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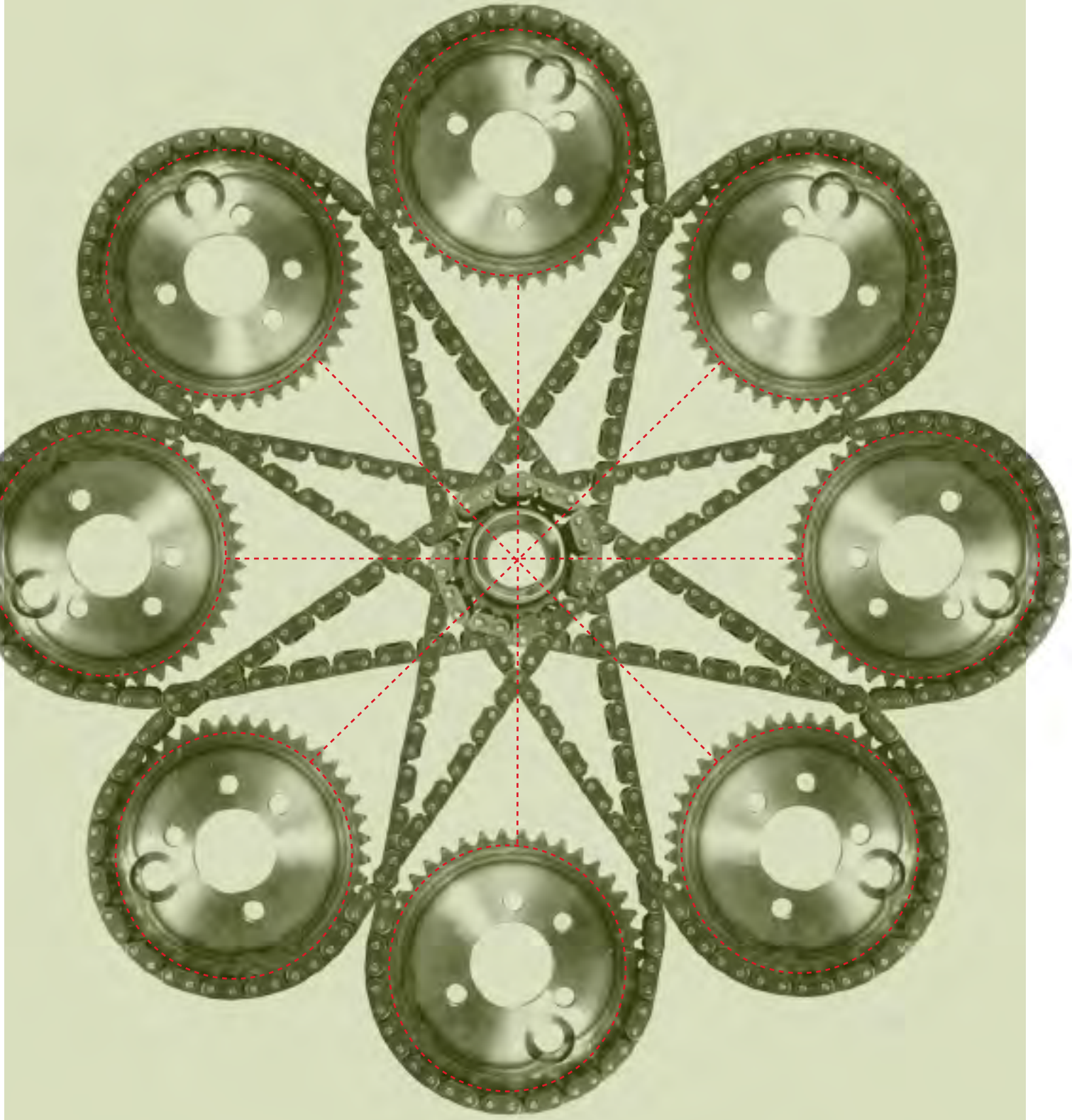

The ***NCSM Journal of Mathematics Education Leadership*** is published at least twice yearly, in the spring and fall.

The editors of the ***NCSM Journal of Mathematics Education Leadership*** are interested in manuscripts that address concerns of leadership in mathematics rather than those of content or delivery. Editors are interested in publishing articles from a broad spectrum of formal and informal leaders who practice at local, regional, national, and international levels. Categories for submittal include:

- Key Topics in Leadership
- Case Studies
- Research Report and Interpretation
- Commentary on Critical Issues in Mathematics Education
- Professional Development Strategies

Note: The last two categories are intended for short pieces of 2 to 3 pages in length

Submission/Review Procedures

Submittal of items for this publication must include three hard copies and a disk copy in text format. Do not put any author identification in the body of the item being submitted, but do include author information as you would like to see it in the ***Journal***. Items submitted for publication will be reviewed by two members of the NCSM Review Panel and one editor with comments and suggested revisions sent back to the author at least six weeks before publication. Final copy must be agreed to at least three weeks before publication.

On the cover:

This issue's cover, created by Bonnie Katz, gets its inspiration from the theme of this issue, whose articles focus on the interconnectedness of the educational system and its importance in creating—and keeping—quality teachers.

National Council of Supervisors of Mathematics (NCSM)

Inquiries about and materials for the ***NCSM Journal of Mathematics Education Leadership*** may be sent to:
Mark J. Driscoll
Education Development Center, Inc.
55 Chapel Street
Newton, MA 02458-1060
Email: mdriscoll@edc.org

Other NCSM inquiries may be addressed to:
NCSM
P.O. Box 150368
Lakewood, CO 80215-0368
Voicemail/Fax: 303-274-5932
Email: ncsm@forum.swarthmore.edu
www.ncsmonline.org

Table of Contents

Purpose Statement

The purpose of the NCSM Journal of Mathematics Education Leadership is to advance the mission and vision of the National Council of Supervisors of Mathematics by:

- Strengthening mathematics education leadership through the dissemination of knowledge related to research, issues, trends, programs, policy, and practice in mathematics education
- Fostering inquiry into key challenges of mathematics education leadership
- Raising awareness about key challenges of mathematics education leadership, in order to influence research, programs, policy, and practice
- Engaging the attention and support of other education stakeholders, and business and government, in order to broaden as well as strengthen mathematics education leadership.

Comments from the Editor:
Insourcing

Mark Driscoll
Education Development Center, Newton, MA • mdriscoll@edc.org

Outsourcing has assumed a Jekyll-Hyde quality in the public eye. From one perspective, it contributes to a world-flattening process that will produce enormous benefits for a number of very poor countries, as well as prod our own creativity at home (Friedman, 2005). However, from the perspective of someone whose job has been outsourced, the trend must appear a regrettable and baneful nuisance. Whatever one's view of it, there is no denying that outsourcing grows wider and wider as a phenomenon. Radiologists in North America are emailing MRI and CAT images to Australia and India to be read overnight. Independent contractors in Colorado are processing fast-food orders from drive-in restaurants several thousand miles away. And the examples keep multiplying. (See, for example, Friedman, 2005.)

