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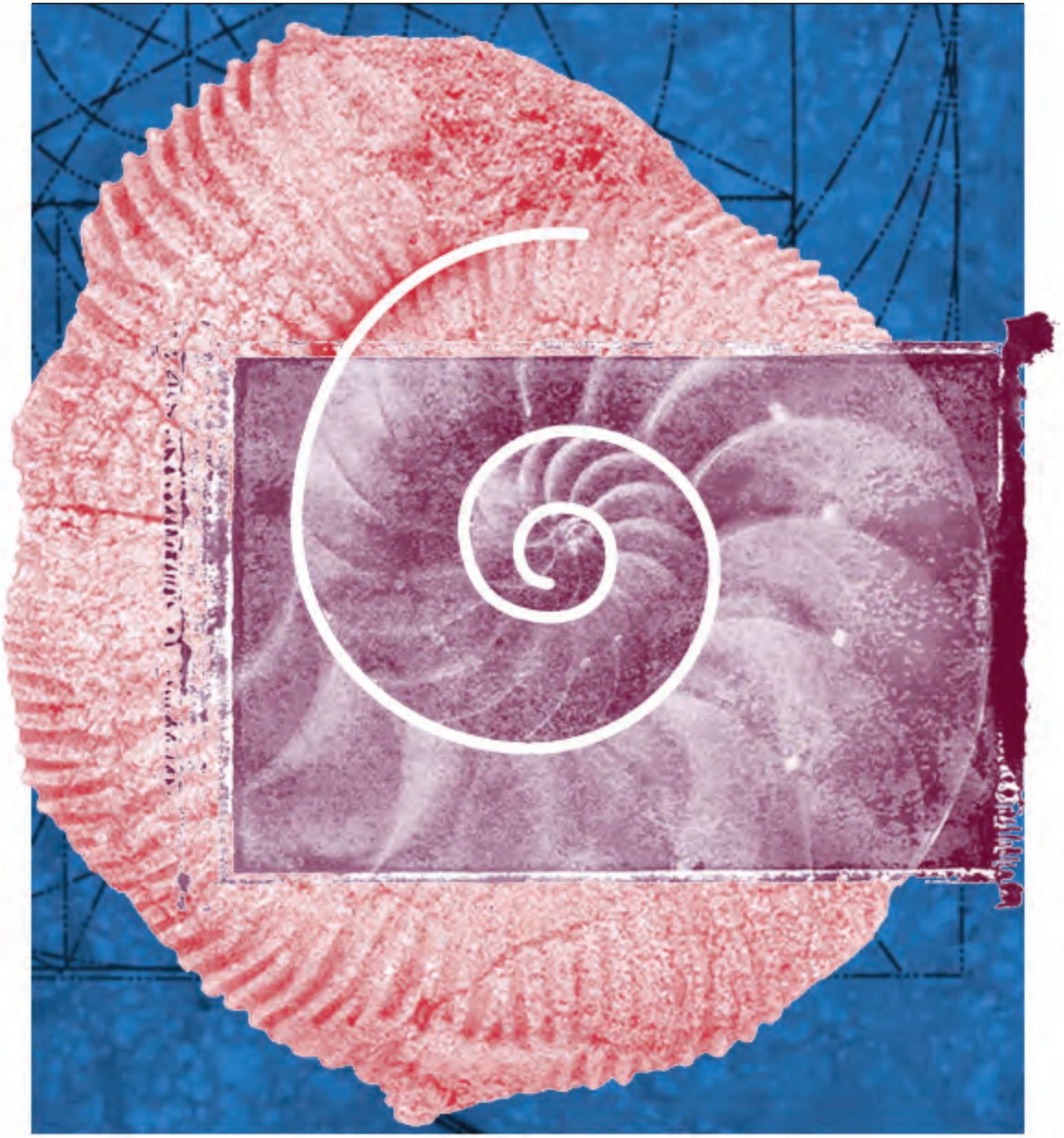

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Learner-Centered Teacher Leadership in Mathematics Education

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Introduction

While mathematics education has been a key priority for professional development as long as we can remember, recently the push for increasing teachers' content and pedagogical knowledge mathematics has received increased attention and scrutiny at the local, state, and national levels. The stakes are higher. The expectations are higher. The purpose of this article is to provide a set of heuristics — rules of thumb — by which districts under fire can develop from within, the capacity for long-term positive change in mathematics teaching and learning.

