Meeting the Challenge of Feeder District Articulation

John Dossey  Marion Hoyda
Illinois State  Lockport Township
University  High School District
Normal, IL  Lockport, IL

Many of the major problems associated with developing and providing a quality high school mathematics curriculum in a 9-12 school district relate to articulating the program with that found in the K-8 feeder districts. As the number of feeder districts grows, these articulation problems increase exponentially. The articulation challenges are not limited to curriculum. They also include the range in instructional patterns, expectations of student work, the use of instructional technology, and differences in students’ opportunity to learn in the many classes of the various feeder districts.

Lockport Township High School (LTHS), District 205, located in Will County, is making headway in developing and sustaining a way of dealing with these challenges. LTHS has 7 public and 2 parochial feeder districts. As the Mathematics Department at LTHS began a study of its curriculum in 1999-2000, it noted that it would be difficult to dramatically impact student learning by limiting their content considerations to the curriculum at their level alone. Any hope of effective change for LTHS students required a K-12 study involving input from key teachers and administrators in all of the districts feeding the high school. This lead to the development of the Lockport Mathematics Consortium, a group consisting of such individuals. The participating districts of the Consortium fund the activities on a pro-rated basis so the expenses are shared and affordable.

In 1999-2000, the main activities of the teacher representatives in the Consortium were to examine the ISBE Student Learning Outcomes and to discuss how teachers dealt with them in the varied districts’ classrooms. However, at the same time, the high school mathematics department engaged in planning that would eliminate lower level math classes so that all students, including significantly more students in special education, would start with Algebra I at the very least. This change added a sense of urgency to making sure all students were ready to enter LTHS prepared for Algebra I to be completed in one or two years. This vision, fueled by issues of equity and opportunity, served as the vision for the goals in the years that followed.

In 2001-2002 the work of the Consortium dealt with the development of a comprehensive curriculum plan focusing on the five state goal areas and establishing time guidelines for achieving the goal related outcomes within each of the grades from K through 8. Teacher representatives from every grade level, in every school, in every district, met to discuss the content and processes related to the state math goals. Consultants, John Dossey and Carol Thornton, from Illinois State University, led the professional development activities. Lockport Township High School administrators, Al Franz, Mathematics Chair, and Marion Hoyda, Assistant Superintendent of Curriculum and Instruction served as liaisons to feeder school superintendents and administrators to
coordinate the activities. Consultants and administrators persistently communicated the need for improving mathematics teaching and learning for the benefit of students. There is an important lesson here; the effectiveness of external consultants is buttressed through internal support.

The 2002-2003 activities focused on the professional development of a core group of teachers to deliver this curriculum in the Consortium’s classrooms. However, the numbers of teachers involved in the instructional component of the professional development tripled from the previous year. These teachers involved serve, in a multiplicative sense, as building consultants relative to the common curriculum and some of the issues surrounding it. During summer of 2003, the Consortium will work to develop sample assessments for the various grades reflective of the curriculum and its stated outcomes. Teachers will design math assessments for grades K-8. The high school teachers will have a role in the design of the Algebra I assessments.

**Why A Common Curriculum?**

Before we examine the nature of the common curriculum, it is appropriate to examine why the decision was made to develop a common curriculum for the feeder districts. The first answer to this question is so that each district had a published and acknowledged curriculum. Several of the districts had an adopted textbook series, which served as a curriculum guide, but there were neither shared curricular goals nor any common grade level or within-grade expectations for the districts. While the Consortium districts had curricular guides, there was great variance in what actually took place in the classrooms, even within the individual feeder districts. None of the districts had an accountability program beyond standardized tests for their mathematics program. Hence, the development of a common curriculum was a start toward bringing some cohesion to the individual programs as part of strengthening the mathematics programs in the Consortium’s schools.

