

A MODEL FOR SYSTEMIC CHANGE IN RURAL SCHOOLS

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This paper describes a theoretical model for systemic change as it concerns the learning and teaching of mathematics in K – 12 schools, with particular attention being paid to the rural context. Systemic change is the active process of establishing change in the community through lasting, long-term relationships, practices, and procedures (Adelman & Taylor, 2003). Our purpose is to describe the mechanics of such change provided by the strategic, continuous, and monitored support of all three of the constituents: Teachers, administrators and community, and externally supported by a temporary catalyst. Systemic change is achieved when the removal of the external catalyst does not affect the rest of the model. Evidence to support this claim has been derived from our case studies.

INTRODUCTION

This paper describes a theoretical model for systemic change as it concerns the learning and teaching of mathematics in K – 12 schools. The motivation for this study comes from an increasing demand for sustainable change in educational systems that seek to improve the performance of American students in mathematics (Stigler & Hiebert, 2009). With the implementation of the Common Core State Standards in Mathematics, there is a shift in emphasis on educational goals that may necessitate sustained school-wide change. Systemic change is an active process of establishing change in a community through relationships, practices, and procedures that become a lasting part of the community and is promoted by school leaders to institutionalize instructional strategies that increase student learning (Adelman & Taylor, 2003). Many recipients of major grants designed to increase students' achievement in mathematics that are intended to produce lasting change in schools struggle with ways to make the change systemic.

Despite the attention this topic has drawn from funding agencies, there is surprisingly little research that describes in detail successful implementation of sustainable system-wide change in mathematics instruction, particularly in rural schools. The proposed model emerged from our work¹ with 34 rural schools in the Pacific Northwest through a NSF funded grant, Making Mathematical Reasoning Explicit (MMRE). The model attempts to describe the interconnections and interactions among teachers, administrators, and the community. We use the term community broadly to capture individuals or groups connected with the school, such as parents, and civic organizations with an interest in education. It is our intent to describe (a) the nature of the strategic, continuous and monitored support provided by these three constituents and their interactions with each other and (b) describe a fourth temporary, external

catalyst (in our case a federally funded grant). We illustrate this process using our case study data.

LITERATURE REVIEW

Three major constituents appear to influence the degree to which systemic change becomes sustainable: Teachers, administrators, and communities (Loucks-Horsley et al, 2009). Stigler and Hiebert (2009) make a strong case for the position that if we want different outcomes in student learning, then teachers must change what they do in the classroom. The process of teacher change is critical to the systemic change (Silvia, Gimbert, & Nolan, 2000). However, we limit our literature to the interactions and influences between, rather than within, the three groups: teachers, administrators, and community. Thus, our brief literature is focused on the influences of teachers, administrators, and community on systemic change.

Teachers as supporters of systemic change

Literature on the influence of teachers on systemic change is focused on their implementation of high quality professional development and the details of change process itself (e.g., Pegg & Krainer, 2008). Pegg and Krainer describe four large scale initiatives in Austria, United States, Australia, and South Korea. These projects focus on supporting individual teachers through collaboration, communication, and partnerships. Teachers collaborated with each other and university staff members as valued members of the community with specific expertise. The inclusion of outside experts leads to in-depth discussions that facilitate the development of new instructional practices. Partnerships and communication were between the national funding agency, teachers, and university staff members. Teachers' professional development is critical to systemic change. Developing teacher leaders have been seen as one component that can support systemic change. Unfortunately, literature on teacher leadership describes their development, roles, and interactions with colleagues (e.g., Christensen, 2012) and does not examine the interactions between the school administrators and the community.