The ideas we provide in this article stem from our own long-term reform effort, begun in Fall, 1994, to improve mathematics teaching and learning in a large, urban school district in Phoenix Arizona. We are happy to say that longitudinally, our efforts have resulted in grade by grade improvement in student achievement, and in general longitudinal change across all grade bands on the mathematics portion of the Stanford Achievement Test. Moreover, results on this and our state assessment (the Arizona Instrument to Measure Standards) reveal that achievement is not only improving, but it is at the highest level in comparison to other districts in the state, despite continually rising levels of poverty in the community. Details of our case can be found in (Middleton & Coleman, 2003) including student achievement data.

First Principles

Two points must be made up front. First, the central orienting principle upon which we built our platform for reform is that of increasing teachers' *understanding of children's mathematical thinking*. The most successful programs to date in the mathematics education literature were built on this premise: That the more teachers understand about the ways in which children interpret mathematical tasks, build informal knowledge about number, patterns, and relationships, and formalize that knowledge into skills and procedures, the better they are at providing appropriate tasks, questions, and feedback at appropriate times (Hiebert, Carpenter, Fennema, Fuson, Wearne, Murray, Oliver, & Human, 1997; Fennema& Romberg, 1999). Second, *we rejected the trainer of trainers* model of professional development. A different (and better) model is that of a job-embedded, democratic, learner-centered leadership (e.g., Barth, 2001; Loucks-Horsley, Hewson, Love, & Stiles, 1998). Under such models, leaders are developed when departments or grade-level teams grapple with issues of student learning and how their own practices can contribute to that learning (e.g., Kennedy, 1999). Leadership development under this model can be defined as *the stimulation of the intellectual capacity of a district, aligned towards programmatic change* (adapted from McNamara, 1999). To enact such a definition, one must assume that the capacity for leadership exists in each and every one of the personnel in the district organization.

So, to share our experiences with colleagues in mathematics education supervision, we put forward several essential elements of a quality long-term professional learning program that prepares teachers to improve the mathematics learning ability of all students. We focus here on 1) Professionalizing the Role of the Teacher; and 2) Providing

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an Alternative to "Pyramid Schemes." We end our discussion by projecting the Positive Outcomes of Learner-Centered Teacher Leadership in Mathematics Education.

Professionalizing the Role of the Teacher

In the elementary and middle grades, the push for the development of deep content expertise in mathematics in teachers creates tremendous fiscal and human resource pressures. It is a fact of the political life of most districts that *more* teachers are expected to learn *more* about content and pedagogy in that content, in increasingly *deeper* and *more* coherent ways (Ball, 2002). To this we add, with *fewer and fewer resources.* But to constitute more than pie-in-the-sky thinking, this goal must be enacted in practice.

One way of developing this deep focus is to shift thinking about the role of the elementary school teacher from that of the multi-subject generalist to that of subject matter specialist in a subset of important curricular areas. Particularly in elementary schools, the model of the generalist teacher has not allowed teachers to become distinguished professionally from each other, to develop deep expertise in any one area of interest, or to take on the role of a leader in driving change in curriculum. Instead, curricular reform has been driven by textbook adoption cycles, state and local legislation, or administrator fiat.