Sooner or later, outsourcing was bound to put its mark on mathematics education. Recently, I saw a piece on CNN.com about outsourced mathematics tutoring. Using whiteboard and web-phone technologies, groups of tutors in India tutor K-12 students throughout North America. Shortly after that piece appeared, Thomas Friedman extolled in his New York Times column the efforts of two Indian developers of a mathematics program called HeyMath. The premise, as described by Friedman, is:

> "If you were a parent anywhere in the world and you noticed that Singapore kids, or Indian kids or Chinese kids, were doing really well in math, wouldn't you like to see the best textbooks, teaching and assessment tools, or the lesson plans that they were using to teach fractions to fourth graders or quadratic equations to 10th graders? And wouldn't it be nice if one company then put all these best practices together with animation tools, and delivered them through the Internet so any teacher in the world could adopt or adapt them to his or her classroom?"

Sounds appealing, doesn't it? It did to me, I must admit, so much so that I was one of the people who contributed to overwhelming the HeyMath website the day the article appeared (http://www.heymath.net/index.jsp). However, my enthusiasm was and is tempered by a cautionary story from 15 years ago.

In the early 1990's, not long after the first set of NCTM Standards appeared, several colleagues and I were convinced that curriculum materials consistent with the Standards had already been published, on this continent and elsewhere, but that they suffered from little, if any, use in schools. The conviction led to a proposal to the National Science Foundation, then to a funded project, and, in the end, to a CD-ROM called MathFINDER, which archives approximately 16,000 pages of curriculum and supplementary materials.

The gathering of the materials to be vetted for the CD was an informative as well as intriguing process. Tapping into a wide network of mathematics educators, we collected materials from school libraries and closets, from home basements, garages, and porches, and, in one memorable search, from a dark and dusty tunnel beneath my building at Education Development Center. As we suspected, most of the materials we sought had apparently vanished from classrooms. No doubt there were multiple reasons for the disappearance. However, in many cases, if not most cases, I believe the developers had suffered from a distorted impression of the influence and power of instructional materials—a mindset with a logic something like: "Made aware of engaging and relevant and mathematically powerful materials, administrators and teachers will be

motivated to obtain and use the materials, and student learning will flow from their use."

Of course, we now know much more about the many variables that influence the successful adoption and implementation of curriculum materials. However, as shapers of people's decisions and actions, mindsets die hard. In the case of outsourcing, I worry that, once more in the history of mathematics education, the mindset about overblown influence and efficacy of rich materials will cause many people to seek unwise, outsourced shortcuts to desired change and to better results for students.

Clearly, the cases of offshore tutoring and HeyMath imply that outsourcing already has had at least an indirect impact on mathematics education leadership. Probably the impact will grow. Already, online teacher professional development is flourishing and one can easily imagine all kinds of school data being outsourced for analysis far beyond the districts where the data are gathered. All of which raises the question: Is outsourcing a friend of mathematics education leadership, or foe?

I believe that we can embrace outsourcing as friend if:

- we minimize our magic-bullet expectations when we drink in the best thinking of mathematics educators from around the world, and
- we work to balance outsourcing with insourcing. Insourcing means tapping the collective wisdom and knowledge about mathematics teaching and learning growing right beneath our noses.

I have some suggestions for balancing insourcing with outsourcing. Let me frame those suggestions with a working definition of leadership offered by Spillane, which my colleagues and I have found a helpful working definition in our own efforts:

> 'Leadership refers to activities tied to the core work of the organization that are designed by organizational members to influence the motivation, knowledge, affect, and practices of other organizational members or that are understood by organizational members as intended to influence their motivation, knowledge, affect, and practices' (Spillane, 2005, p. XX).

Thinking about our leadership in these terms, I believe, puts the emphasis where it needs to be—not on authority, not on finding the best outside resources, but on influence that reaches wide and deep into the work of organizational members. Influence grows from action, and there are numerous activities our community can and should engage in, in order to enhance our influence over the shaping of mathematics teaching and learning. For example, we should:

- *Design, implement, and study variations of Lesson Study that fit the needs of our schools and districts.* Arguably, effective diffusion of knowledge about practice, within a school and across the school's district, is a prerequisite to influence over knowledge and practice. Lesson Study offers immense potential to be such a diffusion agent.

- *Design, implement, and study instructional coaching programs.* A core end goal of instructional coaching is shifting teachers' practice in positive directions. It is hard to imagine this happening without coaches influencing the motivation, knowledge, affect, and practices of the teachers they work with. Based on my involvement with math coaches in New York City, I am impressed with, and hopeful about, the potential for coaching to produce wide and deep influence in a school's mathematics program.

- *Infuse teacher and coach professional development with use of the artifacts of teaching and coaching practice.* Recent research and practice are providing insights into the strategic use by facilitators and teachers of such artifacts as written student work, transcripts of student work, and videos of classroom episodes. (See, e.g., Goldsmith et al., 2005.) This body of knowledge is relatively young and needs more attention. However, it appears that the strategic use of artifacts in professional development can influence not only teachers' content and pedagogical knowledge, but also their beliefs about student learning.

- *Collaborate in building a knowledge base about mathematics knowledge needed for teaching.* Several major efforts have begun to distinguish mathematical knowledge for teaching from mathematical knowledge needed by mathematicians, engineers, etc. (See, e.g., Hill & Ball, 2004.) Building this knowledge base is extremely important for all aspects of mathematics education leadership. I worry about our relying only on a few large university research initiatives to build this knowledge base. As a community, we should find ways to complement these large efforts with the many smaller efforts around the continent to understand mathematical thinking as it applies to teaching.

In conclusion, we in the mathematics education leadership community should not let our attention to external resources distract us from developing the internal

resources that can enhance our influence toward greater mathematics learning by all children. And, of course, I would not be taking that stand here if I did not think there are a host of articles you could be writing and submitting to this journal, which can help us tap into our leadership community's collective wisdom and knowledge. I heartily encourage you to do so.

References

Friedman, T.L. (September 16, 2005) "Still Eating Our Lunch," OpEd column, *New York Times*

Friedman, T.L. (2005) *The world is flat: A brief history of the twenty-first century.* New York, NY: Farrar, Straus and Giroux.

Goldsmith, L., Seago, N., Driscoll, M., Nikula, J., & Blasi, Z. (2005) The principled use of classroom artifacts in professional development. Presentation at the Research Presession of the Annual Meeting of the National Council of Teachers of Mathematics. Anaheim, April 2005.

Hill, H.C., & Ball, D.L. (2004). Learning mathematics for teaching: Results from California's Mathematics Professional Development Institutes. *Journal for Research in Mathematics Education.* 35(5), 330-351.

Spillane, J. P. (2005) *Distributed leadership.* San Francisco, CA: Jossey-Bass.

Mathematics Leadership Needed To Close Achievement Gaps:
A Commentary on a Critical Issue in Mathematics Education

Lesa M. Covington Clarkson • covin005@umn.edu
Ross Taylor • ross@mathpump.com

The need to eliminate mathematics achievement gaps by race and other factors is the greatest challenge we leaders in mathematics education face today. Achievement in mathematics will be a major factor in determining whether a person in the information society becomes a "have" or a "have not." As we move into a global economy our country needs a high level of mathematics achievement to have the brainpower to maintain our leadership role in the world. We need to convert mathematics from a filter that screens out some students, especially students of color, from the pipeline to opportunity into a pump that propels all students ahead to opportunity. Today both of us are active in the Project to Uplift Mathematics Proficiency (PUMP) whose mission is to convert mathematics from a filter into a pump.

