

Improving Instruction: The Role of Elementary Math Liaisons

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Mathematics has increasingly become a critical component of our global society. The news media often reports on how American students, as a group and at specific grade levels, are performing as compared to students from other countries around the world, and the reports are not flattering. *Before It's Too Late: A Report to the Nation from The National Commission on Mathematics and Science Teaching for the 21st Century* (2000), in its Executive Summary (available online at <http://www.ed.gov/inits/Math/glenn/toolate-execsum.html#full>), states that:

America's students must improve their performance in mathematics and science if they are to succeed in today's world and if the United States is to stay competitive in an integrated global economy. . . . the most direct route to improving mathematics and science achievement for all students is better mathematics and science teaching. (p. 1)

At the federal level, "No Child Left Behind" (NCLB) was promulgated, and states have put in place tests to fulfill the legislated requirements of NCLB. In Indiana, these exams are known as the Indiana Statewide Testing for Educational Progress Plus, or ISTEP+. Students are tested in mathematics from the third to the tenth grade. Beginning with the 2008–09 school year, students will be required to pass an algebra end-of-course exam in order to graduate from high school.

This focus on mathematics and mathematics education, whose aim has been to provide a vision of high-quality teaching, has led to improvements in teacher preparation and professional development. Curricula that are based upon research findings and the National Council of Teachers of Mathematics' *Principles and Standards for School Mathematics* (2000) have been written to help provide such teaching.

Professional Development for Elementary Mathematics Teachers in Indiana

At the elementary level, many teachers admit to having greater content knowledge and more professional development in reading and writing, as opposed to mathematics and science. Recognizing the need for high-quality teaching, and, thus, for improving content knowledge and professional development for mathematics teachers, a National Science Foundation (NSF) Math and Science Partnership (MSP) grant was awarded to the Indiana Mathematics Initiative (IMI), a collaboration between Indiana University and nine school districts across the state of Indiana. The original districts were: East Chicago and Hammond in the northwest; Fort Wayne and Elkhart in the northeast; Anderson, Decatur Township and Pike Township in central Indiana; Bartholomew County in the south; and Vigo County in the west. Some of these districts had participated in an earlier NSF Local Systemic Change grant for middle school mathematics, had seen some success with it, and recognized what could be done better in the MSP grant. In 2002, professional development work with elementary teachers participating in the project began.

A primary purpose of the IMI project was to provide professional development that would allow teachers to become teacher leaders, who in turn could provide sustainability in their own districts. These teachers were expected to pilot one of the NSF-funded, research- and standards-based curricula. Content knowledge training, professional development and support for using the new curriculum, and sessions on mentoring and leadership were all provided by a consistent group of workshop presenters, who were mathematics teachers and coordinators.

A Common Standards-Based Curriculum

The Indiana Math Initiative board members had worked with the prior middle school grant and felt that one inadequacy of that project was having different districts using different curricula. Since that had circumvented some of the consistency thought necessary for professional development, it was decided that one and only one NSF-funded curriculum would be used, and *Everyday Mathematics* was the unanimous choice of the group.

Everyday Mathematics empowers students to think mathematically and to measure up to the demand for greater problem-solving agility. Developed by the University of Chicago School Mathematics Project, *Everyday Mathematics* is the result of collaborative efforts by researchers, mathematics educators, administrators, and classroom teachers. The instructional design is carefully crafted to capitalize on student interest and maximize student learning.

The curriculum is organized into six mathematical content strands that cover a number of skills and concepts. This provides a rich yet balanced curriculum. Every strand is addressed throughout all grade levels of the program. Each grade level builds on and extends concept understanding, so children approach each new challenge from a firmly established foundation. *Everyday Mathematics* is a spiral-based program that enables children to make new connections and build on the mathematical content they already know, while gradually learning more difficult and challenging content. Think of this process as climbing a spiral staircase—with each twist of the stairs, the previous steps can be seen, but one is farther along and higher up.