A second reason for developing a set of curricular guidelines for the districts was the development of smooth sequences of courses to provide articulation in expectations and readiness on the part of the high school’s program and for the students matriculating from the feeder districts. As the high school upgraded its program of studies to expect all students to have a significant algebra experience in or prior to the 9th grade, it was incumbent on the high school program to communicate these intentions to the administrators and faculty of the feeder districts. As more and more mathematics is expected of students at the high school level in order to be ready for opportunities and challenges at the collegiate, vocational, or career levels, the high school was moving to considering Algebra II a part of the core curriculum for all students. In addition, it was eliminating any pre-algebra courses from its curriculum. The high school will have a two-year sequence covering Algebra I and some geometry as the minimal level taught at LTHS. Algebra I, the year-long course remains in the curriculum. In fact, the changes taking place in the high school curriculum to assure that all students would have an algebra and geometry experience prior to graduation created a sense of urgency for all of the feeder districts participating.

A third reason for articulation was to strengthen and expand the current 8th grade algebra programs provided by some of the districts. Algebra I was also provided as a 0-hour class by the mathematics department at LTHS for students from the smaller feeder districts which could not afford to staff the class offering. While this 8th grade
algebra program has existed for 12 years as an option for the feeder districts, the high school wanted to expand the offerings for students in mathematics to involve more students in its upper division mathematics classes. The district and school administrators and staff have made persuasive arguments to parents and students for advanced mathematics study. As students begin to think of Algebra II as a part of the core curriculum, the mathematics department is working to increase the numbers of students staying in mathematics through the levels of AP statistics or calculus.

To accomplish such goals, the Consortium needed to adjust their programs so that more students could complete their study of Algebra I at the 8th grade level. The high school revised its identification matrix to allow greater numbers of students to enroll in Algebra I as 8th graders. By changing the matrix over two school years, the percent of students participating in the 8th grade algebra program will double, from 20 percent to approximately 40 percent by the fall of the 2003-04 school year. Initial results about increased numbers and student performance are very promising, which furthers the belief that more students are capable of learning algebra in the 8th grade than previously thought. (A long-term goal is to have 75 percent of students enrolling in algebra at the 8th grade).

For students not possessing the skills needed to meet the matrix requirements, another strategy is in place; transition math for 7th grade. Doing this in a safe, sane, and supportive way requires that participating students be identified at the sixth grade level and provided with a transition course at the 7th grade level. Such a course should provide coverage of the important topics contained in the traditional 7th and 8th grade curriculum. Alternatively, students could be identified in 5th grade and spend two such years in transition from arithmetic to algebra in grades 6 and 7. The transition course may actually be a separate class within some of the schools. It may also be completed in a summer program that builds upon the 7th grade curriculum taught during the regular school year. Making such changes requires consortium articulation of two types.

**Articulation Considerations**

The first type of articulation is that existing between grades within the feeder districts as students move from 5th grade forward. This means that they come to the 5th grade ready to start moving forward in fractions and decimals with a solid command of their work with whole number operations and the related facts. Secondly, it requires articulation with the high school program in assuring that the programs in algebra offered off-site from the high school are equivalent in coverage and expectations to that offered at the high school. This is important for two reasons. First, students need to be prepared both emotionally and content-wise to move on in mathematics in a seamless way as they make their shift to the high school. Secondly, they need to be assured that their work in algebra is accepted as meeting the prerequisites for the high school geometry course and other courses following the first course in algebra.

Another form of articulation is the development of student proficiency with the use of calculators and computers as they aid in the exploration of and representation of core mathematical concepts. Where appropriate, students need to begin to use the same forms of technology in the middle school programs as they will have available to them in their study of high school mathematics. As students enter their study of algebra, it is important that they become conversant and flexible in using graphing technology to explore relationships between algebraic expressions and their graphical
representation. Such knowledge includes an understanding of the relationship between parameters in expressions and rates of change, or slopes, associated with various lines; the recognition of when data is linear or non-linear; and a clear understanding of what the solution or root of an equation is and what the graph of a function might look like. Students also need to know both how to and when—and when not—to use a calculator, when to approach problems mentally or use estimating techniques, and when to intensively employ technology. Students with such knowledge are empowered to attack quantitative situations successfully.

Such teacher knowledge of curriculum and technology does not happen in a vacuum, nor does it come through reflective self-study. Neither does a solid understanding of the conceptual sequences that govern deep understanding of the subject matter material. Quality teaching of the material occurs when teachers know how students come to understand the material, the sequence of concepts and procedures that are required to move to the next level, and what prevalent misconceptions students may form. Two other aspects of teacher knowledge that are required are the ability to model critical ideas with manipulative materials or representations and the ability to show students how the material at hand is important in real-world applications. For this level of knowledge to develop, teachers need opportunities to have a concentrated study of the algebra curriculum, from the beginning stages in the primary grades through the applications of the algebra encountered in Algebra I.