In 1994, we began an extensive experiment, attempting to professionalize teaching in mathematics content. Through a combination of Federal Title monies and external grants, we were able to release grade-level Mathematics Teacher Leaders at each school in our district — time to work with their peers to deepen their understanding of children's mathematical thinking, and its relation specifically to the district-adopted curriculum and the NCTM *Standards* (1989; 1991). Half-time release was a critical innovation. Results from other Systemic Initiatives showed that when leaders are released from their classroom duties full-time, they begin to lose credibility with their peers (i.e., they were no longer *teachers*). With their feet in the classroom half time, teacher leaders kept their own skills sharp and developed good "war stories" they could share with those they were helping in the other 50% of their time. Our Mathematics Teacher Leaders offered classroom demonstrations, peer coaching and other mentoring opportunities on an informal basis. Summer and Academic Year institutes in Algebra, Geometry, and Statistics were coordinated with the local University to enhance teachers' mathematics content knowledge. Two of the Mathematics Teacher Leaders obtained their Masters' degrees during this time, and took over the content instruction from the professor of record (the first author of this paper), further enhancing their professional development and leadership capacity within the district.

The difficulties associated with this shift in culture must not be underestimated given the general attitudes of prospective teachers towards mathematics as a field (not too positive), and the current requirements for certification in most states that minimize the number of hours a teacher spends in any content area. However, providing each teacher with the opportunity to develop a personal area of expertise, i.e., a niche within the school and district culture is a key step towards teacher empowerment.

Pragmatically, it also allows for the development of adequate numbers of experts in mathematics so that each school in a district has a sufficient proportion of leaders driving the reform. With this in mind, as in our case, initial leaders can be identified at the building and grade level. Early adopters, converts, and even the healthy skeptics, who can articulate reforms in the language and practices of professional teachers are all critical to the successful long term structural change that is necessary for sustained reform (Middleton & Coleman, 2003).

This approach takes advantage of the extensive literature that shows that teachers-as-leaders do not exist on their own, but in a community of learners, devoted to better understanding content, pedagogy, and the institutional context within which their practices must be imbedded (DuFour & Eaker, 1998)

Lastly, this approach is developed in reaction to and stands in contradistinction to what we see as a current and prevalent attitude that ignores the power of ideas underlying public education. We maintain that disciplined practical knowledge is coherent, deriving on the best empirical evidence available. It is also generative, continuously striving for improvement as teachers grapple with new content and new contexts, and new student characteristics. Lastly, it must also be theoretical, in the sense that it is tied to a body of knowledge that explains *how* and *why* actions lead to particular forms of behavior and knowledge. This emphasis does not lessen the need for the "wisdom of practice," rather it provides a structure by which this wisdom can be recognized and stimulated.

Pyramid Schemes Don't Work!

The most common strategy for scale-up of reform in districts relies on what we call a *pyramid model* of diffusion — a trainer of trainers model — to exponentially increase the number and quality of teachers with particular expertise throughout large, particularly urban, school systems. The residue of these models (e.g., learnings and practices gleaned from the staff development experiences) often doesn't last for a very long time when the source of funding for the reform ends. Little personnel money is slated to maintain the release time, professional development experiences, and support of teachers identified as instructional leaders. As a result, these teachers go back full-time to the classroom, doing great work personally, but the entire structure of the professional development program collapses with no personnel to perform the tasks of instruction, mentoring, and curriculum development. Moreover, even with some sustained moneys, the nature of expertise shows that after only about two levels of trainers-of-trainers, the coherence of the original message becomes diluted and ineffective. A better approach is to begin with building- or grade-level *teams* that are charged to develop *their own* practice, and provide the highest level of support as needed for just-in-time learning. This practice takes longer, but has the potential for deeper, longer lasting change than the more sporadic workshop model.

Our Mathematics Teacher Leaders did not live outside the regular work day. They remained in their classes, teaching mathematics, and applying their own professional learning to the improvement of instruction. They also led grade-level teams in planning for instruction, sharing student strategies, and developing assessments to gauge their (the grade-level team's) success. Thus, when a MTL retired in 2001, another member of his team who had been mentored and supported as a second-tier leader was able to assume the leadership role. Leadership capacity must be built into the everyday interactions of identified leaders *and* potential leaders. This is job-embedded professional development that runs deeper and has (we think) potential for longer-lasting impact than a trainer-of-trainers model (Loucks-Horsley, Hewson, Love, & Stiles, 1998).

