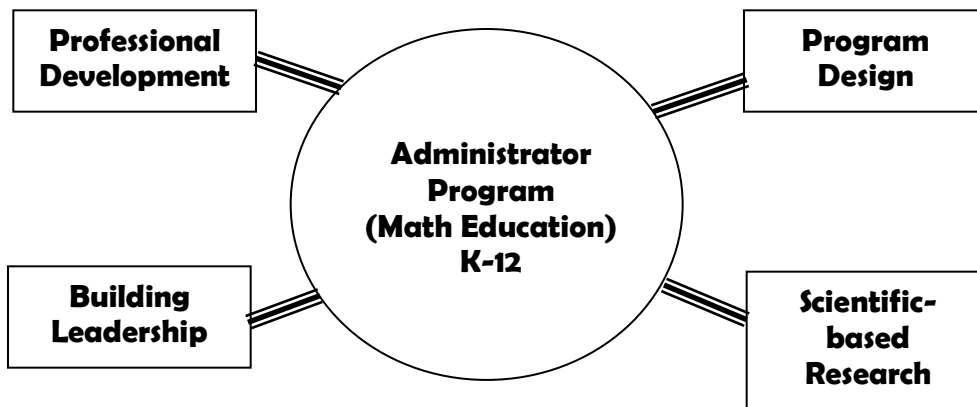


Designing a Successful Administrators' Program for Increasing Student Achievement in Mathematics

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Abstract

The information provided in this report will assist in designing a K–12 administrators’ program targeted to increasing student achievement in mathematics. Though mathematics is the chosen content area, the model has the potential to be adapted to other content areas. The program design is intended to be a general one and not reliant upon any specific curriculum or financial resources.

The program design for school administrators includes highly effective professional development along with building the capacity to exercise appropriate leadership. The inclusion of scientific- based research strategies and the attributes of the constructivist classroom will be cited throughout this report.

This report is based upon the lessons learned through the successes and challenges of the first four years (2002–2006) of the Indiana University/National Science Foundation Mathematics and Science Partnership (MSP) targeted grant. During this period, the MSP was a partnership between Indiana University and eight urban school districts in the state.

Overview

The educational mission of all K–12 school districts is to design and implement a plan of action that will increase student achievement. Federal legislation, namely, “No Child Left Behind” (NCLB) (2001), requires that school districts examine school improvement plans from a comprehensive perspective. No longer can educators focus only on one grade level to improve student achievement, but for effective professional development and growth of the twenty-first-century learner, the perspective must be the entire K-16 educational experience and beyond. The workplace is demanding the same capabilities of high school graduates as higher education is expecting from its entry-level students; therefore, all learners must have equivalent opportunities to meet these expectations. Many stakeholders have forced school-level decision makers to focus on the same educational issues, while seeing them through different lenses.

One of the most influential of the constituent groups is the K–12 school administrator cadre. The school administrator of the twenty-first century must focus on being a true educational leader. Of course, improving student achievement is a complex task accomplished only with the assistance of many knowledgeable people, but creative and supportive administrators can make a tremendous difference. Since the development of learners across the K–12 spectrum must be a seamless process, those with leadership responsibilities across several grade levels are especially well positioned to coordinate and facilitate the multiple tasks required.

As school administrators seek to respond to federal, state, and local mandates to increase student achievement in mathematics, they should consider the following questions:

- What does a high functioning math classroom look like?
- What are the attributes of highly effective professional development for teachers?
- How does scientific-based research impact decisions?
- How do I empower others?

These overarching questions will be addressed in this report.

Implementation

Implementation of the IMI Administrator Awareness Action Plan involved the following three objectives:

Objective 1: Increase IMI principals' understanding of national and state mathematics standards, and the challenges classroom teachers face when they implement a standards-based curriculum.

Within the first year of our four-year plan, we held a series of regional meetings designed to address the importance of the recommendations of the National Council of Teachers of Mathematics (NCTM) document *Principles and Standards for School Mathematics*. The recommendations suggested by NCTM were always a major component of our professional development plan. Approximately three administrator sessions were scheduled for school year 2002-2003 and school year 2003-2004.

The *Indiana Mathematics Standards* were amended and a new version was published in August 2002. There is a very close connection between the *Indiana Mathematics Standards* and the *Principles and Standards for School Mathematics*. The newly designed professional development program focused on the content standards of both of these documents along with the importance of the process standards in mathematics. Problem solving was a major area of importance for school administrators and heavily addressed in every session throughout the year.