The No Child Left Behind (NCLB) legislation has required each state to develop testing systems that include high-stakes mathematics tests in each of grades 3 through 8 and in high school. In this paper we shall: (1) address the need for leadership by mathematics education leaders in the development and implementation of statewide testing systems, and we shall (2) identify the leadership and strategies that are needed to support teachers at the classroom level.

Each state develops standards and then designs a testing program aligned with those standards. We believe that state standards and testing should be aligned with the standards of the National Council of Teachers of Mathematics (NCTM).

One of the authors, Lesa Clarkson, has had experience with the mathematics standards in four different states. She was chair of the middle school grade band standards in Minnesota; she participated in state alignment studies in Alaska and Alabama; and she met with teachers as they worked through the Georgia standards. These experiences indicate that curricular alignment to state standards is not only the right thing to do, it is critically important in the quest to raise student achievement and to close achievement gaps in mathematics.

In addition, time spent with a charter school that was underperforming in mathematics, but which experienced a significant turnaround in eighteen months, support five "start here" strategies for increasing student achievement.

Strategy 1: Curricular alignment.

Curricular alignment provided concrete evidence that a curriculum aligned with the state standards gave students experiences with mathematics content that they were expected to know and directly improved their scores on the state test. Moreover, opportunity to learn increased when the curriculum focused on state standards as opposed to a mere walk throughout the text. Comprehensive alignment would include covering grade level skills that would otherwise follow the state assessment.

Strategy 2: Examination of existing data.

Two different types of data analyses are useful in assessing and improving achievement. The first type of analysis looks for trends over several years to uncover consistent strengths and weaknesses in student performance. The second type of analysis follows groups of students over time to determine steady growth that prepares students for their grade level expectations. These analyses serve unique purposes for guiding instruction.

Strategy 3: Professional development.

Instruction should be continually guided through professional development experiences. Teachers are more effective

when they know (not memorize) and understand state mathematics standards and have embedded the use of test specifications and sample problems within their curriculum.

Strategy 4: High quality curriculum.

While there is no perfectly aligned curriculum, there may be a curriculum that will more closely meet the standards' needs of students. Many publishers taut that their curriculum is aligned to the National Council of Teachers of Mathematics' (NCTM) standards. But states are assessing their standards. These state standards, therefore, are more grade level specific and identify the skills that will be assessed as well as when they will be assessed.

Curricular goals need to be aligned with the NCTM standards. We believe that state standards aligned with the NCTM standards provide students with mathematics that give them options for post secondary study and career choices.

Strategy 5: Effective use of time.

The challenge with underperforming students is that these students have more skills to learn in the same time frame as other students who are performing at grade level. In order to make up for the deficient skills, under-performing students need more time. Teachers then, have to be more creative about creating more opportunities for students to catch-up and move along with their peers. How much time is allocated to mathematics instruction? Most curricula were developed for fifty to sixty minute daily mathematics lessons. The real time question, however, is not "How much time is set aside for mathematics instruction?." The deeper time questions become: How is instruction time used? Is there other time during the day that can be allocated to math skills? What math skills/content can be taught/used during additional times of the day? Students who are behind in mathematics are responsible for their grade-level skills which are usually developmental and dependent upon skills from previous grades.

Both of us attend monthly meetings of Minnesota's Assessment/Accountability Stakeholder Committee. The Committee is chaired by the State Commissioner of Education and includes key leaders from the State Department of Education, the legislature, and various stakeholder groups such as the teacher unions, the administrators, the PTA, etc. However, we observed that the Stakeholder Committee had no leaders from subject-oriented groups such as the Minnesota Council of Teachers of Mathematics. To compensate, we invited ourselves to attend meetings as observers. We find that at the state level everything is political. Teacher unions have political clout. Subject matter organizations do not. Therefore, wherever relevant and possible, we leaders in mathematics education need to invite ourselves to the "table." We have found that electronic communication is an effective tool for providing leadership. For example, we have the e-mail addresses of all members of the Stakeholder Committee and we can easily send messages to the key education decision-makers in the state. We have gotten very good response from that strategy.

Our experience tells us that mathematics achievement gaps can be closed. However, our experience also tells us that we must be proactive; otherwise we could end up with a state-wide testing system that will be part of the problem instead of part of the solution. We need to ensure that we don't go back to the basics, that the test levels are appropriate, and that the testing system is aligned with the state standards, and that the state standards are aligned with the NCTM Standards.

Mentoring Matters: Helping Transitioning Teachers

Dr. Nancy S. Lewis, University of Central Florida • nlewis@mail.ucf.edu
Bonnie A. Swan, University of Central Florida • swan@mail.ucf.edu

"The most powerful instrument for change, and therefore the place to begin, lies at the very core of education—with teaching itself." (National Commission on Teaching & America's Future [NCTAF], 2003).

Changing of the Teaching Force

Teachers matter, and teachers of mathematics are a changing population. Because of problems with retention we are faced with an influx of novice mathematics teachers with diverse backgrounds. Many new entrants into mathematic teaching are people with backgrounds in mathematics, but little education in teaching and learning. One way to help these novices reach their potential as mathematics educators, and thereby improve the mathematics learning of their students, is to pair them with accomplished teachers who can mentor beginners in the complexities of teaching. This article will describe reasons for a changing teaching force, review the literature on mentoring, and finally offer a model of multi-layered mentoring designed to work within a school district/higher education partnership for people transitioning into education.

There is little doubt that the *No Child Left Behind Act of 2001 (NCLB)*, stresses high quality in the teaching force. One aim of NCLB is to lower the barriers that keep many talented people from becoming teachers. NCLB gives states three broad guidelines in defining highly qualified teachers. They must hold a bachelor's degree, have full state certification or licensure, and prove that they know each subject they teach. However, full state certification can be a temporary teaching certificate, which requires no courses on teaching and learning, and that temporary certificate may be valid for up to three years. This means that a person who holds a bachelor' degree and has demonstrated mastery in the content area can easily become a mathematics teacher with little or no background in education. Consequently, the mathematics teaching population is apt to continue to change quite significantly from a population who come with an educational background, as people from industry will become a viable part of the teaching corps. Although many people from industry are mature and successful professionals, they are novices when it comes to teaching.

Industry can provide a valuable pool of novice, inexperienced teachers who can become effective mathematics educators. Typically, people with the high level of mathematics mastery required for secondary certification come from professions such as engineering, where they have used mathematics as a tool in the 'real world'. They know the math; they have used mathematics in their work. Their unique knowledge and skills allow them a true-to-life perspective that can make mathematics "come alive" for students. Studies show that content knowledge of teachers has an impact on student achievement (Goldhaber & Anthony, 2003; Sanders & Rivers, 1996; Wright, Horn, & Sanders, 1997). At the same time, while people transitioning from industry into teaching most likely have content knowledge in mathematics, they often lack the pedagogical knowledge and pedagogical content knowledge associated with good teaching.