Everyday Mathematics also encourages the use of alternatives to the traditional algorithms used for addition, subtraction, multiplication, and division taught in American schools. Many students never become proficient using these traditional algorithms for basic operations. Instead of suppressing children's natural problem-solving strategies, the approach of this curriculum is to build upon them. Although many strategies are taught or recognized as viable, one of the alternative algorithms for each operation is identified in *Everyday Mathematics* as a "focus algorithm." All students are expected to learn the focus algorithms at some point, though students are always encouraged to use whatever method they prefer to solve problems.

Research on the effectiveness of *Everyday Mathematics* has shown that it can improve student performance through active teacher involvement in best practices. (See the U.S. Department of Education's Institute of Education Sciences' *What Works Clearinghouse*, http://ies.ed.gov/ncee/wwc/reports/elementary_math/eday_math/.)

The Role of Elementary Math Liaisons in Vigo County

Several teachers from Vigo County School Corporation participated in the IMI project and began piloting the *Everyday Mathematics* program in their classrooms. In 2004, Vigo County schools adopted *Everyday Mathematics* for all of its students, and the 300+ teachers in all 18 elementary schools were expected to use the standards-based curriculum. The Vigo County School Corporation recognized the need for providing content knowledge and curriculum training for

these teachers, along with the modeling of lessons and activities in the classroom and one-on-one professional development, in order for the program to succeed.

To answer this need, Assistant Superintendent Dr. Karen Goeller sought and found funding to allow four elementary teachers to become full-time “math liaisons” for Vigo County for the past three years and continues to plan for future funding. This was a direct outgrowth of the corporation’s involvement in the IMI project. As members of the first three cohorts of teachers participating in the IMI project, which became known as the IMI Select Cadre, four of the authors (Diane Allen, Sharon Kramer, Sandy McFarland, and Janis Kluesner) received professional development that supported not only their growth as elementary mathematics teachers but also as teachers leaders, who provided mentoring and professional development for the other teachers in their school district. These teachers became the original four elementary mathematics liaisons for Vigo County. In 2007, Sandy returned to the classroom, and Eleanor Rodie, a special education teacher who participated in all the district-level training provided by the select cadre teachers, replaced her.

No program can succeed if it is not implemented properly and completely. With full implementation of the *Everyday Mathematics* program as their goal, the math liaisons provide professional development for all teachers at grade levels K–5, as well as one-on-one assistance in the classroom. They also provide professional development to entire school and team faculties at the elementary, middle school, and high school levels. They work with administrators, parents, and volunteers, and they collect and analyze data on the mathematics learning of the Vigo County students. Because of the existence of these IMI-trained teacher leaders, teachers now have the human resources ready and willing to assist them in the classroom.

Professional Development at the Classroom Level

The elementary math liaisons begin each fall assigned to schools with targeted populations for success on the ISTEP+. In the classrooms and in after-school and Saturday sessions, they model effective problem-solving strategies using ISTEP+ items from previous years. They first focus on modeling to teachers with their entire classes at the third, fourth, and fifth grades, and then continue modeling to teachers with small groups of “bubble” students—students whose scores from the previous year are only slightly above or below the passing mark.

The liaisons model and facilitate activities that elicit children’s solution methods, support their conceptual understanding, and extend their mathematical thinking. For instance, strategies to elicit student solution methods are taught by encouraging the use of alternate algorithms by students and teachers and by demonstrating various problem-solving techniques such as working backward, using guess and check strategies, drawing diagrams, and working easier problems. In order to extend students’ mathematical thinking, it is important to correlate math to other curriculum areas—such as tessellations, poetry, acrostics, short stories, algebra election—and to encourage application of learned strategies to new unsolved problems.

As a special needs teacher at one of the high-poverty, high-risk elementary schools, one of the authors had her own classroom of students and also had students in regular classrooms for whom she provided support. She can attest to the fact that allowing these students to find the algorithm that works for them has greatly enhanced their learning of mathematics. She has been excited to see the increase in ISTEP+ scores from her elementary fifth-grade students and the sixth-grade students who have gone on to the middle school, including one of her mildly mentally handicapped students who passed the fifth-grade mathematics assessment.

