
Transforming Math Education through Revitalization of the PDS Model

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Abstract: The school-university PDS model, implemented at KSU has been effective at training pre-service teachers for future work in local districts, but with the onset of distance placements, the need to extend this relationship to partner districts throughout the entire state is vital. Additionally, the need to provide quality professional development to teachers throughout the state is vital to the simultaneous renewal process for pre-service and in-service teachers. To reach the teachers, the school-university PDS model was reexamined and redesigned to include a third collaborative partner at the state level. At the center of School-University-State PDS Model are the K-12 students and ensuring accessible learning opportunities and engagement for all.

KEYWORDS: Simultaneous Renewal, School-University-State PDS Model, Math Professional Development

NAPDS NINE ESSENTIALS ADDRESSED:

6. An articulation agreement developed by the respective participants delineating the roles and responsibilities of all involved

Introduction to Our PDS

Since 1989, the College of Education (COE) at Kansas State University (KSU) has maintained and expanded strong partnerships with school districts throughout the state of Kansas, utilizing simultaneous renewal (Goodlad, 1994) as the primary catalyst for improving teaching and learning. Four goals for our professional development school (PDS) include: preparation of new teachers, in-service teacher and faculty development, K-12 student learning, and collaborative inquiry. The heart of this partnership is situated around Goodlad's twentieth Postulate (added in 2000), which states institutions and districts "must fine-tune their individual and collaborative roles to support and sustain lifelong teaching careers characterized by professional growth, service, and satisfaction." The KSU PDS model, a cornerstone of the COE, described in detail by Martinie, Rumsey & Allen (2014) encompasses multiple opportunities for pre-service teachers to learn alongside the continued professional development for educators within the partnership.

As pathways for preparing future teachers expand and change, the PDS model requires adaptations and modifications to meet current and future demands. School-university partnerships are recognized as a driving force for teacher preparation. Of particular interest to the mathematics education faculty in the COE at KSU is the inclusion of reciprocal professional relationships in the Association of Mathematics Teacher Educators (AMTE) Standards for Preparation of Teachers of Mathematics (2017). Standard P.4 "Opportunities to learn in clinical settings" and specifically indicator P.4.1 "Collaboratively develop and enact clinical experiences" speak directly to this.

The experience can become a system of simultaneous growth and renewal for the teacher candidate-mentor teacher-university supervisor team when they collaborate; all participants learn and lead while they work on behalf of students. Only when preparation programs purposefully engage with schools, not just in schools, will their clinical preparation become truly robust in ways that maximize candidates' skill development and therefore their abilities to support the mathematics learning of students. (p. 54)

Recognizing the Need to Expand Beyond the School-University PDS Model

The school-university PDS model implemented at KSU is effective at training pre-service teachers for future work in local districts, but with the onset of distant placements, the need to extend this relationship to partner districts throughout the state is imperative; thus the need to provide quality professional development to teachers throughout the state is vital to the simultaneous renewal process for pre-service and in-service teachers. Reflecting on the history and the future of professional development schools, Mercer and Myer (2017) provide a call to action.

Building on past good works, the timing is right to revitalize the PDS movement and propel Kansas to the next level. While simultaneously broadening its scope of work to continue to strengthen ties between [institutes of higher education] IHEs and the state's Local Educational Agencies (LEA), PDSs are a critical component of quality preparation... The needs of the field dictate that the members of the entire educational community jointly provide the most relevant and meaningful experiences to society's most precious commodity: its students. (p. 4)

Working to meet this challenge and to address the AMTE standards, we recognize an important new partner in our PDS model: the Kansas State Department of Education (KSDE). Our modified PDS model maintains the collaborative efforts of the school-university partnership, while

embracing the content consultant at KSDE, specifically the Kansas math consultant, as an integral member of the PDS partnership. Goodlad (2004) argues for tripartite relationships, involving K-12 schools, IHE's and liberal arts colleges. Although the added relationship with the state department of education may not have been an original ideal of Goodlad, the unique contribution is one that represents the current educational contexts in many states and has shown great potential in the initial stages as another pathway to meet the tripartite relationship envisioned by Goodlad.

In this paper, we will describe the changing and emerging roles of the school, university and state agency in our adapted, tripartite PDS model, as we form a state-wide learning community and collaborate to address the diverse and changing needs of K-12 students and their schools through the lens of the core components for partnerships. We will also share challenges and unique perspectives from partners within the PDS.