Problems with Attrition

Most new teachers, either from industry or from colleges of education are talented and have potential. Simply stated, we cannot afford to lose them. And we are losing them—

in droves. Since the early 1990s, more teachers left the field of education than entered it, and the problem is getting worse. For example, Ingersoll found (NCTAF, 2003, also see Ingersoll, 2001) in the school year 1999-2000 a staggering difference of 55,000 (or 24 percent) more teachers left the system than entered it. Compare this with 1987 -1988, when there was only a 3 percent difference. The National Commission on Teaching and America's Future (2003) estimates that almost one-third of all new teachers leave the field in the first three years and after five years we have lost up to half.

We all know having skilled teachers and keeping them is one of the best ways to improve student achievement, hence it is crucial that we make a strong effort to support mathematics teachers in those critical first years. The problem becomes how leaders can best meet the needs of novice teachers coming from industry as the teaching population shifts. Ball (2003) succinctly states that, "We cannot afford to keep re-learning that improvement of students' learning depends on skillful teaching, and that skillful teaching depends on capable teachers and what they know and can do" (p.1). We can no longer do what we have always done.

Supporting Novice Teachers

Some important questions for the educational community to consider are:

- *How can we help novice teachers from industry develop the necessary pedagogical content knowledge essential to becoming effective educators?*
- *How can we be supportive in a way that both improves retention and contributes to new teachers' professional development?*

One way to meet these challenges is to provide all novice teachers with mentors as they learn to teach, and not just at the end of teacher education programs. Mentoring is defined here as the process of supporting or coaching new teachers by more experienced individuals in order to improve and increase work-based learning. Mentoring is especially important for teachers transitioning from industry who are likely to enter the classroom with little formal training in teaching and learning. Effective mentors can provide the population of novice teachers who are transitioning from industry with models of and experiences with exemplary teaching to assist in the new teachers' development of pedagogical skills.

The word *mentor* comes from Greek mythology where *Mentor* was an old friend of Odysseus entrusted with the education of his son Telemachus. Although the notion of mentoring is quite old, mentoring has increased dramatically since the eighties as a way to support new teachers and improve retention (Huling and Resta, 2001). Most of the literature on mentoring describes the benefits for new teachers (Odell and Huling, 2000), but some describe the benefits for the mentors themselves (Holloway, 2001; Gordon and Maxey, 2000). Our focus in this article is on the benefits for *new* teachers.

According to the National Commission on Teaching and America's Future (2003) mentoring has a positive effect on teacher attrition. "With an effective mentoring program, new teachers not only stay in the profession at higher rates, they also become competent more quickly than those who must learn by trial and error." (p.123) Likewise, Eberhard, Reindhardt-Mondragon, and Stottlemyer (2000) investigated variables that influenced beginning teachers' decisions to continue teaching or leave the profession and found that effective mentors increased the likelihood of retention, especially when the mentor-protégé relationship continued into the third or fourth year of teaching.

The importance of learning from a more seasoned, knowledgeable professional is held in high regard and teachers certainly value mentoring. According to Smylie (1989), teachers rate learning from other teachers as the second most valuable source of information about effective teaching over only their own teaching experiences. He found colleagues are a more valuable learning source than university professors, administrators, consultants, or specialists.

Mentoring can be a powerful way to assist people in learning to be effective mathematics educators. But there exists great variability in mentoring programs. Smith and Ingersoll (2004) analyzed data from the nationally representative 1999-2000 Schools and Staffing Survey and identified four different levels of mentoring programs and that had different effects on one year retention—whether or not the teacher left education, or moved to a different school. The levels they identified were:

1) *No support provided*;

2) *Basic induction* which includes a mentor in supportive communication with administrators;

3) *Basic induction plus collaboration* which adds seminars for beginning teachers and collaboration with other teachers (or common planning time); and

4) *Basic induction plus collaboration plus a teacher network plus extra resource*, where teachers participate in an external teacher network, a reduced number of preparations, and a teacher's aid.

Smith and Ingersoll found that in their data 56 percent of teachers had basic induction, and 26 percent had basic induction plus collaboration, only one percent of the beginning teachers had the full package, and three percent had no support at all. As the level of support increased, the attrition rate improved. Attrition rate in this study was defined as *movers*, those who moved to a different school, and *leavers*, those who left the profession all together. The statistics illustrated that teachers who received induction basic (15 percent leavers and 21 percent movers) were only slightly different from those who received no mentoring (20 percent leavers and 21 percent movers). However for teachers who received basic induction plus collaboration the numbers decreased to 12 percent leavers and 15 percent movers. The data also show that the teachers who received the full, multi-layered mentoring had only 9 percent leave the profession and 9 percent move to a different school.

Similarly, the findings of a large-scale study at the National Center for Research on Teachers Learning (Kennedy, 1991) with a sample of 700 teachers and teacher candidates from a variety of programs including pre-service programs, in-service programs, alternative routes and induction programs, found that the availability of mentors alone does not guarantee that new teachers will become "better" teachers. The fact that mentors have seniority or are successful at teaching children does not mean they are going to be effective at teaching new teachers. Another concern of Kennedy's was that often mentors are not given the release time required to meet with new teachers effectively. Mentors need time both to observe and to conduct pre- and post-observation coaching to allow for reflection on the part of the mentors, a need not always possible to meet in an ordinary school setting. The dilemma is further compounded by a wish of many new teachers to remain isolated for fear of being found incompetent. Seasoned educators and the public have high expectations of beginning teachers, often expecting them to perform at the level of a veteran. Consequently, first-year teachers feel overwhelmed and isolated (Brock & Grady, 1998). Plainly, having a skillful mentor can be critical for new teacher retention. But the scenario of new teachers' working in isolation and lacking guidance of experienced teachers is so common that education has been called "the profession that eats its young" (Halford, 1998, p.33).

Clearly, the *quality* of the mentoring program is related to positive effects of teacher retention, and yet not all mentoring programs are of the same worth and have the same positive outcomes (Smith and Ingersoll, 2004; Kennedy, 1991). Leaders of mathematics education are in a position to support the implementation of powerful mentoring programs (Halford, 1998). Implementing a mentoring program carefully, like any other new program, is critical. The literature on educational change identifies lack of proper implementation as one reason that many reform efforts fail (Hoban, 2002). Each year school districts spend untold amounts of money to purchase a variety of mathematics programs promising to have positive impacts, only to find that some schools are not willing to make any fundamental changes in the business of teaching and learning. If the school itself does not value the program, it is unlikely to provide any significant changes. Success is more than identifying a good program and importing it (Fullan, 1993). The mathematics leaders and school administrators should explicitly value mentoring, and teachers need to be provided with on-going support for effective implementation.