The curriculum also includes “Explorations” and projects. The liaisons have worked with teachers to facilitate groups doing Explorations from the *Everyday Mathematics* curriculum in first, second, and third grades. These Explorations are “hands-on” activities that promote discovery of concepts and strategies, and can often be quite lengthy and/or complex. In grades four and five they have assisted teachers with projects that are a part of the *Everyday Mathematics* program. These projects also focus on cooperative learning where children share their ideas and discoveries. They extend the concepts included in specific units and encourage students to think beyond the basic information.

Along with modeling for teachers, the math liaisons also find it necessary at times to provide more specific direction to individual teachers. They conference with teachers to find alternate ways to present lessons, develop and provide activities for teachers to use, and help teachers stay focused on where they need to be in the curriculum.

The liaisons strive to see that the adopted curriculum is implemented fully. They visit classrooms on a by-request basis, and they are in high demand. A new teacher in grade one special education said, as do many Vigo County teachers, “I didn’t like *Everyday Mathematics* at the start, but now I am really liking it, because I can see the kids are getting it.” Teachers tell the liaisons that they see the benefit of the spiral approach, as students are coming to them better prepared than they have been in the past.

Professional Development at the School Level

The liaisons meet with school administrators to explain their role and the services they can provide that would be most beneficial in that particular school. They have spoken at faculty meetings concerning a variety of topics, including the educator resources that are part of the *Everyday Mathematics* program. The eighteen elementary schools have been provided a booklet introducing each of them to the *Everyday Mathematics* philosophy and program.

At the middle school level, the liaisons work with teachers to familiarize them with the focus algorithms of the *Everyday Mathematics* program. Many of the algorithms emphasized in the curriculum are alternatives to the traditional algorithms taught in schools, and many teachers are unfamiliar with them. Working with the middle school teachers allows them to better understand the foundation their students have. Three of the six Vigo County middle schools have requested presentations, and the liaisons have worked with individual teachers in the other three schools as well.

A very successful presentation was made to all teachers and administrators of West Vigo High School in a half-day professional development session. The liaisons presented an activity using some of the alternate algorithms in the elementary curriculum. Participants were highly engaged and seemed to be very accepting of the algorithms; in fact, some teachers voiced that they had been taught in such ways in their own schooling. The next day, the principal called the Mathematics Curriculum Coordinator, Gail Artis, to report that his teachers had brought in a white board to the lunch room, so that they could learn lattice multiplication—an uncommon occurrence in any faculty lunch room. As a consequence, North Vigo High School also invited the liaisons to present to all North Vigo teachers and administrators.

Professional Development at the District Level

Professional development begins each fall with a session for teachers who are new to *Everyday Mathematics* or who are new to a particular grade level of the program. This workshop helps to familiarize the teachers with the three parts of each lesson and the materials available with the

program. It also allows the Liaisons to set up the list of teachers to be mentored for the year, with whom they will stay in contact and provide assistance as needed. This new user training has been funded by the IMI grant and includes two additional days of in-service professional development for these teachers during the school year.

New teachers also have the opportunity to earn a game kit for their classroom, by attending one of the game kit workshops offered by the liaison teachers on two evenings after school. Again, participants have been paid a stipend through the IMI grant. The importance of games is continually stressed by the math liaisons, who show teachers how they can help students to practice the basic facts, develop cooperative learning groups, differentiate their mathematics instruction, and adapt the games in many ways to suit the needs of the individual classrooms. They present a quote from a fifth-grade teacher who had tried several different approaches with a student having trouble learning the basic multiplication facts. After playing the games, the student took ownership of his learning, because he did not want to lose. The teacher stated, "For the first time, it [learning the facts] was important to him and not to me." She also said, "I hated *Everyday Mathematics* at first, but I will tell you now I am a believer."

As a part of the IMI project, the select cadre team members provided other after-school professional development sessions for all elementary teachers in the district. These meetings, held four times during the school year, allowed the math liaisons and other IMI-trained teacher leaders to share what they have learned at IMI workshops and meetings. Topics have included alternate assessments, focus algorithms through the grade levels, the CD assessment that accompanies the curriculum along with related websites, the spiral content strand trace, and the *Everyday Mathematics* levels of "Beginning," "Developing," and "Secure." As a group they have written activities for each grade level, K-5. In doing so, they focused on the question "What do I do to prepare students for ___?" and used a variety of mathematics activities. The math liaisons also presented a well-received session on "Writing and Mathematics" at the annual school corporation conference for elementary school teachers and administrators.

