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A Century of Leadership in Mathematics and Its Teaching

Growth through Reflection in Mathematics Education

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District-University Collaborations to Support Reform-Based Mathematics Curriculum Implementation

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ABSTRACT Curriculum change is inevitable in schooling. For content areas such as mathematics that are already under the national spotlight, transitioning to new curriculum materials while concurrently enacting instructional reform creates both a challenge and an opportunity. This paper discusses how partnerships between two state universities and respective neighboring school districts resulted in the creation and implementation of graduate courses for teachers targeted at curricular and instructional reform specific to each district. Common course components between both university-district partnerships were identified in the areas of mathematics research, practice, and leadership advocacy and found to be instrumental in supporting instructional reform and fostering sustained development. Implications for collaborative partnerships, curriculum implementation and research are discussed.

KEYWORDS *curriculum, mathematics, teachers, professional development, reform, collaboration*

Improving student achievement in mathematics has been a critical topic in the education community for decades. Teachers are the most important factor in student achievement (McCaffrey, Lockwood, Koretz, & Hamilton, 2003; RAND, 2012) and therefore, “substantial” teacher professional development based on research-informed instructional practice is of high importance (Yoon, Duncan, Lee, Scarloss, & Shapley, 2007). The Association of Mathematics Teacher Educators (AMTE) suggests “close, respectful, bidirectional relationships” (p. 166) between universities and PK-12 districts as one strategy to improve the effectiveness of current and future teachers of mathematics (AMTE, 2017). Curricular reform environments provide a prime opportunity to build these collaborations.

Many PK-12 districts adopt reform-oriented mathematics curriculum in an effort to improve educational outcomes. However, district leaders report curriculum implementation often looks different than intended (Olsen & Kirtman, 2002) because providing reform-oriented curricular materials does not ensure reform-

oriented practices (Handal & Herrington, 2003). Lai (2015) challenges district leaders to reduce or close the gap between intended curriculum and implemented curriculum by addressing factors that may hinder change. In this paper we share how graduate courses for teachers were co-developed and implemented by two university-district collaborations to target the factors that impact curricular and instructional reform in elementary mathematics. We found key course components related to research, practice, and leadership instrumental in supporting instructional reform and fostering sustained development.

Background and Rationale

In 2017, two state public universities and respective local school districts developed two targeted graduate courses, both with a focus on research-informed best-practices in mathematics education during curriculum implementation. A mathematics university faculty member (authors Nebesniak and Gomez Johnson) and district curriculum

leader (e.g., curriculum specialist or instructional coach) co-taught each course associated with the selected district curricula. Participants for each course were limited to only district elementary teachers. Instructors designed the graduate courses specifically for collaborating district teachers to attend to their unique systems and cultures for timely and practical application. Participating teachers received graduate credit for completing the district-funded professional development. The instructors aimed to establish stronger ties between PK-12 districts and higher education by connecting theory and practice.

Key Course Components

Although each graduate course focused on corresponding district needs and realities, we identified three key components of the two courses that were instrumental in curriculum and instructional reform in each district: research, practice, and leadership. We identified these three components as integral because they were central aspects of both courses and supported by research in professional development and teacher learning. First, each course incorporated research to define and analyze evidence-based mathematics teaching and learning practices. Through the research component, teachers not only learned the specific structures of their curriculum, but also a more global perspective of their role as teachers of mathematics. Without getting lost “in the weeds” of the new curriculum, the research grounded course content and activities in a common language and frame of reference for all participants.

Instructors also emphasized the translation of research to practice. This component included identifying and aligning theory to each district’s newly adopted curriculum. Participating teachers had the opportunity to bridge their understanding of why certain curricular components were emphasized related to research while also examining where gaps might exist for supplementation.

The third component prompted teachers to put their learning into action. Teachers were empowered to use and share their learning with other stakeholders (e.g., administrators, fellow teachers, parents, students) to pave the way for sustainable change in their building and district.