Supporting the Transition from Industry to Education

To be highly qualified as a mathematics teacher according to *No Child Left Behind*, an individual needs to demonstrate mastery in mathematics, have certification, and hold a bachelor's degree. There are numerous alternative pathways to mathematics teaching that exist. As a result, individuals from industry can qualify to teach without any experiences with or support from a college of education. In a study of novice teachers in New York City, Darling-Hammond, Chung, & Frelow, (2002) found that new teachers who had taken alternate pathways into teaching felt less well prepared than teachers who came from teacher education programs. This sense of preparedness was the strongest predictor of teaching efficacy. One way transitioning people can benefit from colleges of education while they remain on-the-job is by enrolling in a carefully crafted graduate degree program designed for people transitioning from industry into teaching. Not only will a graduate program facilitate an understanding of teaching and learning, the degree itself will provide an increase in

salary, which is important for most people entering a low-paying profession.

Through a collaborative effort, school districts and higher-education institutes can work together to provide an effective program to initiate these novices and provide a multi-layered approach to mentoring through a paid internship. For example, **Transition to Mathematics and Science Teaching** (TMAST) at the University of Central Florida and Orange County Public Schools (OCPS) has formed such a partnership which is now in its third year. TMAST novice mathematics teachers begin the transitioning process during summer; they take nine semester hours of education classes as they work towards a 36 semester-hour Master of Arts in Mathematics Education. At the same time, TMAST teachers obtain a certificate of eligibility from the state department of education. Once a person obtains the certificate of eligibility, he or she can be hired to teach mathematics and is considered *highly qualified*. To receive a certificate of eligibility the applicant must have a bachelor's degree and either pass the mathematics subject area exam or else have the required coursework on their college transcripts.

Like many alternative pathways to mathematics teaching, TMAST has an accelerated classroom entry for novice teachers. This makes mentoring all the more crucial. Towards the end of the first summer semester TMAST teachers are hired by OCPS to teach, as part of an **on-the-job paid internship**. Some schools provide job-sharing positions where novices work half days sharing the regular load of the traditional mathematics classroom while others work full time. They teach during the day and attend class two nights a week during the school year. During the second summer semester the TMAST teachers take nine more semester hours and graduate.

With this collaborative model between an institution of higher education and a school district, critical mentoring roles are shared by several individuals creating a multi-layered design of support. The multiple roles in this model include a school-based accomplished teacher mentor, other school-based personnel, a university-based internship coordinator, university professors, and classmates, as described below.

Multiple Layers of Mentoring

The **school-based mentor** is an important role that should be held by an accomplished mathematics teacher. In this model, consistent with the NCTM position statement on induction and mentoring of new teachers (NCTM, 2002), the school district and a college of education frequently collaborate to assure the school-based mentors have access to high quality professional development where their communication skills can be honed. This is important, as many excellent teachers know good teaching when they ee it, but have a difficult time pinpointing and articulating the reasons a lesson is successful. Mentors should be provided with opportunities to sharpen their abilities to verbalize explicitly the many complex and often nuanced instructional and management activities in teaching.

Teachers entering the teaching field from a college of education have a traditional internship through which a college student works in the classroom of a well skilled teacher and takes responsibility for teaching in incremental steps. With the TMAST model, the novices enter paid internships either half time or full time, and they either have their own classroom (full time) or share a classroom with another TMAST teacher (part time). Their salaries are paid by the school district.

Finding time for the mentor to meet with the novice is critical and challenging. According to NCTM (2002), schools should set aside time specifically so that the beginning teacher and the mentor can work together. Common time should allow ample opportunities for the school-based mentor to demonstrate planning, share resources, and assist in completing required paperwork that often can seem overwhelming to a new teacher. Shared time also allows the mentor the chance to talk to the novice and develop a relationship. All of this is especially important since people primarily learn new patterns of behavior through interactions with others (Fullan, 1993).

How can we provide release time for school-based mentors from their classrooms? Through planning and collaboration, we have found a few different scenarios that work. Since most schools have several support positions filled by individuals who are highly skilled and who don't ordinarily spend time in the classroom with students, one way to provide release time is to call occasionally on these individuals for help. For example, in most OCPS schools a *curriculum resource teacher, instructional coach, or administrator* can assist with providing a school-based mentor release time to work with a full time novice teacher or just as importantly, release time for novice teachers to observe their mentors or other skilled teachers. The resource

teacher can teach a class for the mentor and the novice on a fairly regular basis, thus allowing them to observe each other teach. If mentor and novice are allowed a common planning time to enrich and inform the mutual observations, the relationship grows even stronger.

In the second scenario, two novices job share in a paid internship and they share one mentor. Since a typical teaching load is 5 classes of math, with one planning period, each novice teaches 3 classes (for a total of 6 classes between them), and the unused planning time can be 'given to' the school-based mentor. Once the school-based mentor's teaching load is reduced, she will have time to dedicate to mentoring. Both novices can conduct their planning either before or after school, and the school-based mentor will have ample opportunities to observe the novices teach and collaborate with them. The school-based mentor will also be in a position to teach a class for the novices, thus affording them opportunities to observe other teachers. When release time is afforded, there are opportunities for the school-based mentor to observe and co-teach with the novices and also to arrange valuable opportunities for them to observe other more accomplished teachers.

Another layer of mentoring is provided by the **university-based internship supervisor**. Since the novice teacher is enrolled in a one-year internship course (2 sections) with the university, this role is supplied by individuals who might otherwise have been assigned senior interns going through a college of education program. Our TMAST internship supervisors ordinarily meet and/or observe their assigned teachers once every two to three weeks. This supervisor provides both formal and informal assessment. Because collaboration is crucial, the supervisor is encouraged to keep an open and active line of communication not only with the new teacher, but also with the school-based mentor and the school principal or administrator. They should also be involved in helping the school-based mentor plan mentoring activities.

Having specific forms to be filled in for the observations by both the university-based internship supervisor and school-based mentor can be helpful, as can a journal that briefly recounts meetings, observations, questions, or concerns. Leaving a paper trail is an important part of accountability and provides for a point of discussion as the school-based mentor and the university-based internship supervisor work together for the benefit of the novice. Some specific examples of what we have found to be helpful include systems and procedures for frequent and regularly scheduled collaboration, job descriptions (expectations), regular follow up emails and reminders, mid-term and final evaluation reports, journals, and telephone conversations. All of these help to ensure the novice teachers are provided with the support they need.

College of education courses can include ample time for discussion and questioning about specific classroom and teaching needs and the development of a **network of peers** who can support each other in another layer of mentoring. Having the status of a student uniquely situates the novice to apply immediately what is learned in college courses to daytime teaching practice. The fact that the novice has access to **college professors** provides further support. The professor can facilitate the application of learning to the mathematics classroom of the novice. For example, while taking a methods class the novice will likely learn to use manipulatives for instructional purposes. The professor can assist the novice in planning to use manipulatives effectively, and support them in becoming reflective practitioners through assignments and discussions with their peers. Furthermore, if enough novices are enrolled at the university, the graduate degree program can be designed so that the novices proceed through the program in a cohort where novices learn and grow with each other as they complete their program of study and thus can mentor each other.

We have found that effective mentoring and support are valuable beyond the first critical year. Often students in cohorts build strong relationships with each other that outlast a university program or when teachers move to assignments at other schools. Furthermore, in a model such as TMAST, with a paid internship and supportive first year, teachers are likely to be rehired at the same school the following year. That puts the novice in a very beneficial situation of continuing a relationship and working with her original school-based mentor as a colleague.