Content training has also been provided in two half-day sessions to every elementary teacher in the Vigo County School Corporation. The liaisons created a PowerPoint presentation for each of the Indiana Academic Mathematics Standards, and then used it along with hands-on activities with the teachers in specific grade-level sessions. (These presentations will be available on the IU-IMI website: <http://www.indiana.edu/~iucme/>.) Again, funding for this training was provided through the IMI grant.

The elementary math liaisons not only work with teachers but also with administrators. They presented at a workshop held at the Holiday Inn sponsored by Indiana Math Initiative. At this workshop, elementary and middle school administrators participated in an algorithm activity in which they experienced firsthand the benefits that using alternative algorithms can provide. Their participation and excitement were obvious. At the beginning and middle of the school year the liaisons report on their activities at the district-wide meeting of all elementary principals conducted by the director of elementary education. Lastly, they have worked with the superintendent's cabinet, who requested a presentation from the liaisons after hearing about them from the teachers, parents, and community members. Cabinet members were pleased to learn more about all of the activities and successes of the liaisons' work.

In addition to all of the above, the elementary math liaisons are working with Rex Ireland, assessment coordinator for Vigo County School Corporation and former mathematics coordinator, on modifications for students in grades two through five. These modifications are first to be used for special education and high-risk students, and, after field testing in 2008-09,

they will be available for all classroom teachers. The after-school sessions with special education teachers for work on this project have been funded by the IMI grant. They are also currently working on a summer remediation curriculum that can be used by any of the schools for their summer programs. They are tying the summer curriculum closely to the school-year curriculum, using many games and activities to enliven the program.

Professional Development at the State Level

Three of the elementary math liaison teachers were presenters for the IMI summer conference, Sustaining Success by Supporting Teachers, in Indianapolis, Indiana, in 2007, for teachers in all of the IMI participating districts across the state. One session was on leadership transfer and content training and another on alternative algorithms.

Working with Parents

The liaisons have assisted with Family Math Night activities at all the schools, including six schools in the fall of 2007. These activities have focused on a variety of topics, such as active play of games to practice computational skills, *Everyday Mathematics* games online, the importance of the Family Letter at the beginning of each unit, activities that can be done at home to enrich a child's math education, and the presentation of an *Everyday Mathematics* lesson to parents.

Parents often raise questions when their children come home with alternative ways of solving problems. These methods and algorithms may be unfamiliar to many parents. An important role of the family math nights and parent meetings has been to demonstrate that these "new" algorithms are based on common sense and children's informal knowledge of mathematics and allow them to devise their own methods for basic computation. The irony is that many of these new approaches are thousands of years old.

The math liaisons also provide information to parents during Parent/Teacher Conference Week and at Kindergarten Parent meetings at schools as requested. Parents are given take-home materials to continue play of games and access the *Everyday Mathematics* games online. Parents of incoming kindergarten students are given passwords so that their children can play *Everyday Mathematics* games at home or at the public library over the summer before entering kindergarten. They are also given a brochure on the benefits of *Everyday Mathematics*, a spreadsheet showing the nine online games for early childhood and the content strand of each game, and a daily calendar with suggestions for summer math activities.

Enriching Opportunities for Volunteers

Opportunities for volunteers are enriched by training community support groups as math mentors to provide extra help with specific math skills. Kids Hope USA volunteers, Western Indiana Community Action Agency staff, Title I teaching assistants, local college students, Educational Assistants, and peer tutors engage students in math activities following training by the math liaisons.

Even the youngest learners benefit from the math liaisons. Community and Alliance Services for Young Children daycare providers and Vigo County Head Start teachers are provided with training to begin building a foundation at the pre-kindergarten level. The liaisons are currently training Kids Hope USA volunteers for all 18 elementary schools. The volunteers will now be able to use *Everyday Mathematics* activities for students in after-school care, providing enrichment and added support to mathematics taught in the classroom.