Further, for change to really take place, new modes of structuring instruction for learning in an algebra classroom needed to take place. Classes totally dependent on lecture and paper-and-pencil work are no longer the accepted norm for Algebra I. Students who learn algebra in an empowering way need opportunities to examine situations involving change, growth, and proportionality in a variety of settings—investigating, experimenting, and learning to represent the relationships they see. These non-teacher centered learning activities do not indicate that the teachers are “not teaching” their classes. Changes in instructional methods call on teachers to become educational leaders of their students—often leading by engaging the students in material that is curricular and developmentally appropriate and challenging them to resolve the situations through employing what they know to develop new knowledge and understanding. Teachers in such classrooms employ a balance of pedagogical methods, ranging from small group work, to laboratory experiences with technology (calculators or spreadsheets) and manipulative materials (algebra tiles, measurement activities…), and whole class settings to provide overviews, to consolidate findings, and set the course for new materials. Such a repertoire of methods also requires the development of new skills. Finally there is the need for the development of new methods of assessment and evaluation to go along with the content and instructional approaches mentioned. The Lockport Consortium had developed a multi-year model to scaffold teacher, curricular, and assessment development to meet the requisites previously identified.

Meeting the Consortium Needs

In order to address some of the articulation issues, the Lockport Mathematics Consortium instituted a series of professional development sessions during the 2001-2002 school year. These sessions were directed by Drs. Carol Thornton and John Dossey of the Illinois State University Mathematics Department and held in the
professional development workshop room at Lockport Township’s East Campus. Carol Thornton conducted the sessions for teachers of grades K-4 and John Dossey conducted those for teachers of grades 5-12 (a group of teachers from LTHS participated in each of the sessions to further develop articulation and lines of communication, as well as understand the curriculum that their students had encountered prior to coming to LTHS). The primary teachers were further divided into groups for K-2 and 3-4 and met in half-day sessions. The 5-12 teachers met in full-day sessions.

During the 2001-2002 year there were 7 professional development sessions for each of the groups of teachers. These sessions focused on the following topics:

- Changing Mathematics Education: Instruction, Assessment, & Problem Solving
- Number Sense and Number Operations
- Geometry and Making Connections
- Measurement Concepts and Skills and Reasoning
- Data Analysis/Chance and Communication
- Algebraic Thinking and Representations
- Putting It All Together – Building a Common Curriculum

Each of the sessions involved the teachers in a consideration of the NCTM and ISBE recommendations for curriculum within the content and process areas mentioned. Along with this, the teachers considered the major sequences of concepts, procedures, and processes taking place at the various grade levels and how these build on one another. Further, they examined the models and representations that might be used in helping students come to develop the understanding desired and meet the objectives set for each of the goals at each grade level.

The consideration of the national and state recommendations for student learning occupied a good portion of the time during the first year. Each of the grade level groups discussed what they did with the content related to these recommendations at their grade levels. They compared and contrasted their work to the recommended sequences and the ways in which their students learn. Time was spent working to align the instruction in the individual districts and match it up with the developmental and curricular sequences examined in the other portions of the workshop. Teachers also discussed their fears and concerns of delivering upon the expectations for the new curriculum with the consultants and each other. Slowly but steadily confidence replaced doubts. There may be a few teachers reticent to accept the changes, however, the change process continues with support.

By the end of the 2001-2002 sequence of sessions, the teachers participating in the Consortium workshops had developed a set of curricular outcomes for grades K-8 and had even made suggestions for focal emphases within the program at each grade level. These emphases were stressed limiting the number of outcomes per year in order to allow for greater emphasis on these specific topics within a given year. This was done with the goal of eliminating cycles of reteaching by teaching to a greater degree of mastery when the topic was considered the first time. In addition, a pacing guide was developed suggesting what topics should receive emphasis in which quarter(s) of the school year. The pacing recommendations help teachers maintain a focus on an entire year and establish a reasonable pace to assure that the topics critical to between-grade articulation received appropriate attention. These outcomes were shared at the building level with other teachers by those teachers
participating in the workshops. These outcomes were also discussed and reviewed with the district superintendents, curriculum specialists, and principals at a meeting in June, 2002. They were also distributed to all teachers and in some districts, officially adopted by the Boards of Education.

