Mathematics Teacher Retention Working Group Summary: Raising Awareness to Better Support Mathematics Teachers and to Increase Retention

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A working group on mathematics teacher retention met at the 2009–2011 meetings of the North American Chapter of the Psychology of Mathematics Education conference (PME-NA) in an effort to bring together researchers across the nation and build a community of research practice to share results and to identify and explore new directions for research. This paper summarizes the work accomplished by the working group in a community focused on the support of mathematics teachers.

Introduction

In this paper, we share efforts to raise awareness and advance research on the issue of mathematics teachers' retention and turnover. In recent years, an increasing number of researchers have focused on mathematics teacher retention and built on existing literature (Guarino et al., 2004; Johnson et al., 2005; Ingersoll, 2001) to study the effect of professional development interventions on teachers' decisions to stay or leave. A working group on mathematics teacher retention met at the 2009–2011 meetings of the North American Chapter of the International Group for the Psychology of Mathematics Education conference (PME-NA) in an effort to bring together researchers across the nation and establish a community of research practice to share results and to identify and explore new directions for research. This paper summarizes the work accomplished by the working group in a community focused on the support of mathematics teachers.

Brief Overview of the Working Group

The Supporting Teachers to Increase Retention Working Group was launched in 2009 at PME-NA 31 in Atlanta, Georgia, to investigate the relationship between professional development (PD)/support and the retention of mathematics teachers. A second meeting in 2010 at PME-NA 32 in Columbus, Ohio, elaborated on this initial groundwork and identified directions in which participants would focus. A final working group meeting was held at PME-NA 33 in Reno, Nevada, in 2011, with the aim of moving forward with broader dissemination of participants' research results. Over three years, a total of 29 participants attended the working group sessions and helped to identify gaps in the research in order to better tackle this complex national issue. Participants contributed their ideas and their research results to the discussion and shared their backgrounds and interests on retention issues; they

identified key directions for a research agenda; and they proposed examining the ongoing preparation, support, and retention of Grade 7–12 mathematics teachers from a variety of angles, including:

- impact of professional development on teacher retention,
- relationship between content knowledge and retention, and
- identification of the research that examines the dimensions of professional development and supports interventions impacting retention.

An important aspect of mathematics teacher retention is often overlooked under the assumption that effective professional development should lead to increased retention. In fact, it is necessary to take a closer look at the type of support that helps teachers stay in their schools, let alone their profession. Therefore, we aimed at addressing the following related questions: *Can professional development/support positively impact the retention of mathematics teachers? If so, what type of support is most effective?*

To stimulate discussion, members of the group provided summaries of ongoing projects in five categories:

1. Role of technology in support/retention
2. Professional support communities that reflect the building of networks and contacts to support work, decisions, challenges, and opportunities that arise in the teaching of mathematics, including lesson study and electronically based communities of practice
3. Role of leadership and/or career enhancement in retaining mathematics teachers, including the professional development of new teachers entering the field through alternative certification and transition from other careers, as well as necessary shifts in professional development as new teachers move through the challenges of their first five years of teaching
4. Content-based professional development with emphases on conceptual linking and problem solving
5. Research issues that arise in examining teacher retention.

An extensive review of the literature supporting the work of the working group can be found in other parts of this monograph (Faughn, 2012, p. 11). In this article, we report on our discussions, which enriched the dialogue about the support gap and the work and retention of teachers of mathematics, while proposing areas ripe for further research. In light of national efforts to close poor performing schools, this work has become especially critical in order to identify ways to improve retention of mathematics teachers in the United States.

Summary Report: Activities of Working Group Meetings 2009, 2010, and 2011

Initially, participants were asked to consider the question *"Can support impact teacher retention?"* More specifically, they were asked *"What are the different aspects of support? How is impact measured? What are the opportunities and challenges encountered when researching teacher retention?"* The primary goal was to select directions for the work and identify

missing foci in the literature. Participants organized their questions and interests into four main categories:

1. Impact of PD on teacher retention
2. Content knowledge and retention
3. Research issues and retention
4. Equity and retention

A detailed list of questions arranged by interests under these four major themes was published in Faughn et al., 2010. Further discussions concluded that:

- PD must be sustained long-term and involve a community of learners.
- Effective PD can be done through videotapes and reflections.
- Mentoring necessitates careful pairing.
- Decreasing the number of preparations for beginning teachers could provide more time for planning and reflecting.
- Finding the connections between teacher retention and student learning is necessary. For example, does a teacher's perception of student success help with retention? Would evidence of increased student performance help build confidence and a sense of competence?

Finally, the advantages of "whole school" reforms and the development of leadership skills were emphasized so that individuals could bring PD back to their sites and increase an onsite presence through lesson study, lesson planning, online communities, coaching, and/or videotapes.