Research: Define and analyze evidence-based mathematics teaching and learning practices

Research on effective professional development highlights the importance of discussing and analyzing effective instructional practices specific to the content being

taught (American Educational Research Association, 2005; National Staff Development Council, 2001). Therefore, course instructors used the eight high-leverage, research-grounded mathematical instructional practices presented in the Principles to Actions: Ensuring Mathematics Success for All (PtA) framework (National Council of Teachers of Mathematics [NCTM], 2014) as the foundation of the course. “High-leverage” refers to “those practices at the heart of the work of teaching that are most likely to affect student learning” (Ball & Forzani, 2010, p. 45). The instructors engaged teachers in detailed study of the PtA mathematical practices and the supporting research behind each practice. Teachers read NCTM publications, conceptualized teacher and student actions aligned to each practice, and participated in course activities to better understand how the practices might be applied in their classrooms.

Practice: Identify and align theory to newly adopted curriculum

Since teachers are more likely to implement new instructional practices if those strategies are tied to their current curriculum and practice (Cohen & Hill, 2001; Putnam & Borko, 2000), the instructors designed opportunities for teachers to investigate their newly-adopted curriculum at a deeper level through a PtA lens. Direct ties between research-based practices and the district’s newly adopted curriculum were emphasized in course activities and assignments. Instructors helped teachers identify how the reform-based curriculum leveraged the mathematical practices, which underscored the purpose and rationale of the curriculum. Based on their understanding of best practices in PtA, teachers also identified crucial components of curriculum lessons/units where mathematical practices may have been lacking and then collaborated to supplement those lessons/units with support materials.

Leadership: Empower teachers to lead sustainable change

According to Loucks-Horsley, Stiles, Mundry, Love, & Hewson (2010), quality professional development occurs when teachers have the opportunity to serve in leadership roles and connect their newly gained information to other district initiatives. In these courses, instructors sought to empower teachers by emphasizing the role of reflection in practice, connecting elements of the new curriculum to previously established district structures, and building teachers’ confidence to share their new learning with others. In addition, the instructors highlighted the role and importance of teachers as leaders and advocates of change. Course assignments included

teacher-created district support materials (e.g., pacing guides, formative assessments), communication plans for principals, and elevator speeches and infographics as a way to share fundamental concepts of PtA and their curriculum with other stakeholders. The instructors intended for these courses to be a springboard for further leadership opportunities for enrolled teachers and also a catalyst of sustainable change for participating school districts.

Discussion & Implications

Reactions from teachers, district leaders, and university faculty have been favorable to this collaborative approach. In particular, teachers shared how the attention to research, practice and immediate application were valuable to their overall learning. One teacher noted, “Before taking this course I wasn’t always sure how to make myself a better educator. Now I can continue to use the things I learned through this course to impact my class this year and for years to come.”

A district principal added,

My teachers have also become stronger reflective practitioners. Reflecting on their students’ demonstration of mathematical skills and the impact of their instructional practices has become a part of their daily routine. I believe this is due to their own deeper understanding of best practices in the area of mathematics. All of which had been developed during their time as a student in this graduate course.

Although our study of teachers’ changing beliefs and instructional reform is ongoing, both school district and university participants have expressed value from the collaborative effort and courses. The districts have noted increased teacher support of the newly adopted curriculum, as well as more discussions on effective mathematics teaching strategies among teachers. Also, enrolled teachers have taken on increased leadership responsibilities within their districts as curriculum “experts.” The collaboration furthered the university faculty’s understanding of current trends in curriculum and practice, as well as provided research opportunities and graduate program exposure. Furthermore, unanticipated collaborative opportunities have arisen between the district and universities including ongoing professional development, instructional coaching, Q and A sessions with building staff, and presentations at local, state, and national conferences. The continued interactions between research and practice are evidence of successful collabora-

tion and provide momentum for future projects and research.