During the 2002-2003 school year, teachers participated in a second series of workshops conducted by Carol Thornton and John Dossey. These workshops focused on two different goals. The grade levels were split differently to provide grades K-5 a focus on number through decimals and grades 6-9 with a focus on algebra. This resulted in Grade 5 teachers shifting to work with the K-4 teachers. The K-5 sessions during 2002-2003 also involved a larger sample of the teachers from grades K-5 in the Consortium schools, many of which had not participated during the first year. Carol Thornton modeled instructional techniques, using a variety of manipulatives and mental processes aimed to increase student understanding. In addition, districts’ special education teachers, including those from the high school, also joined in the workshops at the 6-9 level.

The 6-9 teachers’ program in 2002-2003 focused more directly on preparing students for the algebra curriculum with the expressed purpose of developing a smooth transition to Algebra I in Grade 8 for those students for which such a program was appropriate. As a result, the teachers participating in the 6-9 sessions were essentially the same as the first year with some additions. The teachers at these grades were, in addition, more departmentalized in the schools across the feeder districts.

At the end to the 2002-2003 school year, the program of workshops had resulted in over 120 K-5 teachers in the feeder districts having completed either a one or two-year sequence of professional development in mathematics focusing on their curricula and instruction. Further, approximately 35 Grade 6-9 teachers had completed a second year of study of the mathematics curriculum at their level. Beyond the professional development, the teachers and districts had developed a common K-8 sequence of expectations for their curricula in mathematics. They also developed a special transition course in mathematics for use at Grade 7 for those students transitioning from Grade 6 mathematics in Grade 6 to Algebra I in Grade 8. The high school teachers of mathematics for special education students developed core objectives they shared with special education teachers from the middle schools as another means of articulation. This further communicated the high school’s expectations.

As the teachers and districts look forward to 2003 and beyond, they are involved in developing common assessments and programs for technology usage within the districts that will bring them into further congruence. These steps will continue to strengthen their mathematics programs. The foci for 2003 and beyond include instruction, technology, assessment, and continued work on delivering the best curriculum possible to their students. The progress of this initiative continues due to the commitment at the district level and building level within the consortium. A long-term relationship with the consultants has accelerated the success and contributed to teacher confidence in the program expectations for themselves and their students.

Concentrated articulation over multiple years on a specific subject increases the likelihood of greater success for teacher learning and student learning. District and school leaders must “stay the course” and identify outcomes at the onset so they can benchmark their progress. They must also revise outcomes as they collaborate with
each other and the consultants and prepare for the logistics of communicating and planning because it takes centralized leadership to attend to the details. In the case of Lockport Consortium, the high school assumed those responsibilities. Lastly, accept the slow but deliberate start and enjoy the progress from stage to stage. The curriculum, instruction, achievement and use of technology will accommodate the new learning for the benefit of students.

If There Were No Pentagons or Hexagons

David Peabody

Let’s pay tribute to two shapes for being alive
The Hexagon with six sides, and the Pentagon with five.

The Hexagon can exist in things inorganic,
Like nuts, bolts, and wrenches used by a mechanic.

The bees that make honey in their combs made of wax,
Make Hexagon cells and use space to the max.

And that’s also why Hexagons make good picnic bench seating,
If you build with this shape, more people are eating.

And in shapes of some crystals we hear the hexagon’s voice,
Build with my unique shape and you’ve made a wise choice.

And now for the Pentagon with all of its strength,
A regular figure with five sides the same length.

If we didn’t have Pentagons, much of life would be bare,
They’re not as round as a circle, but more round than a square.

In natural forms this shape shows its powers,
In arms of the starfish, and the petals of flowers.

Cut the top off an apple and inspect the insides,
In the seeds of this fruit, a Pentagon resides.

So to have blueberry tops, soccer balls, and all flakes of snow,
These two beautiful polygons we just can’t bear to see go.

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