Administrators as supporters of systemic change

Guskey & Sparks (2002) describe the types of support that administrators may provide to teachers: supervision, professional opportunities, coaching, and evaluation, as well as their leadership and its influence on the school community and culture. Specifically, principals who support their teachers by individually participating in and allotting time for professional development have reported increases in teacher effectiveness and organization (Darling-Hammond & Bransford, 2007). Pegg and Krainer (2008) summarize the influence of principals on teacher change in a large-scale Austrian initiative. Teachers who had support from their principal and colleagues were more motivated to use new instructional practices and their students were more enthusiastic. In contrast, teachers with little support or who felt pressure from the administration had little intrinsic motivation to use new instructional practices.

Community support for systemic change

To support systemic change, it is important for all stakeholders to articulate the vision of this change (Adelman & Taylor, 2003). Stakeholders must anticipate barriers to change, create structures within the school system, and appropriately allocate resources to confront and remove these barriers. The likelihood of long-term systemic change is greatly enhanced when parents and the community support the innovation (Joseph & Reigeluth, 2010). Including parents into the change process is a “step toward helping parents not only to get *involved*, but also to take *ownership* of the change process.” (p. 10).

SYSTEMIC CHANGE MODEL

Anderson (2003) suggests that research is needed to investigate the reciprocal interactions among the various components of a school system. To investigate these reciprocal interactions, we needed a model to help us analyse the interactions among school personnel and the community. Our 3-D model (Fig. 1) consists of a double tetrahedron that represents the multidimensional aspects of these influences, with the central plane representing the playing field where interactions among teachers, administrators and community constituents occur.

The playing field is supported by the external funding agency, and in turn supports student learning. The edges represent the interactions among these constituents. The goal of systemic change is to accomplish the shrinking of the lower tetrahedron until the external funding agency support is no longer necessary, while still maintaining the integrity of the upper tetrahedron. We next describe the external support, followed by a discussion of the interactions between community and school personnel.

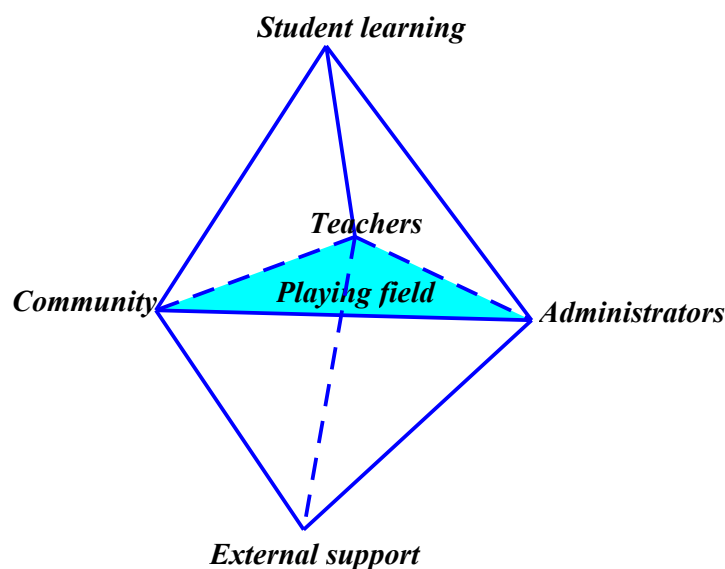


Figure 1: The goal of the systemic change model is to describe the school and community-based interactions that can provide continuous support to improve instruction and increase student learning.

External support

External support most often occurs as the result of local, state or federal grants. Valley School District, the focus district of our case study, is supported by MMRE, an ongoing five-year National Science Foundation Mathematics and Science Partnership grant project. The goals of MMRE are to (a) develop teachers' understanding of generalization and justification so that they can create opportunities for students to engage in these actions, (b) build mathematics teacher leaders, (c) support school districts create structures that increase students' intellectual engagement in mathematics, and (d) boost student achievement. MMRE Teacher leaders are expected to mentor their colleagues during their second and third year of participation and then to continue working with colleagues for two additional years.