Core Components of the School-University-State PDS Model

Burns, Jacobs, Baker and Donahue (2016) analyzed three national documents: the National Association for Professional Development School Nine Essentials (2008), The NCATE Blue Ribbon Panel Report (2010), and the National Education Association's report titled *Teacher Residencies: Redefining Preparation through Partnerships* (2014) and identified seven core ingredients that should compose every school-university partnership, and they include:

1. A shared, comprehensive mission dedicated to equity for improved PreK-12 student learning and educational renewal,
2. Designated partnership sites with articulated agreements,
3. Shared governance with dedicated resources that foster sustainability and renewal for the partnership,
4. Clinical practice at the core of teaching and learning,
5. Active engagement in the school and local community,
6. Intentional and explicit commitment to the professional learning of all stakeholders, and
7. Shared commitment to research and innovation through deliberate investigation and dissemination.

Upon further examination of each of the core areas, our revised PDS Model, which includes KSDE as an integral member of the School-University partnership, addresses many of these components. Specifically, the School-University-State PDS Model provides substantially more opportunities to improve K-12 student learning and simultaneous renewal for all stakeholders. In the sections below, we will explore the roles of all partners and identify numerous ways that the partnership has succeeded in broadening partnerships beyond local schools by addressing the core components of our expanded School-University-State PDS Model.

A Shared, Comprehensive Mission Dedicated to Equity

The first core component emphasizes equitable access for K-12 student learning and educational renewal. The traditional PDS model is often limited by geographical location, but the revised School-University-State Model encourages equitable access to professional learning for all teachers in the state, not only those close to a university with a PDS. Our School-University-State PDS model supports the vision of "a time and place where each and every LEA maintains a

PDS relationship with an IHE where the concerned professionals congregate multiple times a year to envision, plan and enact steps to bolster clinical experiences and the development of on-going professional learning opportunities for all” (Mercer & Myers, 2014). As our programs continue to grow and technology allows for virtual supervision models, the need to involve teachers from all school districts in the School-University-State PDS Model, including those within close geographical location and those in the far-reaching corners of the state, has become a key to ensure pre-service teacher placement in effective classrooms. The content area trainings incorporate both mathematics content and pedagogical content knowledge. Pre-service and in-service teachers are engaged in learning around the National Council of Teachers of Mathematics (2014 & 2017) eight effective mathematics teaching practices that encourage access and equity for all students to engage in high-quality mathematics learning experiences. KSDE, specifically in the field of math education, has played a vital role in broadening relationships between schools and universities. As more teachers are involved in regional math trainings, content area communications and Mathematics and Science Partnership (MSP) projects and as pre-service teachers from KSU transition into their teaching careers, the shared, comprehensive mission may be closer to attainment with the continued support of the School-University-State PDS

Designated Partnership Sites with Articulated Agreements

The second core component is ripe for revitalization in the School-University-State PDS Model, as a statewide professional learning community with shared ideals would be in place in lieu of individual schools “designated” for specific university partnerships. Upon relationships being built, individual School-University partners articulation of agreements and expectations will need to be based on a shared mission of the School-University-State PDS. A vision for Kansas PDS relationships was written by the Kansas Coalition of PDS upon their formal chartering in 1999. This organization serves as a state-wide PDS coalition in Kansas, offering a forum for learning and a network for sharing that supports PreK-12 learning and innovative educational practices throughout the state. Schools play a vital role in this partnership, as the goals set in place by the Kansas Coalition of PDS encompass the revitalization of K-12 education that can take place through the PDS processes (Mercer & Myer, 2017). Each school in the PDS relationship has an obligation to its students to provide equitable access to the most engaging classrooms through the use of effective teaching practices for all children. Teachers, who serve as cooperating teachers, clinical instructors or mentors to pre-service teachers have an added obligation, as they are fostering the growth of their K-12 students, while offering a substantial learning experience for pre-service teachers. They observe, co-teach, and coach pre-service teachers through the transition process from students at the university to classroom teachers (Martinie, Rumsey, & Allen, 2014). To achieve these lofty goals, in-service teachers are engaged in professional development in the form of individual learning and on-going, job-embedded professional development opportunities provided by university faculty and KSDE.