Participants also examined the following models of support:

- New York City Teaching Fellows
- University researcher–beginning teacher onsite mentorship
- Reformed, curricula-based PD
- Content knowledge through higher education courses
- CMP STIR 10 sites/10 models of PD intervention
- Online community of support

The 2010 working group continued by building more focused research based on active engagement of participants in productive reflection on the issues across projects. Two main breakout groups aimed at laying down the foundations of publishable collaborative work around categories 1, 2, and 4 described in the overview above.

Discussions focused on identifying background work on these issues, questions to be raised, existing data/ongoing research, and work in progress to help better understand their relationship to mathematics teacher retention. A comprehensive summary of all discussions can be found in Faughn, et al., 2011.

The 2011 meeting of the working group came in conjunction with the group organizers' endeavors to promote discussion and raise national awareness of the issue of mathematics

teacher retention through the Mathematics Teacher Retention Symposium, held March 22–24, 2012, in Los Angeles. In preparation for this symposium, several documents were drafted that set the directions and foci of the 2011 working group meeting: a clear statement of the current problem in mathematics teacher retention, a list of guiding principles in attempting to address this national issue, and a list of guiding questions aimed at advancing research based knowledge. Regarding PD and support, we continued to explore the themes of technology, online professional communities, content knowledge, and research. The following central questions and answers emerged.

Communities of Practice

- How do we build communities of practice both at the school level and at the local/regional level?
- Do communities of practice emerge as a byproduct of PD, or are they purposefully created? Are the communities sustained regardless of how they are developed?
- How do we sustain communities of practice when project funding ends?
- What purpose and value do communities of practice bring to mathematics teachers?

Communities of practice breakout participants discussed the use of video clubs in which teachers were videotaped in their classrooms and watched videos of their colleagues during professional development sessions as an adapted lesson study model. Teachers participated in a Facebook group, in conjunction with the video club, where they could comment on the experience of watching themselves and their peers. Indicators that the community provides meaningful support can be recorded as growth of participants' professionalism as they move from commiserating about their struggles to sharing lesson plan ideas within the community. Through a Noyce program in Georgia, the use of Second Life and avatars with Google Groups, and a Wiki for sharing of lesson plans and articles, an online community was developed. This program helped participants influence the content of the professional development and at the same time, was attractive to Millenials. Hosting online meetings can sustain the community through the use of comprehensive websites with lesson plans, videos, and interactivity (ability to comment and post). Communities of practice bring purpose and value to mathematics teachers by creating a sense of community in professional development settings, strengthening their identity as doers of mathematics, and instilling a sense of belonging to a more equitable group. For example, in a professional development setting, high school teachers may look up to elementary school teachers' modes of thinking and solving problems. Some reports in the literature on attitudes of teachers within a lesson study cycle suggest that members first try to hide their difficulties—thus hanging onto their view of themselves as mathematicians. They avoid threatening that view by exposing misconceptions in their own knowledge. Once such obstacles have been overcome—through community building, establishment of trust in group problem-solving activities, and presentations/discussion—changes in classroom practices are evident through better acceptance and understanding of students' difficulties, thanks to more open sharing of knowledge. Studying

professional teacher identity in communities of practice may reveal some of the appeal teachers find in nurturing professional settings. But what are indicators of a strong, professional mathematics teacher identity? We think this means that a teacher is willing to critically evaluate oneself and one's practice; to reflect on what is effective or what is not; to negotiate beliefs about oneself as a mathematician and as a mathematics teacher and to navigate society's perceptions of the latter; and to negotiate various expectations from schools, parents, district, community, oneself, and policymakers.

Mathematics Content and Pedagogy

- What aspects of mathematics content and pedagogical content knowledge contribute to teacher retention?
- What models of professional development contribute to the increase of mathematics content knowledge and/or pedagogical content knowledge of teachers?
- How can technology contribute to increasing mathematics content knowledge?
- What models of PD contribute to increasing the cognitive level of mathematics presented to students? In other words, how do we ensure transfer to the classroom?
- What models of PD increase teachers' ability to teach for understanding, as articulated in the *Standards for Mathematical Practice* in the *Common Core State Standards*?

