and analysis project. They also prepare written syntheses and oral presentations of research on elementary mathematics education, aligned with the concepts of each course (one per course, four total). Last, during the Internship course, they create a professional portfolio documenting proficiency in teaching elementary mathematics, including data from classroom observations by a university coach.

TSCE. The TSCE program has a concentrated focus on the EMSs' preparation as teacher leaders by developing their understandings of teacher development, coaching, and facilitation of professional development. It aims to develop: knowledge of adult learning and the continuum of teacher development across the career span; and coaching skills that support instructional change through cognitive coaching (Costa & Garmston, 2016), observations of classroom practice, analysis of student work, and examination of lesson components. The cognitive coaching cycle is an iterative process that includes a pre-conference focused on goal setting, followed by a lesson observation using specific data collection techniques, and then a post-conference involving sharing of data with connection to goals and actionable feedback, with the coach encouraging reflection and decision-making centered on the mentee's concerns. Coupled with cognitive coaching, there is a focus on coaching for equity, specifically a transformational approach (Aguilar, 2020) involving coaches and their mentees continual analysis of behaviors (what we do), beliefs (what we think), and ways of being (who we are). EMSs are immersed in these understandings and approaches during the first course, Teacher Leadership & Coaching.

Then, in the second course the EMSs apply their learning in an internship focused on coaching a teacher candidate or novice teacher. With an understanding of adult learning and teacher development, the EMSs identify their coaching approach (Orland-Barak & Wang, 2020) and adjust their style, as needed, to alleviate resistance and to promote mentee reflection and self-

direction (Costa & Garmston, 2016). They develop a trusting relationship with their mentee, engage in goal setting, and provide continuous, targeted opportunities for collaboration and sharing feedback. The EMSs implement the cognitive coaching cycle at least 3 times across the course with their mentee, and also provide support through teacher development activities dependent on the differentiated needs of their mentees (e.g., curriculum and lesson plan support, data analysis focused on student learning, modeling, co-teaching, video self-study).

PLCs and Individual Mentoring: Support for Teacher Leader Activities. In addition to preparation for teacher leadership in the endorsement programs, support for the EMSs as they serve as teacher leaders is provided through a PLC and individual mentoring, both facilitated by the project's program director. PLCs and individual mentoring focus on: building a community of learners within each PLC, augmented support for developing effective and equitable mathematics instruction, and targeted support for their selection and implementation of what is called in this project *teacher leader activities*. The three PLCs are clustered around grade levels/teaching focus, with each having nine EMSs, and meet monthly eight times across the school year.

To lead instructional change and support wide-ranging improvements, the EMSs engage in a number of teacher leader activities across the 5 years in their school, district, community, and other contexts, applying their teacher leader understandings and capabilities learned in the K-5 ME and TSCE programs and the PLC. Two primary teacher leader activities include: (a) coaching a teacher candidate each year, and (b) supporting the nonprofit's after-school tutoring program for at least 1 of the 5 years. Other teacher leader activities are selected based upon the needs of the school and in consultation with school leadership. The PLC serves as a context for collaborative selection, planning, and reporting on teacher leader activities, in addition to individual conferences with the program director.

Toward the beginning of the school year, each EMS proposes 3-6 specific teacher leader activities in writing to the program director, describing in detail the anticipated activities (i.e., Teacher Leader Plans), after discussion with school leadership. The program director consults with the project's Leadership Team and collaboratively refines with each EMS a plan for specific teacher leader activities to accomplish across that school year. Check-ins related to progress across the school year are included in both PLC meetings and individual conferences. PLC meetings also include time for EMSs to collaborate on these activities, as there are often multiple EMSs implementing similar efforts. This collaborative planning time cultivates support for individuals, productive brainstorming on shared ideas, and positive working relationships between EMSs, who because they are in schools across the district would not otherwise interact. Each EMS provides documentation at the end of each year of this work in a Teacher Leader Record (TLR), providing a detailed description of each activity's content, duration, frequency, and outcomes. For their work as EMSs and participation in the project, the teachers are provided an annual stipend through the grant funds.