School administrators attended both regional and local training sessions. The regional training sessions were held on Saturdays and on occasion after school from 4:30–8:00 P.M. Administrators who participated in a training session were awarded an honorarium and dinner was provided at each of these sessions. Three or four sessions were offered during each school year. Potential schedule conflicts were avoided by carefully examining calendars of school holidays and special events.

Other resources that may be useful to school administrators seeking to become more familiar with state and national initiatives, proposals and reports relating to K–12 mathematics instruction include knowledgeable staff in the State Department of Education and faculty and staff at universities. Individuals from both groups have contributed to the programs for school administrators hosted by the IU/NSF MSP.

Objective 2: Increase awareness in IMI principals of specific ways they can support their teachers' implementation of a standards-based classroom.

At each of our administrator awareness sessions one of the major agenda items addressed was how to support the implementation of our pilot curriculum *Everyday Mathematics*. Administrators shared strategies as a group, concentrating on how the early pilot teachers were being rewarded for their time and extra efforts. The discussions were continued in small groups with all participants sharing ideas and strategies they had used to support the early implementers. Administrators left each session with several strategies proposed by their colleagues, and these strategies were revisited in subsequent sessions where administrators gave reports on the most successful strategies.

At each administrator awareness session the importance of school administrators actively demonstrating their support was emphasized. The goal is to improve student achievement in

mathematics through a vertically articulated curriculum, and the enthusiasm and support of the school administrator are essential. Administrators agreed that recognizing the facets of the constructivist mathematics curriculum was essential, but also that developing and understanding sound classroom observation procedures are critical to effectively carrying out their evaluation roles in their schools.

Hosting Parent Math Nights is a strategy suggested by most school administrators to show program support. Usually these special nights were scheduled twice during each school year to help parents become familiar with the goals and features of a good reform mathematics program. Administrators were encouraged to not only be present at these parent nights but also to actively support the teacher facilitators. Many of these facilitators were teachers trained by IMI and by members of the IMI Select Cadre.

Objective 3: Increase awareness among IMI principals of the essential role of a cadre of well-prepared teacher leaders and of the importance of giving them appropriate leadership responsibilities.

The case can be made that the most important aspect of the administrator's role in creating a lasting collegial and academically sound environment in his/her district's schools is to have confidence and trust in well-prepared teacher leaders. It is the administrator's responsibility to identify those staff members who have leadership potential, and to see to it that they have an opportunity to develop that potential. Once these individuals are identified and prepared, the administrative staff both in a school and district must support and trust these teachers to take leadership roles and then permit them to lead.

In order to identify and prepare a cadre of teacher leaders, the IMI project developed and implemented a thorough and well-planned long-term teacher leadership development program. IMI teachers were involved in training sessions conducted both at central locations with large groups and in sessions held regionally. During the latter sessions, teachers became more involved, competent, and comfortable with their leadership roles. The various areas of concentration in leadership training included content competency, understanding curriculum, and commitment to the goals and objectives of the project. After the teacher leaders went through the training process and had demonstrated competence in these leadership requirements, they had the responsibility to become the trainers, mentors, and supporters of other teachers in their districts. The ultimate goal of this on-going process is to sustain a standards-based, research-driven reform mathematics program in each IMI school district. Through our administrative awareness program, school and district administrators have come to support the developmental teacher leadership process, so that now administrators recognize their teacher leaders and utilize their skills and enthusiasm.

Program Design for School Administrators

A successful administrator awareness program must address these concepts:

How students best learn mathematics along with best instructional strategies

The Indiana MSP provided all school administrators with the most current scientific-based research linked to learning theory and best instructional practices in mathematics. Education

researchers such as Robert Marzano, Doug Reeves, and Willard Daggett were primary resources for our facilitators, and all three have very current information that positively impacts student learning and best instructional practices. A critical question for administrators is, *What Should I Look for in a Math Classroom?* The question has been the focus of a great deal of study and writing, and several useful brief summaries are available. For instance, the Annenberg Foundation has a very useful brochure [<www.learner.org/catalog/resources/mathclass/mathcl_one.html>](http://www.learner.org/catalog/resources/mathclass/mathcl_one.html) that explicitly lists characteristics of the effective teacher and the observed behavior of highly engaged learners. Also, the Math Connection (a group which includes representatives from several professional organizations for school administrators) and the Mathematical Sciences Education Board [<www.utdanacenter.org/mathtoolkit/support/look.php>](http://www.utdanacenter.org/mathtoolkit/support/look.php) have a summary with sections titled *What are students doing?* and *What are teachers doing?* In addition, a discussion of the constructivist classroom is also highly recommended.