Each year of MMRE teachers' participation includes: attendance at a 2½ week Summer Institute, four to six half-day regional meetings during the school year, and three classroom observations by MMRE staff. During the summer, we engage teachers in mathematical reasoning through the content areas of algebra, geometry and proportional reasoning. We hold daily sessions on leadership, designed to equip the teacher leaders with the skills necessary for leading professional development with their colleagues. Administrators from the participating school districts join their teacher leaders for three days to work on a three-year school district plan to support other teachers in the district implement instructional practices that support students to reason mathematically. In addition, administrators attend sessions to help them recognize mathematical reasoning as it occurs in mathematics classrooms and instructional strategies that promote it.

Influences and interactions between school administrators and teachers

School administrators include the superintendent, principals, curriculum coordinators, mathematics coaches, specialists, and their assistants. These individuals set the budget, define school district goals, policy and vision, set the schedule of classes, oversee curriculum, hire staff, and provide supervision and evaluation of them. Administrative support for change ensues from (a) allotting time for professional development, (b) allocating money for substitute teachers or supplies, and (c) revising policy to create a safe environment for teachers to use new practices. Through these actions, administrators influence teachers and their practice by providing opportunities for teachers to learn new instructional practices, collaborate, plan and enact instruction using them, and reflect on the impact of these new practices on student learning.

Teachers influence administrators by their enthusiasm and willingness to embrace a change. They may discuss with staff members and parents the importance of changing instructional practices and their impact on students' learning. They provide specific anecdotes to administrators, illustrating the positive and negative impacts of the new practices. Teachers discuss the importance of changing instructional practices and their impact on students' learning and request resources to support them. Administrators often find these professional conversations inspiring and energizing.

The superintendent and the elementary principal in our case study school district, Valley School District, were enthusiastic about participating in MMRE from the outset. During an informational meeting, four teachers expressed interest in participating in the project. Funding to support two additional teachers was requested and provided by the school board, setting a tone of support which was in place from the advent of the project and established their continued investment in the goals of MMRE.

The four teacher leaders and principal formed the MMRE Valley team. During the first year, they created a plan for implementing, sustaining and spreading MMRE instructional practices over a three-year time period. The focus of the first year was on developing teachers' own practices. The principal observed the teachers and gave supportive feedback to them. The principal reflected on his early observations and noted,

I could see impact. The difference was in instruction. I saw entry points for students across the spectrum. Students got connected to the problems and were engaged. It was this student engagement that sold me on MMRE [during the first year].

From this reflection, it is clear the teachers and their students influenced the principal, leading to further support from the principal. This additional support came in the form of a reassignment of committee work for the three elementary teachers to focus solely on MMRE and he attended these meetings. This was a significant contribution as small schools have many needs to fill with very few staff members to contribute.

During the second year, the MMRE teachers each selected a teacher to mentor, planned presentations for the school board, and provided professional development for staff members. The teachers continued to influence the principal and the administration during the school year. Their enthusiasm and students' excitement about learning math were contagious. One teacher wrote,

The students were engaged in math conversations. They found patterns, made conjectures based on their observations, and were able to defend or explain why things happened the way that they did. I was excited to see the kids all use exhaustion as their first strategy, but very few of them use that as a prevailing strategy as the problems became more difficult... Kids were excited about math and enjoyed working in the group setting. (Teacher reflection, September 2012).

The students' intellectual engagement in solving problems further encouraged the teacher to continue to implement these types of problems to teach mathematics. All of the MMRE teachers in Valley Schools shared these insights and commented on how students were able to think more deeply than they expected. A different teacher noted that, "I don't have to teach them anything. I just give them the opportunity to explore and they figure out what I want them to learn."

A key element of Valley Schools' success was the weekly meetings between teachers and the principal. The anecdotal stories that teachers shared increased their commitment and helped them gain confidence. The principal commented on the

transition of one elementary teacher who went from someone who was “apprehensive about teaching math to a teacher who wanted to go to a two-day state conference [on math instruction] to become a better resource for teachers.”