The National Council of Teachers of Mathematics challenges a variety of mathematics education stakeholders, including PK-12 and post-secondary educators, to initiate critical conversations to improve learning experiences and mathematical outcomes (NCTM, 2018). This collaboration during curriculum reform serves as a model for creating customized teacher professional development to meet local needs while also maintaining a global perspective. The coordination of district and university collaborations like this requires an investment of time and resources from all parties, yet the value-added aspects of social ties, learning, and engaged scholarship outweigh the costs.

Admittedly, the task of enacting change in mathematics instruction is a challenging one (NCTM, 2014). Solving complex problems requires innovative ideas and unified efforts. We believe our course model serves as a mutually beneficial option for local districts and universities to support each other in this national conversation regarding mathematics education. These district-university collaborations evolved from conversations on how to best support teachers through change. Each course and district-university collaboration had its own flavor, yet the core components of research, practice, and leadership defined the vision and overall outcomes of the courses. We hope our model inspires other collaborations where diverse perspectives can leverage research, practice, and leadership advocacy concurrently to create sustainable change and progress for the benefit of teacher and student growth.

References

- American Educational Research Association (2005). Teaching teachers: Professional development to improve student achievement. *Research Points*, 3(1), 1–4.
- Association of Mathematics Teacher Educators. (2017). *Standards for Preparing Teachers of Mathematics*. Retrieved from <https://amte.net/standards>
- Ball, D. L., & Forzani, F. M. (2010). Teaching skillful teaching. *Educational Leadership*, 68(4), 40–45.
- Cohen, D. K., & Hill, H. C. (2001). *Learning policy*. New Haven, CT: Yale University Press.
- Handal, B., & Herrington, A. (2003). Mathematics teachers’ beliefs and curriculum reform. *Mathematics Education Research Journal*, 15(1), 59–69. doi:10.1007/BF03217369

- Lai, E. (2015). Enacting principal leadership: Exploiting situated possibilities to build school capacity for change. *Research Papers in Education*, 30(1), 70–94. doi:10.1080/02671522.2014.880939
- Loucks-Horsley, S., Stiles, K. E., Mundry, S., Love, N., & Hewson, P. W. (2010). *Designing professional development for teachers of science and mathematics*. Thousand Oaks, CA: Corwin.
- McCaffrey, J. R., Lockwood, D. F., Koretz, D. M., & Hamilton, L. S. (2003). Evaluating value added models for teacher accountability [Monograph]. Santa Monica, CA: RAND Corporation. Retrieved from http://www.rand.org/pubs/monographs/2004/RAND_MG158.pdf
- National Council of Teachers of Mathematics. (2018). *Catalyzing change in high school mathematics: Initiating critical conversations*. Reston, VA: Author.
- National Council of Teachers of Mathematics. (2014). *Principles to actions: Ensuring mathematical success for all*. Reston, VA: Author.
- National Staff Development Council (2001). *Standards for staff development* (Revised). Oxford, OH: National Staff Development Council.
- Olsen, B., & Kirtman, L. (2002). Teacher as mediator of school reform: An examination of teacher practice in 36 California restructuring schools. *Teachers College Record*, 4(2), 301–324. doi: 10.1111/1467-9620.00164
- Putnam, R., & Borko, H. (2000). What do new view of knowledge and thinking have to say about research on teacher learning? *Educational Researcher*, 29(1), 4–15. doi: 10.3102/0013189X029001004
- RAND Corporation (2012). *Teachers Matter: Understanding Teachers' Impact on Student Achievement*. Retrieved from https://www.rand.org/pubs/corporate_pubs/CP693z1-2012-09.html.
- Yoon, K. S., Duncan, T., Lee, S. W.-Y., Scarloss, B., & Shapley, K. (2007). Reviewing the evidence on how teacher professional development affects student achievement (Issues & Answers Report, REL 2007–No. 033). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Southwest. Retrieved from <http://ies.ed.gov/ncee/edlabs>