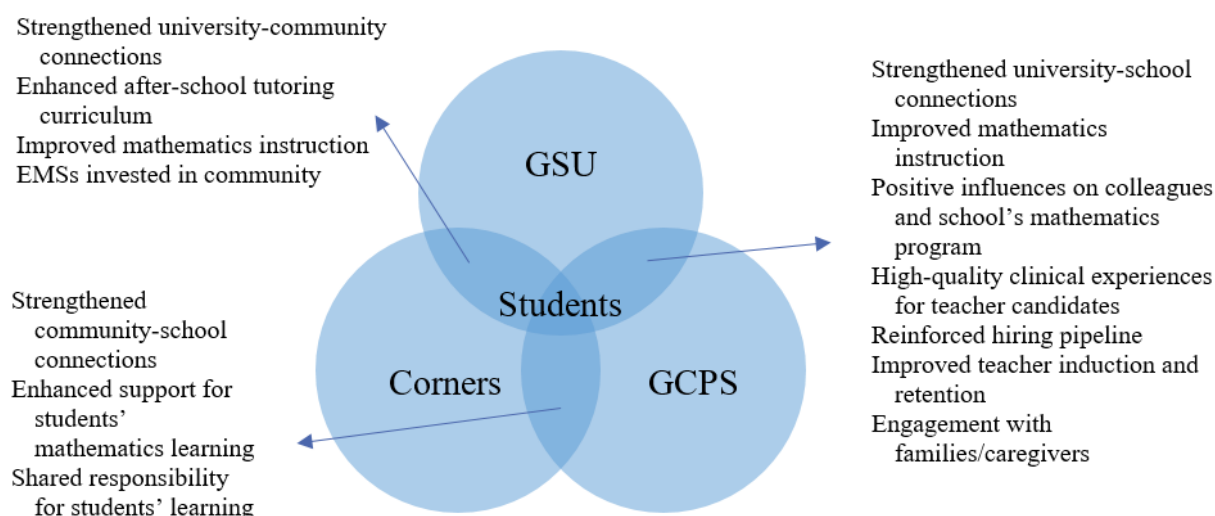
Project and Mutually Beneficial Partnership

The project's components, supported by the collaborative partnership, are grounded in *reciprocity with mutual benefits* for all partners and have the ultimate goal of improved student learning. Specifically, the *proximal* goals of improving EMSs' mathematics instruction with them in turn supporting others (e.g., fellow teachers) in doing the same, should influence the *distal* goal of enhanced student learning and understandings in mathematics. Figure 1 displays some of the mutual benefits, with supporting students and their mathematical capacity for success at the center.

The text following the figure provides further description, including connections to the teacher leader activities of the EMSs during Year 1 as reported in the TLR, since the project is currently in its second year of implementation (see Table 1 for preparation and support timeline). During the first year, the EMSs provided teacher leadership in a number of ways, with each reporting 3-6 distinct teacher leader activities, dependent upon the scope and scale of each activity. These activities provide several benefits for all partners, including the EMSs and their fellow teachers, teacher candidates, students, school and district administrators, university faculty, teachers at Corners Academy, and other key stakeholders, such as parents and families. Further, these activities illuminate how the project supports the position that school-university partnerships should intentionally develop teachers' leadership capacity, in order for them to productively influence others (NAPDS, 2021).

Figure 1

Project Partners and Mutual Benefits with Students at the Center



During Year 1 of the project, each EMS coached a teacher candidate, serving as a classroom mentor teacher and/or university coach. A total of 27 teacher candidates were impacted, strengthening the university-school partnership, contributing to high quality clinical experiences for teacher candidates, building teacher capacity for coaching others at the school sites, and reinforcing the hiring pipeline for high-need, urban schools. Notably, the EMSs having specialized training and developed expertise in coaching, which is too often not the case for those who host teacher candidates, should allow for especially meaningful, supportive experiences for teacher candidates placed in their classrooms. Further, this aspect of the project should contribute to a coherent vision and meaning for the expectations of the clinical experiences—that is, the teacher candidate and mentor teacher/university coach, in this case the EMS, will have common understandings as the EMSs continue to serve in this role. In addition, when considering effective mathematics instruction, the emphasis of the K-5 ME program for the EMSs aligns with that of the undergraduate mathematics methods courses completed by the teacher candidates, supporting