The last important layer support for the mentoring process comes from **administrators**. In a model such as TMAST, school administration plays a critical role. Hargreaves and Fullan (2000) found that when new programs do not work, often it is because it is not considered an integral part of teaching. The multiple layers of mentoring should be embedded in the school culture, and the expectations of all mentors should be explicit and supported by the principal.

Conclusion

Effective mentoring programs are an embedded, well understood, part of teacher induction programs. It is important that this support system is not reduced to a single individual, in particular, a busy colleague who is "assigned" to a novice. Instead, it should be a complex system comprising several individuals and organizations all working together to best meet the needs of a new teacher.

In order to support the population of mathematics teachers who are coming to education from industry, mentoring is more important than ever. Many of these people are not entering America's classrooms at the end of an education program in which novices are under the supervision of, and in the classroom of, an experienced teacher. In fact, they often come to teach with little or no knowledge of teaching and learning, or experience with children. But they do have knowledge of mathematics. They are a valuable pool of knowledgeable people who have a strong desire to teach, and we cannot afford to lose them. We have an obligation to help them to become what they desire: Effective teachers who remain in teaching . One of the best ways to stem attrition and create effective mathematics teachers is to support them, with mentoring, as they learn to love to teach.

References

Ball, D.L. (2003). Mathematics in the 21st century: What mathematical knowledge is needed for teaching mathematics? Retrieved from http://www.ed.gov/inits/mathscience/ball.html.

Brock, B., & Grady, M. (1998). Beginning teacher induction programs: The role of the principal. The Clearing House, 71(3), 179-183.

Eberhard, J., Reinhardt-Mondragon, P., & Stottlemyer, B. (2000). *Strategies for new teacher retention: Creating a climate of authentic professional development for teachers with three or less years of experience.* Texas A and M Univ., Corpus Christi. South Texas Research and Development Center.

Fullan, M. (1993). *Change forces: Probing the depths of educational reform.* London: The Falmer Press.

Goldhaber, D., & Anthony, E. (2003). Teacher Quality and Student Achievement: Urban Diversity Series (No. ED477271).

Gordon, S. & Maxey, S. (2000). *How to help beginning teachers succeed.* (2nd ed.). Alexandria: Association for Supervision and Curriculum Development.

Halford, J. M., (1998).Easing the way for teachers. *Educational Leadership*, 55(5), 33-36.

Hargreaves, A., & Fullan, M. (2000). Mentoring in the new millennium. *Theory into Practice*, 39(1), 50-56.

Hoban, G., (2002). *Teacher learning for educational change.* Philadelphia, PA:Open University Press.

Holloway, J. H. (2001). The benefits of mentoring. *Educational Leadership*, 58(8), 85-86.

Huling, L. & Resta, V. (2001). *Teacher mentoring as professional development*. Washington, DC: ERIC Clearinghouse on Teaching and Teacher Education No. (ERIC Document Reproduction Service No. ED460125).

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

Kennedy, M. (1991). Some surprising findings on how teachers learn to teach. *Educational Leadership*, 49(3), 14-17.

National Commission on Teaching and America's Future. (2003). *No dream denied: A pledge to America's children.* Retrieved September 16, 2004, from http://www.nctaf.org/article/index.php?g=0&c=4&sc=16&ssc=&a=6&navs=

National Council of Teachers of Mathematics. (2002, August). *Induction and Mentoring of New Teachers*. Retrieved December, 15, 2004, from http://www.nctm.org/about/position_statements/induction.htm

No Child Left Behind *New No Child Left Behind Flexibility: Highly Qualified Teachers.* Retrieved May 2005, from http://www.ed.gov/nclb/methods/teachers/hqtflexibility.html

Odell, S. and Huling L. (2000). *Quality mentoring for novice teachers*. Joint publication: Washington, D.C.: Association of Teacher Educators and Indianapolis, Indiana: Kappa Delta Pi.

Sanders, W., & Rivers, J. (1996). C*umulative and residual effects of teachers on future student academic achievement.* Knoxville: University of Tennessee, Value-Added Research and Assessment Center.

Strong, M., (2004). *Induction, mentoring and teacher retention: A summary of research*. Paper presentation to the Association of Teacher Educators of Europe, Agrigento, Italy

Smith, T., & Ingersoll, R., (2004). What are the effects of induction and mentoring on beginning teacher turnover? *American Educational Research Journal*, 41(3), 681-714.

Smylie, M. (1989). Teachers' views of the effectiveness of sources of learning to teach. *Elementary School Journal*, 89, 543-558.

Wright, S. P., Horn, S., & Sanders, W. (1997). Teacher and classroom context effects on student achievement: Implications for teacher evaluation. *Journal of Personnel Evaluation in Education*, 11(1), 57-67.

Growing Teacher Leaders for the Classroom

Mary S. Anderson, PhD, Pasco, WA • manderson@esd123.org

How do we grow teacher leaders? In what ways can we increase the capacity of teachers to lead from within the classroom? These questions are foundational if we truly wish to leave no child behind. It is the teacher through whom all efforts expended on education, from the district to the building level, filter to the child. How can we provide an environment that is conducive to teacher growth and that encourages them to use their leadership skills in the classroom, rather than leave the classroom to accept leadership opportunities elsewhere?

For the past two years, Tami Matsumoto and I have formed a team I have been part of a team that has worked closely with teachers to provide professional development in math and technology through a Title II grant called NO LIMIT. While leaders of the grant provided some leadership strategies for professional growth for teachers in Paterson, WA, there were qualities of leadership that already existed in the school to create an inviting environment for teachers to reflect, study, and risk growth. This article will mine the qualities of leadership in the environment at Paterson School that cultivated the potential for the personal and professional growth of the teachers toward becoming classroom leaders. M. Fullan's book, *Leading in a Culture of Change* (2001) helped to organize the data and my thoughts.

Fullan (2001) identified five qualities of leaders that are essential for the complex world in which we work. These qualities are equally important for administrators in education and for teachers who lead from the classroom. Leaders should lead:

1. from a "moral purpose" or a passion about one's purpose for work;
2. by understanding the change process thoroughly;
3. by emphasizing the key role of constant learning;
4. by building relationships within the organization;
5. by making coherence from confusion.

I will show how the administrative and teacher leaders in Paterson School District exemplified these qualities as they developed into a community of learners.

Moral Purpose: Administrator

Peggy Douglas, the Superintendent/Principal of Paterson School District, loves her job and the students and teachers she works with. She has worked for Paterson for 13 years: as the part-time business manager for nine years and as the Superintendent/Principal since 2001.

In the application for the NO LIMIT Grant she describes the school district.

> The Paterson School District serves a small, rural, unincorporated community located on the banks of the Columbia River in south-central Washington. The economy of the area is determined by the health of the local agricultural industry—unstable at best. Many of our families must travel at least 30 miles to the nearest city to take advantage of recreational and shopping activities. Time and money prohibit this for most. Because of the isolation of our community, and the socio-economic situation that many of our families struggle with on a daily basis, the district has had to find creative ways to provide educational and enriching opportunities for our children.