Extending an offer to train volunteers from local churches, the elementary math liaisons recently met with area pastors. This will provide an additional intervention to strengthen math skills.

All staff members in the Vigo County School Corporation administration building were assigned as mentors to work with students at Deming Elementary School, which did not meet the standard for annual yearly progress of No Child Left Behind. The elementary math liaisons provided training for the staff on the philosophy of standards-based mathematics and the daily components of the *Everyday Mathematics* program.

Other Activities

The liaisons begin the school year updating the class lists from all eighteen elementary schools for the *Everyday Mathematics* games online, thereby allowing the students to continue to use this service with their password for the school year and following summer. They also enroll students new to the Vigo County School Corporation and generate a password for them. They continue to provide assistance throughout the year by being a contact with McGraw-Hill, if a need arises. Teachers are initially trained on the system and then taught to update their class lists.

Following the first session of new user training, the liaisons continue to assist new users with the *Everyday Mathematics* assessment CD, which provides a wealth of possibilities for the classroom teacher. Workshops and individualized training are provided modeling the use of the *Everyday Mathematics* games online. There have been numerous comments from parents indicating the benefit of this program. It appears that *hooking* children on the program at school has carried over to playing the games at home as well.

An exciting development is the formation of a working partnership with the Vigo County Public Library. Elementary students visiting the various library sites in Vigo County have been eager to play the *Everyday Mathematics* games online. The library was anxious to oblige, so the elementary math liaisons provided training to the library staff, and the library made the computer modifications necessary to accommodate the online games. As a follow-up, three *Everyday Mathematics* games—one for prekindergarten and kindergarten students, one for primary students, and one for intermediate students—were donated by the school corporation to the library, where they are used as a part of their highly successful tutoring program.

Janis Kluesner makes presentations to Indiana State University (ISU) elementary education students preparing for their two-week teaching experience in the classrooms in Vigo County. The ISU students are exposed to the focus algorithms and the importance of active play of games, as well as the three parts of each lesson they will teach over the two-week period.

Data Collection and Analyses

In the fall, the four liaisons begin working with the data generated by the previous year's ISTEP+ results for the two subgroups of highest concern: students who receive free and reduced lunch and students with special needs. They also look to see which students had scores just above or below a passing score. They work out a schedule to meet with these students often, leading up to ISTEP+ in the middle of September. Upon examining the results of the fall 2006 test, it was clear that many of these targeted students from the previous year were successful on the ISTEP+ in mathematics. This success was duly noted by the administration. The liaisons continue to work with teachers, so that classroom teachers may gain an understanding of test results to better determine strengths and weaknesses of their students on specific standards.

The corporation requires that quarterly tests be given in all grade levels, one through eight, both in language arts and mathematics. The elementary liaison teachers were responsible for writing the mathematics questions for grades one through five, and data from these tests are being collected and examined to help determine individual and school strengths and weaknesses.

Results

On the state assessment, ISTEP+, in the fall of 2007, the percent of students passing in grades 3, 4, and 5 exceeded the previous year and at all three grade levels met or exceeded the state average. Most impressive, however, was the jump in achievement by special education students. At grade 3, the percent passing jumped from 46% to 53%; at grade 4, from 50% to 65%; and at grade 5, from 37% to 58%. The textbook adoption in 2004 was the first time that special education teachers and students adopted the same materials that were used in the regular classrooms. Also, special education teachers participated in all the professional development offered to regular classroom teachers, and more focus was on inclusion. Thus, it appears that both the role of the elementary math liaisons and the implementation of a standards-based math curriculum are instrumental in these achievements.

This embedded staff development model has had an impact on teachers, administrators, parents, community members, and ultimately students. The elementary math liaisons and their superiors are confident that additional support for teachers and students in mathematics will continue to lead to improved performance, both in the classroom and on standardized tests. A key component of this support is the role the elementary math liaisons play in the district, allowing for complete implementation of the chosen curriculum and the sustainability of its success in the classroom.

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