congruency related to theoretical underpinnings and pedagogy within mathematics education. Too often there are pedagogical mismatches between what teacher candidates learn in university teacher preparation programs and what they observe and experience in K-12 schools. Shared understandings of effective mathematics instructional practices will improve the clinical experiences and quality of the field placement classrooms for teacher candidates. The EMSs' mathematics instruction should provide an example of innovative, high-leverage, research-based practices (AACTE, 2018), with their classrooms providing space for teacher candidates to implement the same.

Beyond the project period, the EMSs' classrooms will be targeted as those that provide exceptional experiences for teacher candidates, building upon the enhanced partnership developed via the project. This is critical as GSU places many teacher candidates in schools across metro Atlanta, with quality of clinical experiences evidencing variability as some school districts use self-selection of mentor teachers rather than strategic placement. Over time, teacher candidates in the EMSs' classrooms are in a pipeline for being hired at the high-need, urban schools. Within the current national and local contexts of a pervading teacher shortage exacerbated by the COVID-19 health pandemic, this positioning of teacher candidates especially serves the needs of GCPS.

During the first year of the project, over one-third ($n=10$) of the EMSs supported Corners Academy after-school tutoring program, promoting school-university-community partnerships. This support was driven by the needs of the after-school tutoring program, based upon consultation with the program's leaders. The EMSs' initial efforts largely focused on collecting, organizing, and sharing tools and resources to support remote learning, which reinforced the mathematical concepts students were concurrently learning in their classrooms and prioritized problem solving, reasoning, and enjoyment of the subject. Then, they engaged in analyses of the after-school mathematics curriculum followed by revisions. First, they met with the curriculum developer at Corners Academy to discuss the types of changes and focal points desired for the curriculum, which included an increased focus on conceptual understanding for students and added elements that make tutoring more engaging. The EMSs then carefully analyzed the year-long curriculum for all grades and provided feedback on how to increase cognitive demand during instruction, implement instructional tasks that are worthwhile and engaging for students, and utilize more manipulatives and tools to improve conceptual understanding. They provided additional resources and supplements to that curriculum, with the continued aim of increasing rigor, conceptual understanding, and enjoyment of mathematics. All in all, these teacher leader efforts focused on curriculum development should lead to improved mathematical learning experiences for students in the after-school tutoring program. Since some of these students are in the EMSs' classrooms, the EMSs should receive direct benefits from this work via their students.

Additional teacher leadership was evident in Year 1, with 11 participants leading professional development of some kind for fellow teachers at their schools that focused on mathematics education (e.g., PLC, grade level planning sessions, districtwide and schoolwide professional development). As the EMSs serve as a "more knowledgeable other" for a community of practice within a school, influencing teachers and the school's mathematics program as a whole, students should ultimately benefit by having improved mathematics learning experiences within the classrooms of both the EMSs and the teachers with whom they work. These teacher leader efforts across the 5 years of the project and beyond aim to have a wide-ranging effect on mathematics teaching and learning at their school sites. In addition, 10 EMSs formally mentored new teachers at their schools, beyond coaching a teacher candidate. This coaching of novice

teachers fosters retention during these mentees' induction period in the profession. Support for teacher retention is critical, as nearly 1 out of every 2 teachers (44%) leave the profession within 5 years (Ingersoll et al., 2018), and with teacher turnover comes negative impacts on student learning (Ronfeldt et al., 2013; Sorensen & Ladd, 2020). Notably, a body of research shows that individual mentoring of those in the first 3 years of teaching is critical for persistence in the profession (Maready et al., 2021; Ronfeldt & McQueen, 2017; Smith & Ingersoll, 2004).