Shared Governance with Dedicated Resources

Shared governance and resources, as stated in component three, are vital to the PDS partnership. Such developments would be included in the mission of the School-University-State PDS. While resources are shared in the statewide learning community, as well as individually

between school and university, the engagement in local community is shifting with more transient populations and virtual capabilities. The School-University-State PDS Model plays a role in the sharing and dissemination of resources statewide. The KSDE Math Consultant, Melissa Fast, spearheads many of the opportunities for collaboration between the state department of education, universities, and schools. She has the primary responsibility of overseeing the development and adoption of statewide curricular standards and providing support for the development of corresponding assessments. To do this, committees comprised of teachers, coaches, and university faculty were created for the writing and review of the elementary, middle and high school math standards. In addition, there was an Ad hoc committee consisting of members of business and industry, parents, and legislators. The math consultant also confers with the committee on an ongoing basis as questions arise from the field around the math standards. She also recruits teachers and faculty to assist in the production of resources to support the implementation of the standards found on the KSDE math website.

Not unlike what Goodlad says to Durden (2005) “the political and reform cultures were closely interconnected and reflective of one another,” Kansas schools are in the midst of the redesign era, which opens a myriad of opportunities for simultaneous renewal. Pre-service and in-service teachers explore and implement innovative instructional practices at the same time. The state consultants provide guidance and advice for school administrators and work with them to address larger issues around math education. Often this will lead to creating taskforces charged with further investigation of a specific topic resulting in the production of guidance documents for the field (e.g. KSDE White Paper on Unpacking the Standards, KSDE White Paper on Fluency, KSDE White Paper on Acceleration). To create a collaborative environment for dealing with issues and concerns, a “Math Leaders Group” was created. This group meets a minimum of four times throughout the school year, face-to-face and virtually, to discuss hot topics and to create useful resources. A Math Content Educators Listserv is utilized to share vital information regarding mathematics teaching and learning. Collaborations between KSDE, math education leaders, both from the school and university have prompted the design and implementation of professional development opportunities, reaching all demographic areas of Kansas.

Clinical Practice

Core component four addresses the heart of the School-University PDS model that has been in place at KSU for nearly three decades. The field experience components of our elementary and secondary education programs both support and dictate the learning that takes place in the university setting. For pre-service teachers, this model is the driving force for a variety of learning experiences. It is the role of the faculty to prepare pre-service teachers for the classroom and to thoughtfully make and supervise practicum and internships placements. In alignment with Goodlad (1994), Mercer and Myers (2017) suggest at KSU it is more than simply assigning pre-service teachers to a classroom, the university also needs to ensure these classrooms are being supported. Faculty arrange an initial introductory meeting to ensure clear and consistent expectations with each pre-service and in-service teacher pairing. We participate in formal and informal observations following a coaching model with in-depth reflections and goal-setting. Finally, we host a debriefing at the conclusion of practicum and student teaching experiences to set goals for the next stage and to gain insight into current practices and issues. According to Goodlad's (1994) Postulate Fifteen, as described by Paufler and Amrein-Bearsdley (2016), these

types of experiences are vital to preparing pre-service teachers, even stating that “teacher education programs must not admit more students than can be assured access to quality educational experiences”. Many education programs at the university are growing, primarily in online settings, but through the use of a supervisor model, distance placements, and virtual observations, pre-service teachers can still be engaged in high-quality learning experiences, both in the university classroom and through field experiences.

Another key role of the university in this model is building and maintaining relationships with and between students throughout their time at the university and in the first few years of teaching. KSU faculty developed a committee specifically for the purpose of fulfilling Goodlad's Seventeenth Postulate, stating the need to “establish linkages with graduates for purposes of both evaluating and revising these programs and easing the critical early years of transition into teaching.” As a result of this committee, EDCATS was created. EDCATS is a student- and faculty-led organization that pre-service teachers join as they begin their careers as students at the university and maintain membership through their first years as classroom teachers, providing a shared vision for education, support in their practices, and professional learning opportunities. As EDCATS become classroom teachers, university faculty are still in connection with and aspiring to equip our new teachers for success in their classrooms.

Active Engagement in the School and Local Community

As the term “local” is being redefined with the invention and implementation of virtual recording, streaming and communicating platforms, component five, which encourages involvement and engagement in the school and local community is also reimaged. Pre-service and in-service teachers are seeking the ability to stay in the hometowns or to move to new locations in the state. The School-University-State PDS Model promotes regional and localized training, based on the needs of the school and community as described below. Faculty have worked alongside KSDE content consultants to design courses, professional learning opportunities and host state-wide conferences to further engage with communities and meet the needs of local districts as they take part in redesign efforts. A foundational principle of the redesign initiative is community support through the means of town hall meetings, clear and consistent communication, and feedback on initiatives.