Peggy believes that many of her students need early childhood education; some of them need extra time in class during the school year; and others need extra time in class during the summer. To provide these opportunities for the students, she has written and received grants that supplement

district funds. Paterson School District now has a pre-school within the newly renovated school building. This year Paterson offered one additional day of kindergarten for students whom the teacher identified as needing extra class time. The district provides summer school in August, rather than June, to give students a jump start before the new school year begins.

Peggy has also written and received grants to improve the curriculum for students in both reading and math over the last three years. Her commitment to the students leads her to provide an environment in which the teachers are supported to do their jobs well and to embrace their own learning on a continuous basis.

Moral Purpose: Teachers

Though an isolated community, Paterson is widely recognized in the region for educating and caring for its students, as indicated by a waiting list of students who wish to transfer to the K-8 school. All the teachers must drive at least 25 miles from their home to school. They also bring their own children with them to attend Paterson School; and some teachers bring children other than their own.

The teachers' sense of passion and purpose is expressed individually and collectively, as evidenced in this example. The school was invited to tell the story of work with the NO LIMIT Grant at the Washington State Superintendent's January 2005 Conference in Seattle—a 200 mile drive one way from Paterson. A team comprising all but one teacher traveled to make the presentation, while Peggy and the remaining teacher, along with a group of substitute teachers, made sure there was continuity in classroom instruction. I noted that one of the teachers drove alone to Seattle for the hour-long presentation so he could drove directly back to cover his after school activities. To me, it was apparent that the teachers took seriously their responsibility both for professional sharing at the conference and to their work in their classrooms.

Understand the Change Process: Administrator and Grant Leaders

The NO LIMIT grant nurtured the development of a learning community among the teachers, and learning about change was one focus of that community, particularly as it pertained to curriculum adoption. Paterson School District had recently adopted standards-based instructional materials in mathematics for all grades. The teachers needed outside support to work with the new materials together. Peggy recognized that the new materials meant changing teaching pedagogy and beliefs and she provided time, money through the grant and from district funds, and creative scheduling for the teachers to do this work as a community.

As math leaders we were also aware that changes would need to happen because the new instructional materials were based on national and state standards in mathematics that were new to the teachers. We were aware that change happens on three dimensions: 1. the possible use of new materials; 2. the possible use of new teaching approaches; 3. the possible alteration of beliefs based upon shared meaning (Fullan, 1991, p. 37). The first dimension changes only the materials or schedule or classroom routine without understanding the change in terms of new teaching approaches or the basic beliefs underlying the change. Such change is often superficial or faddish (p. 4). While the three dimensions of change are interrelated, it is when new meaning is given by the teachers to their pedagogical assumptions, i.e. when change happens at the second dimension, that a change is more likely to be continued. To press further, when the innovation alters the teacher's beliefs and understanding about education, change has the greatest chance of being continued (Anderson, 1992). We were looking for changes in the teachers' pedagogy and in their beliefs about mathematics.

Leaders who truly understand change have the tools with which to provide an environment for teachers to grow. Peggy knew that it would pay dividends to provide her teachers with time and opportunity to make the changes that are necessary, especially with new curriculum.

Understand the Change Process: Teachers

While administrators may need to be reminded that change takes time, teachers know it deeply. Often they are not given the time they need to make the changes others require of them.

During the initial math meetings we held with the teachers in the fall of 2003, they raised several concerns. They talked about:

- Wanting to see lessons modeled for them, using pedagogy inherent in the new materials

- Knowing that it would take a considerable amount of time to learn to teach from the materials
- Recognizing that, while they were adapting to the materials, they were barely keeping ahead of their students
- Being aware that some strategies and ideas embedded in the materials did not mesh with their existing belief systems,
- Being aware also that there was a conflict between these strategies and ideas, and some of their established ways of teaching.

As the teachers at Paterson struggled with all of these issues inherent in learning to teach the new instructional materials, they recorded goals for their transition. One teacher wrote that she wanted to "use more partner and whole group sharing" and help her students, "effectively and confidently share strategies with me and the class." Another wrote that she aimed to "allow time for better summary—more meaningful summary."

Because making real change is such a slow and difficult process, evidence of progress was clear and often startling. The growth we saw in these teachers stood out like shining gems. One such gem is the way in which we began a modified lesson study, described in the next session.

Leadership in a classroom may look different from administrative leadership, but as teachers began to group their students for peer discussions, as they began to ask open-ended questions and expect students to listen to each other's responses, as they practice "think time"—teachers were leading their students toward new ways of learning. Teachers do this best once they embrace the advantages such strategies provide to learners. One teacher wrote as a goal for the 2004-2005 academic year, I intend to, "not interrupt student thinking" and "journal everyday after math to assess myself." The teachers accepted the challenge to make the changes inherent in new teaching materials.

Knowledge Building: Administrator

Fullan writes that leaders need to create new settings conducive to learning and build each other's knowledge about the craft of teaching. When we learn from each other, the information we share becomes useful in a specific, social context and it becomes possible to make contextual change that is conducive to learning and sharing our knowledge (Fullan, 2001, p. 92).

Both the reading and the math grants at Paterson offer professional development for the teachers, particularly regular, weekly time for learning together during early release days. During the first year of the grant, teachers met once a month to study mathematics. During the second year of the grant they met during early release days twice a month to work on reading and twice a month to work on math. In addition to early release days, the administration provides time for the teachers to learn together during school hours. Peggy hired teacher aides, who have emergency teaching certificates, for all classrooms. The aides have also been given opportunities to learn. For example, the district paid for them to attend a full week of math training during the summer of 2004. Therefore, when teachers need to be gone for professional activities, student work continues under the direction of the teacher aides.

Because Peggy attended the cluster meetings and the classroom visits, she saw the students and teachers use the document camera, which had been purchased by the three NO LIMIT teachers through grant funds. She was so impressed by seeing students share their thinking about mathematics with their classmates, that she purchased a document camera for the other two classrooms in the building from district funds. Her intention is to provide the best available tools for teaching and learning to all her staff.

The NO LIMIT grant was awarded to three of the five K-8 teachers at Paterson. After we met several times, Peggy asked if we could invite the other two teachers to our meetings so the staff could work as a group on mathematics. This was an insightful request that led to the powerful learning community they formed. During the 2005-2006 academic year, Peggy's plan is to form a learning community for the teacher aides as well, and thus build capacity within her school district.

Knowledge Building: Teachers

As we gradually came to understand, not all of the teachers liked the new standards-based math materials. Also, not all of them were teaching exclusively from the new materials. Our early cluster meeting discussions often included topics such as the need for students to learn basic math facts and how to get students to ask their own questions about math and to listen to each other. Often during our meetings issues were raised related to "how we were taught math" and how the teachers are now expected to teach math. These monthly meetings were invaluable to

allow the teachers' time to speak and listen concerning their deeply held beliefs about teaching and learning math.