Additional teacher leader activities focused on outreach to parents and families. Twelve EMSs facilitated a Math or STEM Community Event for families and students in their respective schools. Twelve led workshops or created resources for parents focused on mathematics as a direct response to remote learning struggles or language barriers (e.g., instructional videos, bilingual resources). Community connections and intentional interactions with parents and families such as these promote key relationships and shared responsibility for students' learning in mathematics. This is especially true for supporting multilingual learners in mathematics, with "engagement with families" (NCSM and TODOS, 2021, p. 2) described as key for their success in the subject. With GCPS having the largest population of English Language Learners in the state compared to other school districts, these types of connections are particularly important. While the fore-mentioned categories of activities were the most frequently reported, the EMSs also engaged in a number of other activities, all of which were mathematics focused. Examples include co-presenting at national conferences, serving on leadership teams within the school district, creating original content for use with teachers and students, facilitating after-school boot camps or tutoring for students, and writing grants in order to procure resources.

When considering benefits and impacted individuals of the collaborative partnership, this project prepares and supports 27 EMSs at 22 elementary schools, who across the 5 years will affect over 10,000 elementary students and numerous teachers at the high-need, urban schools. This project intentionally supports students who have been historically marginalized and under-served in mathematics education, with the EMSs' schools serving 91% students of color. Further, selection criteria for the project ensured the EMSs are a diverse group, with 70% identifying as persons of color. This is significant as increasing research shows students of color benefit from having teachers of color (Carver-Thomas, 2018; Egalite & Kisida, 2018; Yarnell & Bohrnstedt, 2018). In addition, across the project, at least 135 teacher candidates will be impacted as the EMSs serve as their mentor teacher and/or university coach. Notably, for these teacher candidates, program data show 75% are from underrepresented groups (non-White) in the teaching profession, contributing to the much needed diversity of the teacher workforce as recent data show 78% of public school teachers in the USA are White (NCES, 2022).

This project aims to support teacher retention of the EMSs, an aspect that is addressed in the high-quality preparation and support as well as the community of teacher leaders being cultivated. Notably, the extant literature shows that teachers who engage in teacher leadership perceive an upward professional trajectory, thus increasing their own satisfaction and retention in the profession (Tricario et al., 2015). With this project occurring in the context of the COVID-19 health pandemic, the sudden, unanticipated shift to emergency remote teaching followed by concurrent instruction of face-to-face and virtual learners have generated tremendous challenges and angst for K-12 teachers. Those were and continue to be trying times for teachers, testing their resilience, fortitude, and persistence in the profession. Throughout, the EMSs have found community and comradery with one another, the project providing a space for supportive and open, safe conversations as they grapple with the tremendous demands placed upon them as educators,

which has been illuminated through both anecdotal data and initial interview findings. Their passion for and commitment to mathematics education are apparent, which brings us hope that our goal of retaining EMSs in GCPS will be successful.

Concluding Thoughts on Partnership

In conclusion, this project supports the *simultaneous renewal* of all partners, fostering change, growth, and improvement, with a focus on innovative, high-leverage, research-based pedagogical practices (AACTE, 2108) in mathematics. Further, the project's components support all partners having *shared responsibility* for the preparation of teacher candidates and the professional development of teachers, ultimately aiming to improve students' learning experiences in mathematics (AACTE, 2018; NAPDS, 2021). Development of the EMSs' leadership capacity is central, which is an important aspect of school-university partnerships (NAPDS, 2021). Further, the partners are sharing the work and benefiting from the collaboration, thus promoting *reciprocity with mutual benefits* for all involved stakeholders. Research involving mixed methods is being conducted across the 5 years of the project, which will provide insights into the functioning of the partnership and the development of the EMSs' mathematical content knowledge, instructional and coaching practices, beliefs, and teacher leader skills. The continued data collection and analyses provide a unique and exciting opportunity to follow the trajectory of the project participants as EMSs in high-need, urban schools serving diverse student populations, providing continued understandings related to reciprocity with mutual benefits of the partners. The project's through-thread of addressing issues of equity and agency offers the EMSs' students, teacher candidates, and fellow teachers an advocate for effective and equitable mathematics instruction, made possible by the collaborative school-university-community partnership.

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