Intentional and Explicit Commitment to the Professional Learning of all Stakeholders

Through the School-University-State PDS Model, intentional and explicit professional learning for all members of the partnership is emphasized. University faculty, administrators, and teacher leaders identify needs for professional development and work collaboratively to design, develop, and implement high-quality professional development. Starting in 2017, the KSDE math consultant, with the support of trainers, hosted four regional trainings designed around similar mathematical and pedagogical content as the MSP projects from the prior year. They quickly reached capacity and the number of regional trainings doubled in 2018-2019. Host schools or universities were identified in a variety of regions throughout Kansas. A 2-day trainer of trainer model is employed to build capacity, with math education faculty from KSU serving as the trainer of trainers. In year one, we drew on what we learned from our MSP grant work and our plans for the two-week summer institutes for teachers to design the 2017-2018 regional trainings. The

training presentation, with notes and all materials, are stored in a shared drive allowing all trainers to access and implement the trainings. Years two and three of the regional trainings, followed similarly, utilizing Basecamp as the platform for sharing resources from the training and for continued dialogue.

From this experience, university faculty gathered what they learned from their work with teachers in the grant project and regional trainings, then translated it into training for pre-service teachers. In this way, in-service and pre-service teachers have a common base of knowledge regarding the teaching and learning of mathematics. As Goodlad (1994) states in Postulate Fifteen, universities must only admit the number of students they can ensure will have access to appropriate and effective placements. As student populations grow and teacher shortages are abundant in the state, with over 600 vacant teaching positions in 2018 (US News and World Report, 2019), providing professional learning experiences to teachers throughout the state will allow more pre-service teachers access to effective placements.

Shared Commitment to Research and Innovation

Members of the School-University-State PDS partnership engage in research that promotes lifelong learning by analyzing current school cultures, addressing needs, evaluating progress and redesigning academic curriculum and professional development in an on-going, cyclical manner as demonstrated by faculty engagement with local, regional and national organizations. A shared commitment to research and innovation, core component seven, has been and will remain a key aspect of the School-University-State PDS model, with an emphasis placed on the vision and goals, written with input and collaboration from university faculty and district representatives throughout Kansas. The math consultant has many roles, one is to oversee the work of the Mathematics and Science Partnership (MSP) grants obtained by university faculty and attended by school staff, including teachers, instructional coaches and administration. Further situated in the works of Goodlad (1994), the MSP programs provide opportunities for simultaneous renewal on multiple levels; in-service teachers and administrators are engaged in the ongoing and in-depth professional development led by university faculty, and in the schools, opportunities arise for university faculty and staff to gain valuable insights into current school cultures and to collaborate with in-service teachers. While several MSP grant projects have been implemented at KSU over the past 15 years, the opportunities for collaboration among partners and simultaneous renewal will be highlighted with two recent MSP projects.

Project Achieve and Project Excel

Project Achieve and Project Excel are two of KSU's most recent MSP projects that were funded through the Kansas State Department of Education. The KSDE Math Consultant oversaw the funding and reviews of these projects, that were designed and led by IHE faculty. School administration gave input to IHE faculty and two-week summer institutes were designed, with school year, job-embedded coaching following each institute. Pre-service teachers were involved in the summer institutes and were often placed in classrooms with teachers who participated in these projects. This allowed each partner in the School-University-State PDS relationship to be a part of the simultaneous renewal process (Goodlad, 1994). The goals of Project Achieve and Project Excel were to deepen teachers' content knowledge and increase the use of eight high-

leverage, research-based teacher practices articulated by the National Council of Teachers of Mathematics (NCTM) (NCTM, 2014). NCTM (2017) displayed these teaching practices as an iterative process outlined in Figure 1.