Lessons Learned by our MSP

Some school administrators were under the false impression that learning theory and best instructional strategies were a function of the learner's age; i.e., that using manipulatives and other hands-on resources were more appropriate for younger math students. This is not what current research indicates. All school administrators were introduced to a host of hands-on activities such as games, alternative algorithms, algebra tiles, and geoboards to help them better understand the constructivist classroom and its importance for K-12.

Knowledge about the district's K–12 mathematics program

The Indiana MSP offered professional development for K–12 administrators and was sensitive to the need to avoid grouping administrators by levels (i.e., elementary, middle, high). Administrators examined mathematics programs at all levels to look for philosophical similarities and differences. The elementary program chosen by our MSP was *Everyday Mathematics*, which employs a constructivist approach to learning mathematics. Middle school and high school course materials, usually textbooks, had to be reviewed to analyze how these were similar or different to the constructivist approach. School administrators must be knowledgeable of mathematics programs K–12. This doesn't necessarily imply a deep understanding of mathematics content but rather the educational philosophy that exists at each educational level (i.e., elementary, middle, and high school).

Lessons Learned by our MSP

Critiquing math programs across multiple K–12 grade ranges is a new concept for many administrators. The adoption of mathematics textbooks must be done from a global perspective. The vertical articulation of textbook choices is a critical decision that will heavily impact instruction and student achievement. Our MSP offered regional professional development that involved school administrators from a variety of school districts. The constructivist approach of the *Everyday Mathematics* program was a major feature of our regional professional development. The professional development facilitators were IMI cabinet members, guest speakers, and classroom teachers.

Teachers who are implementing a standards-based mathematics program are more likely to succeed with strong and consistent administrative support.

Teachers who are early implementers of a standards-based mathematics program need support both with resources and professional development. The amount of extra time spent by these maiden voyagers is substantial and needs the full support of administrators. Central office administrators and building-based administrators must have a good understanding of the philosophy of the standards-based mathematics program. As teachers must be risk-takers during the implementation stage of a standards-based mathematics program, administrators need to acknowledge the successes and failures of these early developmental years. Without administrator support, new progressive standards-based mathematics programs will eventually fail.

Our MSP rolled out professional development for *Everyday Mathematics* in a three-year cycle for school administrators. Professional development involved the program features, training for what administrators should actually see in a classroom that is implementing the program properly, and how to assist teachers who were struggling program implementers. Our MSP strongly suggested that building-level administrators visit classrooms and positively and professionally reward teachers for exemplary teaching.

Lessons Learned by our MSP

Administrators in our districts were astonished by the pedagogical difference in a standards-based mathematics curriculum compared to a traditional mathematics curriculum. The instructional strategies used in the standards-based curriculum are multi-dimensional, involving many new approaches that are frequently unfamiliar to school administrators. Teaching mathematics from a conceptual understanding approach and using hands-on manipulatives were major innovations for many school administrators. The importance of content knowledge in mathematics was also a major aspect of program implementation. Administrators concurred that providing professional development for teachers of mathematics focusing on content knowledge was essential.

Provide an Electronic Learning Community for Teachers

Having access to an electronic-based web site for teachers to communicate information with their colleagues is an efficient way for them to get assistance with instructional issues in a timely fashion. The support of central office administrators in this endeavor is important. The sharing of successes and challenges of program implementation is best handled by teachers implementing the standards-based program in mathematics. However, school administrators need to endorse this electronic version of professional development and provide the technical support essential for smooth operation.

Lessons Learned by our MSP

The computer skills of teachers varied widely. Professional development was needed at the basic level to help ease the frustration of some teachers. Also, teachers wanted to be assured that information shared electronically would be confidential and not used as a part of teacher evaluation.

Professional Development

A successful professional development program must address these concepts:

The scope and sequence of a successful K–12 Mathematics Program

In the early professional development sessions for administrators, the global aspect of a high-functioning mathematics program reaching across elementary, middle school, high school, and higher education was critiqued. This approach allowed administrators discussing issues across the K-12 grade spectrum to design strategies to impact identified areas of concern. These sessions were in regional locations usually involving four to six school districts. The cross fertilization of ideas from many school districts was a rich learning experience for our school administrators.

Lessons Learned by our MSP

The regional sessions for administrators provided a fine opportunity for school personnel to gain new perspectives about similar issues. As a kickoff for our administrative awareness activity, our MSP recruited a school administrator from Pennsylvania to share implementation successes and challenges, and this provided an excellent starting point. The regional sessions were a great start, but the travel after work was difficult for some administrators. Our MSP responded to this issue by shifting to on-site professional development sessions. Some sessions were within the work day, while others were offered locally immediately after school.