These issues surfaced in unplanned fashion as we did and discussed mathematical activities. When we began with these teachers, we offered them several, different opportunities for activities around professional development, and we showed them the TIMMS video of the Japanese classroom. We offered lesson study as one option, but we knew that trust needs to be built for lesson study to be successful and building trust usually takes time. We were also aware that "lesson study must meet the needs of the teachers. . . once it is started, they must find it relevant and useful to the problems they face each day in the classroom." (Stigler & Hiebert, p. 151). To our surprise, the teacher leaders at Paterson quickly embraced the use of a modified lesson study that eventually included their entire faculty. It happened in the following way.

At one of the first fall cluster meetings in 2003, Monica, the new 7-8th grade teacher, shared concern that her students did not understand positive and negative numbers when they needed to use them for their science lessons. After much discussion about when and how positive and negative numbers are introduced in elementary school before the students reach seventh grade, the group decided they would like to look at a lesson on positive and negative numbers together. After the teachers thought about the mathematics that students need to know to understand the concept, Monica offered to teach a lesson to her class so we could observe the class for student understanding of the concept of negative and positive numbers.

Building on this experience, the teachers chose the topic for the next series of cluster meetings: to work on the mathematics of the lesson together and then plan each step of a lesson for the 7-8th graders. During the lesson planning time, we predicted possible areas of student misunderstanding and suggested ways to build understanding for different learners in the class. We had rich discussions about phrasing a question to be sure we knew if the students understood the concept. The questions that survived this discussion were included in the lesson plan.

Next we worked with a different lesson for Bob's class and then for Kerry's class. By early winter we decided we would like to include the 1-2nd grade class and the kindergarten class in our classroom visits. Therefore, we invited both teachers to join our math meetings.

One of the benefits of observing in different grade levels is that it gives teachers a close up view of what the younger students don't know and are learning in the previous grades. All of the teachers were astonished to realize just how important this knowledge was for them. It gave them more appreciation for the work that each other does. The Paterson teachers felt lesson study is much richer for them as they move from grade to grade.

After they completed their experience with lesson study during the first year of the grant, they decided to select one math strand on which to focus all community lessons during the next year of the grant. They wanted to see how one strand developed from kindergarten through 8th grade. They chose geometric sense because the Washington Assessment of Student Learning (WASL) scores were low in that area and because they often do not teach that material until the very end of the year.

When teachers take charge of building their own knowledge they demonstrate leadership skills. These teachers were offered many ways in which they could learn together such as book study, case study, a study of the Washington State Grade Level Expectations (GLEs). It is remarkable that they were drawn so quickly to such a risk-taking venture as lesson study. Although some of these teachers were hesitant at first, all were drawn to the benefits of opening their classroom to each other. After each lesson, we held a discussion about the student learning that we observed. Through this process, we attained a cross-school view of learning.

"Change in instructional practice involves working through problems of practice with peers and experts, observation of practice, and steady accumulation over time of new practices anchored in one's own classroom setting" (Fullan, 2001, p. 97). As the teachers planned lessons together, watched each other teach, focused on student understanding of the math of the lesson, and discussed the lesson after it was taught, they were increasing their own understanding about mathematics and how students learn math. During the process of building their own knowledge, they were also increasing their own self-confidence and thus, their willingness to accept leadership to further their own professional growth.

Build Relationships: Administrator

Fullan believes it is not only the people that make an organization great—it is also the relationships among these people. Because most of the teachers' own children

attend school in Paterson, the teachers and their families have become a part of the culture of the school.

I believe it is evident that relationships are important to Peggy's work with children and teachers. Decision-making is collegial and completed as a team. Her leadership style is hands-on and inclusive. She attends math and reading meetings with her teachers and, in that way, she is available to help make decisions as suggestions and needs arise. She did this effectively during the discussion at one of the meetings about the math skills of the teacher aides. The teachers were making suggestions for ways in which their aides could be included in the monthly math meetings. After listening to their ideas, Peggy agreed to work on a way in which the aides can meet together next year around the instructional materials in math.

Build Relationships: Teachers

Teacher relationships were forged as we worked together to turn information from the new math materials into knowledge and understanding about mathematics and pedagogy. Then the relationships were enriched and teachers began learning even more from each other during the lesson study and classroom visits. Their relationships have also grown stronger because of the regular meetings and the open discussions they have promoted. Absences at meetings were rare and unavoidable when they happened. Regular attendance gave credibility to the group and made it an interdependent community of learners. To cite one indicator of interdependence and trust: when setting their yearly goals for the grant, the teachers name each other as resources they can turn to.

Making Coherence: Administrator and Teachers

The fifth quality necessary for a leader during complex times is to make coherence out of uncertainty and confusion. Educators have any number of tugs for their focus and time, and they must reconcile diverse interests across groups. Coherence must support moral purpose because there are too many "goods" in our complex society to do them all. Peggy chose to focus the efforts at Paterson on reading and mathematics, bringing in grants that complement each other. For example, the adopted math series relies heavily on reading to understand the problems the students are asked to solve.

Coherence efforts for the Paterson community means interweaving different initiatives. Recently Paterson received a grant from migrant education. Peggy and the teachers thought it was important to introduce the leaders of the migrant education grant to the work of the NO LIMIT Grant. To accomplish this, Peggy invited them to attend a lesson study observation in the first grade classroom. They observed the students with us and took part in the reflection session with all the teachers after the lesson. During the reflection session they were able to give us insight into ways that we could have planned the lesson to include elements that help second language learners learn English. They added a perspective to the discussion that was important. By inviting them to this event, Peggy and the teachers brought about coherence between the math grant, which has a history in the school, and the beginning of a new venture. The leaders of the migrant education grant saw what is already being done with students in Paterson and will be able to build their support for migrant students at Paterson from that experience.

Towards the end of the year, because we were aware that the grant was ending, the teachers were especially clear that they wanted to continue meeting next year. We also discussed the features of lesson study that we had used over the past two years, particularly those that we needed to learn from in order to become better in the future. To season this planning process, two teachers volunteered to attend a two-day workshop on professional learning communities, and brought back to the group several ideas they want to use next year in their work together. I have every confidence that they will continue meeting as a learning community around mathematics. In fact, they have requested central office services on a more limited basis for the next year.

In summary, leadership at the district level, from the superintendent/principal and the lead teacher, was supported by the opportunity to grow teacher leaders provided by the math/technology grant. The administrative leaders, teacher leaders, and grant leaders worked side-by-side. The uniting force, however, derived from the qualities of leadership that were present in the school: strong moral leadership, the realization of the complexities of change, provision of time for knowledge making, strong relationships, and coherence making. I am indebted to Michael Fullan's *Leading in a Culture of Change* for providing the framework through which to analyze and appreciate the leadership we intuitively knew existed at Paterson School.

References

Anderson, M. S. (1992). *The Diffusion of Computers as an Innovation in a Rural School District*, unpublished dissertation.

Fullan, M. (1991). *The New Meaning of Educational Change*. New York: Teachers College Press.

Fullan, M. (2001). *Leading in a Culture of Change*. San Francisco: Jossey-Bass.

Stigler, J. W. & Hiebert, J. (1999). *The Teaching Gap*. New York: The Free Press.

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