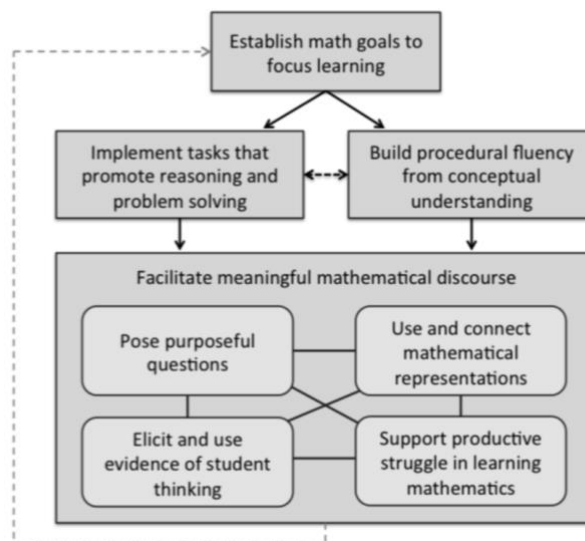


Figure 1. Effective mathematics teaching practices framework. (NCTM, 2017)

Project Achieve began with a summer institute in June 2016 and follow up activities occurred during the 2016-2017 school year and ran for three years in this manner. Project Excel, running from June 2017 through August 2018, included many similar components to the previous MSP project (i.e., the summer institutes and school-year coaching), but was expanded to a multi-university project, reimagined to include virtual components to reach rural and long-distance partner districts with an emphasis placed on building learning communities throughout the state with the underlying theme of “growth mindset”.

Goodlad's (1994) Postulate Thirteen, states that teacher education programs “must be infused with understanding of and commitment to the moral obligation of teachers to ensure equitable access to and engagement in the best possible K-12 education for all children and youths”. Throughout the MSP Grant Projects (Project Achieve and Excel) pre-service, in-service teachers and coaches, as well as university faculty were engaged in pedagogical content knowledge building that promoted equitable learning opportunities for all students. NCTM's *Principles to Actions* (2014) clearly outlines “Access and Equity” as a principle for effective programs. Teachers explored this principle, with an emphasis on shifting teacher mindsets towards equitable access to learning for all, including examination and implementation of instructional strategies to reach all learners.

Each year the structures were similar with the focus on the NCTM (2014; 2017) teacher practices of “build procedural fluency from conceptual understanding,” “implement tasks that promote reasoning and problem solving,” and “facilitate meaningful mathematical discourse”, respectively. Activities included math content presentations by mathematicians from KSU, study of the math standards in grade bands, book studies with a pedagogy focus, creation of “action plans,” and professional learning community time. This parallels what Goodlad (1988) described as opportunities for educators at all levels to “infuse their efforts with the expertise of others

engaged in similar work". Participants joined forces to create a network of teachers committed to improving mathematics teaching and learning. Follow-up activities included classroom visits by a math coach and the project principal investigators and district-wide professional development experiences.

These initial collaborations between members of the School-University-State PDS served as platforms and were extended to provide more systematic feedback and professional development to the entire state. Continued involvement of all partners has clarified a unified need for pathways to provide professional learning and networking opportunities for teachers, many of whom serve as cooperating teachers for university students throughout the state.

Perspectives from Partners

Gathering the perspectives of those involved in the partnership is a valuable way to understand the ways that the School-University-State PDS Model has expanded to reach more schools and to stay connected to KSU graduates as they transition from pre-service to in-service teachers within the PDS model.

Voices from the University

Tonnie Martinez, Assistant Professor COE, Coordinator of the Office of Innovation and Collaboration

EdCats supports graduates and provides mentoring to new teachers through social media, EdCat Chats (PD videos), STEAM career interest videos, and EdFEST (Summer STEM camp visit and EdCamp format for professional development). We have been successful in creating an EdCat "movement" in the college, which has resulted in a welcome back "ringing of the bell" ceremony for "Forever EdCats" and invigorated the recruitment environment in our college.

Debbie Mercer, College of Education Dean

The foundation has evolved throughout our 30-year history of PDS partnerships with schools of differing demographics to best provide both school partners and our college faculty and pre-service teachers with mutually beneficial learning opportunities. While the foundational elements built on strong relationships have remained the same, the specifics have evolved to best meet the needs of the participants. For example, technology plays an ever-increasing role in our society. We use technology to provide more detailed feedback during internships and student teaching experiences; conference with CTs, CIs, building principals, candidates and/or college faculty; and professional learning opportunities. We work more closely with the Kansas State Department of Education as they add content area consultants and other support structures. One final example of the ever-changing nature of our PDS partnership involves a closer relationship in supporting early career teachers. Society and schools are not static; neither can our PDS partnerships remain stagnant.