Content knowledge breakout participants discussed the necessity of long-term intervention for content based professional development to be effective. The purpose of math content in professional development is to increase participating teachers' math content knowledge and deepen their own conceptual understanding of mathematics. But is the mathematical content explored for immediate applicability in the classroom or for longer term increased understanding? One presumed link between increased content knowledge and retention is that increased content knowledge can lead to more employment opportunities in the teaching profession and thus better options for a teacher to remain in teaching. Collected research based evidence could perhaps use case studies to look at how particular teachers' increased content knowledge made them effective and at confident teachers who want to stay in teaching and whose employers want to continue employing them. In order to ensure that the use of technology (e.g. TI Nspire) serves a deeper understanding of math content, technology should be introduced using appropriate activities that link it to increased conceptual understanding. But what are good technology activities to increase/deepen the understanding of math? Professional development providers need to be aware of the danger of using technology for technology's sake. As for classroom transfer, the basic assumption is that teachers who develop deeper conceptual understanding will want to share that with their students. But is this really the case? It may help teachers if they have an immediate venue in which to put their newly learned content knowledge to use. For example, teaching summer school in parallel with summer professional development or lesson study implementation. Ideally, such a place would be a low-stakes environment where teachers can freely experiment with new math content without feeling pressure to cover conventional material in a conventional way.

Research

- How are motivations to teach linked to expectations of career pathways?
- What factors does research say contribute to mathematics teacher retention?
- What has been the impact of PD programs that target mathematics teacher retention?
- What kind of research helps to identify the factors that contribute to mathematics teacher retention?
- What changes do mathematics teachers make in the classroom over time as a result of PD that targets teacher retention?

Research breakout participants shared professional development models of support with ensuing research efforts. They discussed an instance of PD that was content and knowledge based and focused on mathematical reasoning and conceptual understanding, while investigating its transfer to classroom practices and its impact on student achievement. Possible measures of student achievement include increased enrollment in high level mathematics classes and the comparison of district or school standardized test scores, if these can be obtained. A Noyce fellowship funded a preparation and induction support program from the junior year in college to two years into the profession. The fellowship was aimed at monitoring the effects of enhanced preparation and induction on mathematics teacher practices and retention. The challenge of tracking teachers on the job can be addressed by designating a researcher whose ability to trace individuals and collect retention and transfer data in detail is improved thanks to proximity to and trust with the teachers. Otherwise, it can be challenging to track movements between schools, even within the same school district. A local researcher can uncover nuances in the global picture of teacher retention that national data is unable to capture, especially through personal interviews to identify reasons for leaving. This site based researcher can also point to overall staffing actions, anecdotal circumstances, working conditions, or specific support activities that might have had a strong impact on teachers' decisions to stay or leave. The last model of support considered was technology intensive professional development through a master's level certification (MAT). The university group provided a community, as well as leadership opportunities, while teachers were enrolled in the program. One of the key questions raised in this case was whether completing an MAT may have a long-term negative effect on retention by providing a means for leaving the secondary classroom to pursue careers in higher education. Limited evidence on classroom transfer also suggested that it may be necessary to establish alternate onsite support when the support community is found exclusively among fellow master's students and university faculty.

Conclusions

Researching mathematics teacher retention and raising awareness of this national issue without undermining our nation's public schools has proven to be challenging. Collecting reliable data and making sense of the numbers are intricate tasks. However, more and more researchers are attempting to paint a better picture of what can be done through professional

development to help mathematics teachers. Support from communities of practice, combined with broad availability of appropriate subject matter and pedagogical content resources, are some of the strategies that professional development providers can focus on to help maintain a strong, high quality pool of mathematics educators in the classrooms. Opportunities for advancement will also be crucial for a new generation of teachers who seek further challenges and broader recognition of their abilities to make a difference. The STIR Working Group at PME-NA has suggested models of effective professional development and recommended new directions for research into the problem of secondary mathematics teacher retention.

References

Faughn, A., Pence, B., & Thomas, C. D. (2010). Working group: Supporting teachers to increase retention. In *Proceedings of the 2010 Meeting of PME-NA*, Columbus, OH.

Faughn, A., Felter, T., Pence, B., Thomas, C. D., Kent, N., & Tuba, I. (2011). Working group: Supporting teachers to increase retention. In *Proceedings of the 2011 Meeting of PME-NA*, Reno, NV.

Faughn, A. (2012). Issues of psychology of mathematics education: A review of the literature supporting research in mathematics teacher retention. *Monograph: Mathematics Teacher Retention*. Los Angeles, CA: California Mathematics Project.

Guarino, C., Santibanez, L., Daley, G., Brewer, D. (2004). *A Review of the Research Literature on Teacher Recruitment and Retention*. Education Commission of the States.

Ingersoll, R. M. (2001). Teacher turnover and teacher shortages: An organizational analysis. *American Educational Research Journal, 38*(3), 499–534.

Johnson, S. M., Berg, J. H., & Donaldson, M. L. (2005). *Who Stays in Teaching and Why: A Review of the Literature on Teacher Retention*, a report sponsored by NRTA's Educator Support Network.

AXELLE FAUGHN and BARBARA PENCE were introduced earlier in this monograph.

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