Positive Outcomes of Learner-Centered Teacher Leadership in Mathematics

There are a number of critical reasons why a local colleague, who is a peer at the building or grade level, is a more credible and more effective staff developer, in the long run, than either an outside expert, or an expert at the administrative level of a district. These reasons center on the place of a teacher in the local community, and the place of administration (particularly in the current politics of urban school districts).

Sustained Reform Over Time. As alluded to earlier, one of the key failures of systemic reform efforts is the inability to institutionalize and sustain the initiated reforms beyond the typical 5-year lifespan of most local, state, or federal projects. If continued activity is in fact a goal, there must be some administrative structure that 1) embeds the key learnings incurred in the professional development project in the building and grade levels; and that 2) provides a feedback loop regarding the success of the reforms to the project as a whole. With the size of modern districts constituting multiple schools with potentially hundreds of teachers, some personnel that have *direct access to each classroom* on a *regular basis* are required to staff such an administrative structure. When faced with the further constraint on the limited number of people with *both* the subject-matter expertise, *and* legitimacy in the eyes of the in-the-trenches practitioners, the pool of potential people to make up this staff is limited to teachers and a few experts at the district level and perhaps at local higher education institutions. A final constraint, cost, predicates that the structure for sustained activity in systemic reform be made up of current district employees—teachers.

Releasing our MTLs half-time maintained continuity in mathematics instruction for their own students thus insuring higher test scores, kept MTL's teaching skills honed, and as we said earlier, kept them legitimate in the eyes of their peers. The half-time release was also relatively cost-effective. By blocking special subjects, utilizing teaming, and by augmenting district funds with Federal dollars, the district was able to sustain at least two MTLs in each school (serving 2 grade levels each) for eleven years. Our data also suggest that it also kept MTLs and other teachers in district despite intense competition from neighboring schools.

Moreover, the development of local experts who have an investment in the community and institution is more likely to afford continued activity than hiring a set of paid consultants from the outside that bop in very once in a while. Our teachers by and large live and work in, or at least have a professional investment in, the communities within which their schools are located. And, while teacher mobility across districts is becoming more and more of a

staffing problem, our experience suggests that there are still large numbers of teachers who remain in district for extended periods of time, sustaining the institutional knowledge of the reform beyond the life of external funding.

Transcending the Revolving Door Administrator. While acknowledging teacher mobility to be a difficult problem, the bigger problem in school leadership today is the tendency for high-level administration to move or leave office in 3- to 5-year cycles (i.e., a rate of approximately 30% each year) (Gates, Ringel, & Santibanez, 2003). As a result of this turnover, when teachers are faced with new mandates, policies, procedures and personalities regularly, they tend to perform their duties *in spite of* administration, with an attitude of "this too shall pass." (Middleton & Webb, 1994).

In contrast to administrators, teachers move or leave the profession at an annual rate of only 15% nationally (Tabs, 2004). Research suggests that teachers who are provided leadership opportunities, ongoing professional development and who receive some material reward for their role as leader are less likely to move than the general population of teachers (Institute for Educational Leadership, 2001). We suggest that because of overall stability within districts, teacher leaders, may, if identified and supported properly, provide a more stable infrastructure upon which to hang systemic reform than say, superintendents and principals.

In our own case, we have had two associate superintendents, two superintendents, and several principals leave office during the 10 years of our reform efforts. We still have MTLs who joined up from the very beginning, and more importantly, we have the institutional capacity now to build new leaders from our junior ranks.

Embeddedness in the Community. High quality teachers have the legitimacy to enact reforms which may be at first controversial, by virtue of their connectedness with parents. Both the fact that teachers may encounter multiple children from the same family year after year, and their presence in community affairs, makes them key brokers of information about reform and key advocates for the district.