Voices from the Schools

Joyce Temanson, Kindergarten Teacher, Skyline School District

We were very fortunate to have the opportunity to be a virtual site for Project Excel, which allowed our teachers the convenience of staying local to attend the Project Excel class. Out of a PK-12 building we were represented by the following grade levels: kindergarten, first, second, third, fifth, sixth, seventh/eighth, and high school, which allowed us to collaborate across the grade levels. We were able to have the tough conversations about aligning curriculum across the grade levels, common vocabulary, and goals that we would like to meet as a building in Math. Another benefit from the class were the resources and connections to districts throughout the state.

Tegan Nuser, Cooperating Teacher-Mathematics, Wamego High School

My role as a cooperating teacher is complex. I see myself as a mentor, a colleague and a co-learner. We can impact the pedagogy of teachers and ensure that new teachers are as well-prepared as possible to positively impact students. Professional development should facilitate individual teacher's needs by providing access to what research suggests are best methods and connecting them with experts in their field to help implement them. My student intern has knowledge of and attempts to implement the mathematical teaching practices found in NCTM's Principals to Actions, based on what she is learning in her coursework at KSU.

Pam Dombrowski, Secondary Math Specialist, Geary County School District

There are many benefits for our teachers participating in the MSP Projects. One is mathematics knowledge. Teachers are able to learn more deeply about math concepts, that they may have only been exposed to in their undergraduate programs. Another benefit for teachers is collaboration with colleagues. In the MSP Projects, teachers are able to collaborate with teachers, not only in their building, but in their district and other districts across the state. It allows them to receive ideas to implement, and also to validate the good things they are doing already. Our partnership with KSU is invaluable, these collaborations help drive professional development in the district.

Scott Harshbarger, Principal, Rock Creek School District

The benefits of the MSP program were many. Foremost was the chance for elementary teachers from two different buildings within the district to attend and bond together for two weeks. Collaboration like this is often thought of theoretically, but rarely does the time present itself to make it happen. They accomplished much together, and the action plan that was developed is in place today. The teachers enjoyed using the Basecamp application to share articles, plans, ideas, and results with each other and with teachers from across the state. One of our goals was to develop our Professional Learning Communities (PLC's). Without the training we received at Excel, I am not sure we would be this far along in the process.

Challenges

We have identified numerous ways that the partnership has succeeded in broadening partnerships beyond local schools; however, a variety of challenges exists. Reaching all districts and IHEs throughout the state is a challenge, and greater yet, is creating and maintaining a shared vision for education. As the math leaders' group and regional trainings continue to grow, we are reaching out and differentiating professional learning opportunities to meet the needs of all teachers of mathematics throughout the state. Another caveat to explore is the expansion of this School-University-State PDS Model to every content area. Currently the math education

consultant and math education faculty at KSU have been at the epicenter of this transformation, yet for greater impact on teaching and learning to engage all learners and a clear mission to be fully developed and implemented, all content areas will need to be included in this partnership. These challenges offer unique opportunities for collaboration and growth throughout the state that can be embraced by the School-University-State partnership.

Implications

This tripartite School-University-State PDS Model has been influential within math education throughout the state of Kansas. The three separate entities, School, University, and KSDE, work collaboratively and simultaneously to cultivate engaging classrooms and equitable access for all K-12 children. Faculty at Kansas State University are actively engaged in work with the Kansas State Department of Education through the MSP projects and Math Leaders Group driving professional development for in-service teachers and impacting the content and pedagogy being learned by pre-service teachers. Other content areas can follow a similar process to encourage renewal amongst their counterparts. The KSDE content program consultant plays a vital role in this model, forging relationships with teachers and administrators in the schools and university faculty. The network of math leaders from around the state, formed through the School-University-State PDS model are organized into working groups and teams to help disseminate information about the standards, train teachers to teach the standards, respond to questions from the field, address issues, generate resources, and to build a professional learning community of math educators across the state. University faculty and K-12 teachers work side-by-side to review standards, create resources to assist with the implementation of the standards, write white papers to address important issues, design and implement professional development and more. This work simultaneously informs the work faculty will do with pre-service teachers. The potential for growing new partnerships within the School-University-State PDS remains optimistic. The simultaneous renewal among the members of the partnership serves as a catalyst for change with the aspiration of providing equitable access to a high-quality math education for all K-12 students.

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