Influences and interactions between teachers and community

Teachers have opportunities to share new instructional practices directly with parents during informal and formal meetings. During parent-teacher conferences, teachers may provide work samples showing how the new instructional practices are directly impacting individual students. Parents share personal observations of their students at home and ask questions about their students’ learning during conferences, through email communication, and casual exchanges in or outside school. These communications build support from the community. Although students attend a school, they can also be considered as part of the community and are one of the strongest supporters for teachers. When students are engaged in mathematical thinking with carefully scaffolded activities, they often show enthusiasm for mathematics. Their positive attitude and statements like, “Now I get it,” encourage teachers to persevere in using the new practice.

All of these interactions occurred in our case study school. The teachers were proactive in communicating with both parents and the broader community. Teachers in Valley Schools were responsible for communicating instructional changes with parents and the community through three venues. They met with parents during Back-to-School night when they could help parents “understand what the kind of work that students would be bringing home.” Students from the MMRE classrooms “talked about something very different [in mathematics instruction].” Second, parents and teachers discussed students’ learning during conference. The teachers communicated the new depth of understanding using classroom examples. Parents were pleased about their students’ enjoyment of mathematic and new abilities. Third, teachers made yearly presentations to the school board about MMRE, its impact on their instruction, and anecdotal stories about students’ learning. The school board responded by acknowledging the teachers’ efforts and continuing their financial support of the project.

Influences and interactions between school administrators and community

Administrators in the United States typically meet monthly with their school board, (community representatives elected to provide oversight of the school district) approve policy and budget, and support the education of students. Administrators gain the support of the board by providing updates of educational programs, discussing new research-based instructional practices, and describing how these practices will enhance students’ learning. Administrators also create relationships with various community and civic groups. The support of the school board and other groups can be a critical factor in the success of systemic change.

The administrators also interact with the community through the Parent Teacher Organization. Four meetings are held each year in which the principal provides a

school update, including a summary of MMRE activities along with progress on the school improvement plan. Another venue for communication among the administration and parents is at fall registration, and in newsletters that are sent home with students and posted on the school webpage.

The Rotary Club is an example of a civic organization that supports the schools, promotes the community, and helps to develop its economic vitality. In Valley, the Rotary Club holds one meeting each year in the school. The principal arranged for students from the MMRE teachers' classrooms to lead a mathematics problem, much to the surprise and delight of members! They commented that the math was more interesting than what they had experienced in school and thanked the students for the opportunity to work with them. These interactions garnered community support for MMRE. It is important to note the members of the Rotary Club tend to be the most influential individuals in a small rural community.

SUMMARY

When we began MMRE, we knew that administrative support was important. As we worked with schools, we began to notice differences in how school districts supported teacher leaders. We needed a theoretical model to provide a lens to describe the school district's playing field and identify supporting interventions. From this model we were able to analyse the interactions between the three players, teachers, administrators, and community. The case study serves as an illustrative example of a school district that created a strong base. However, not all of the school districts create a strong base like our example.

The model suggests interventions that we can use to shore up the base of school districts that may rely on only one or two players. Some of our school districts support the MMRE teachers in very superficial ways. For example, they provide substitute teachers to attend school-year meetings but do not provide time or resources for collaboration or professional development for teachers in the school district. The model suggests that the MMRE leadership team needs to work with the school district administration to help them understand their role in providing support to the project if long term gains are to be systemically induced and maintained. We also noticed that many school districts do not provide information to the community about the project. The model suggests that the community is an important constituent in reaching sustainability.

The model helped us identify ways that the school administrators and the community can help a project become sustainable and suggest interventions that can support our goals of increasing students' mathematical achievement by engaging students in making generalizations and justifications. Additional research is needed to describe the usefulness of the model in our understanding of the playing field and the specific interventions that build school districts' bases so that systemic change can be realized in school districts receiving temporary support from an external source.

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