Authority by Virtue of Experience. While there are numerous cases of young and inexperienced teachers becoming leaders, our work leads us to characterize this as the exception rather than the rule. The level of experience working in classrooms with the same characteristics as others in the school or districts is taken seriously by teachers, and they hold a healthy skepticism of any new reform proposed by someone who hasn't actually tried to implement it under authentic conditions of teaching. Moreover, as the community becomes more attuned to the difficulties new teachers experience during their first few years in the classroom, the natural leadership (both good and bad) that an experienced teacher can exert over the inexperienced colleague is powerful. It seems profitable, then, to harness this natural apprenticeship, identify good role models and support them with high quality experiences, tools, and materials. This influence may also be important for experienced teachers who are new to a school and who could use information about curriculum, available technologies, district expectations and philosophy, and school culture.

Our model builds this mentoring and support into the MTL job-description in a sustainable manner. But it is not the *role* we find most important, but the nurturance of a culture of support across all grade levels and subject-matter. Grade-level teams have time to meet and plan. District-level leaders, including MTLs, principals, and central administration, meet regularly, attend professional development sessions, and plan for the future. This model also is in place for literacy and is beginning for science.

Capability for Moving Administration. As we speak of influence, the potential impact of teacher leaders on the coherence and consistency of service in the district, given the increased mobility of administrators, cannot be understated. In numerous districts we have worked with, the core leadership among the teaching cadre remains stable across multiple administrations, which often bring competing agendas that may countermand any current direction of reform. Teacher leaders, as successful agents of reform have been approached by new administrators for guidance in the implementation of new policies, for identification of appropriate sites for action, and for communication of new directions to the general district faculty. In some instances, initiative by the teachers in the district may actually provide impetus for administration to change or enact new policies, curriculum cycles, or priorities for professional development.

Conclusions

In an earlier publication the first author described the notion that a system as complex as a public school district should have as a goal, coherence at all levels of the system, from classroom teacher to Superintendent (Middleton,

Sawada, Judson, Bloom, & Turley, 2002). The goals of the reform, even if they are fluid and evolving, must be understood by all, and their place in the overall support structure must be embraced. The push for reform in school mathematics is no different. This has been a key national priority for nearly fifteen years. While the entire education system is expected to align with these (sometimes conflicting) national goals it is the classroom teacher who has the responsibility for articulating the diverse sources of information, designing effective instructional strategies to meet the standards, and providing diagnostic, remedial, and advanced mathematical experiences for an ever more diverse student body.

Given the economics of professional development, and given the pressures of the No Child Left Behind Act, new models for leadership development are critical for deep and lasting educational improvement. In our experience, key learnings underscore the need for teacher leaders to continue to practice their own craft in the classroom, to utilize resources from higher education, and to plan for the long haul. In particular, we challenge the notion that "trainer-of-trainer" models are superior to "learning community" models. Briefly, trainer-of-trainer models assume that leaders are knowledge disseminators as opposed to mentors, colleagues, or coaches, i.e., as separate from people who are struggling under the same conditions of practice as the classroom teacher. Moreover, the impact of trainer-of-trainer models degrade quickly as successive generations of trainers diffuse the original message of the professional development. The model of Learner-Centered Teacher Leadership we have developed is one alternative model for achieving this national goal under the real conditions of local implementation.

Finally, none of our modest inroads could have come to pass without the influence of a visionary leader at the district-level. Kay (the second author) maintained high expectations, focused the use of district professional development resources to begin the work, and acquired external dollars to support large scale change across the district. The mandate to achieve more in an economy with fewer resources is a critical dilemma for all educational leaders.

The achievement outcomes of our work show an improvement of 11 percentile ranks over the years 2000 through 2003. Given that this improvement really started to appear six years into our efforts, appropriate time scales for improvement given current mandates and sanctions must be considered carefully. An important discussion for leaders is how to manage both the short term time needs *and* the long term coherence in the face of ever greater challenges, shorter deadlines and trimmed budgets.

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