Offer professional development sessions that are linked and very focused

For an effective program, three to four professional development sessions per year are highly recommended. Sessions which were linked with a unified theme have proven to be a successful professional development model for administrators. Our MSP chose to focus on increasing student achievement in mathematics by concentrating on mathematical content and best instructional practices. The following major objectives were developed throughout our three to four professional development sessions for school administrators:

- Content of a constructivist mathematics program
- Best instructional strategies from the research (Marzano, Reeves and Daggett)
- What administrators should observe in a high-functioning math classroom
- The importance of state standards (big ideas)
- The use of benchmark assessments
- The importance of content knowledge in mathematics

Lessons Learned by our MSP

Mathematics content knowledge surfaced as an important topic of discussion in every administrator session. Our MSP conducted a measurement of teacher content knowledge by

administering the LMT (*Learning Mathematics for Teaching*) assessment designed by a RETA (Research Evaluation Technical Assistance) based at the University of Michigan. Our targeted teacher group was elementary teachers grades K–6. This content knowledge assessment measured three mathematical strands: number and operations, algebra and functions, and geometry. The 30 multiple choice assessment instrument provided our MSP with valuable information about content knowledge deficiencies of the targeted elementary group of teachers. After reviewing the results of this assessment, our MSP responded by providing specific content knowledge professional development for teachers at the local and regional levels.

Administrators also learned about using games as a catalyst to better understand concepts in mathematics. District benchmark assessment models were shared along with how districts were using data to improve student achievement. Administrators also were very interested in learning how to better prepare special needs students in the area of mathematics.

Building Leadership Capacity

Developing leadership capacity among district personnel is critical

Building leadership capacity among district-level personnel was always a major component of our administrator professional development plan. Administrators are cognizant of the fact that to increase student achievement in mathematics requires assistance from all district personnel. Developing in-house, knowledgeable staff such as classroom teachers was important. Administrators were encouraged to support a critical mass of teachers to become educational leaders willing and able to conduct building-level professional development in the area of mathematics. Sustainability of the gains made in student achievement in mathematics is directly related to having a critical mass of building-level leadership capacity.

Lessons Learned by our MSP

A group of highly qualified classroom teachers was identified by our MSP and became known as “Select Cadre Teachers,” grades K–6. These “superstar” teachers were given additional professional development to become district and school leaders of mathematics teaching in practice and to provide professional development to others. Success at the K–6 level led to extending the concept to secondary math teachers. Administrators were informed of these select cadre teachers and were encouraged to use their expertise. Many select cadre teachers conducted district- and school-wide mathematics professional development sessions with the recommendation and support of school administrators.

Summary

School administrators provide the leadership in K–12 school districts, and they are expected and empowered to make decisions about policy that will directly impact student achievement. The cross-fertilization of knowledge spanning elementary, middle school, high school, higher education, and the workplace is needed to problem-solve solutions to complex issues. This is a teamwork approach, collaborative in nature and difficult for some school administrators to

endorse. The twenty-first-century demands of the school community, coupled with accountability of NCLB, have forced school administrators to become more cohesive as a professional learning community.

Research results confirm that innovative programs in mathematics education are increasing student achievement in mathematics. Most of these recently developed mathematics programs incorporate instructional strategies that are on the cutting edge of current learning theory. School administrators must be knowledgeable about these contemporary programs in mathematics.

School administrators must also be aware of the increased content knowledge that is needed to implement such demanding new mathematics programs. Providing opportunities for math teachers to focus on content knowledge is essential. Professional development offered to teachers must include the best instructional practices, and the professional development plan must be at least a year in length. Keeping the professional development focused on a few objectives is a recommended approach to designing an effective plan. School administrators need to support this type of professional development design by encouraging teachers to participate and by attending themselves. The school administrator must have an eye for the highly effective mathematics classroom.

Building leadership capacity among a critical mass of school and/or district personnel is extremely important. These top selected educators will lead and direct a school and/or district to achieve expected student objectives. The school administrator must find ways to motivate and reward these highly qualified staff members. Not only will these individuals deliver professional development sessions but will also assist other staff members who are struggling with classroom issues.

Improving student achievement in mathematics is a multi-dimensional task, requiring the K–12 school administrator to stimulate the combined endeavors of many highly qualified stakeholders. The issues related to improving student achievement are many, and they require the expertise of a variety of highly trained school and district personnel. Additionally, seeking input from such professionally qualified outside stakeholders as state departments of education and universities is highly recommended.