

Each and Every Student: The Stamford, Connecticut Model for Change in Mathematics

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Abstract The major aims of this paper are to: present the background of the mathematics education problem in the Stamford Public School (SPS) district which is common in most U.S. cities; explain the need for change in mathematics education; describe the process to systemically transform both the curriculum and instruction of mathematics thereby ensuring that each and every student is prepared for the 21st century, for higher education, and for success in a global society; and provide ways to measure these changes. The K-12 mathematics education reform model presented can be replicated in other cities and for other academic areas.

Introduction A survey of recent studies and research show that mathematics education in the United States is in dire straits and when compared to their international counterparts and therefore, U.S. students do not perform as well on international assessments. Much has been written about the need for reform in both curriculum and instruction as it relates to mathematics. But performance on international assessments alone is not the only reason why mathematics education in the U.S. should change; indeed teachers need to educate students so that they are successful participants of the 21st century, global society.

Revising the content in the mathematics curriculum which stresses fewer concepts each year to provide time for the depth of these concepts and providing professional development for teachers which focuses on instructional strategies is the change that needs to take place in the United States. Teaching for deeper understanding and teaching conceptually is not what most U.S. teachers are accustomed to doing; rather, many teach procedurally because teachers' preparation programs train educators this way. Therefore, a focused and precise plan is needed in order to train teachers on how to teach for the 21st century. Educators need to learn how to teach mathematics without solely relying on computational algorithms. They should be knowledgeable about why the algorithm works and about how to encourage students to critically think about strategies; teachers should support students to invent their own ways of thinking (Conyers & Wilson, 2006, p. 7). Once this is done, student achievement will improve.

Background

The state of Connecticut has standardized test for elementary, middle, and high school students. Elementary students, beginning in 3rd grade and middle school students in all three grades, take the Connecticut Mastery Tests (CMTs). At the high school level, students in 10th grade take the Connecticut Academic Performance Test (CAPT). Throughout the years, students in Stamford have not performed as well as expected on the state standardized tests in the elementary, middle, and high school grades. Although elementary students in the Stamford Public Schools have done relatively well on the CMTs in mathematics, the middle school students in the district seem to follow the national trend which shows a decline in students' math achievement during those three years. A decline in students' math achievement in SPS continues in high school.

The Goals for Change in Mathematics

There are many goals that are to be achieved with a change in mathematics curriculum and instruction in the district. The first is the creation of a common, district-wide mathematics curriculum that will be taught in each elementary and middle school grade and within each high school math course. This curriculum will not only provide educators with a foundation of what to teach and how to teach it but will also ensure that all students have the same mathematical experiences and skills necessary for the 21st century. The consistent curriculum will also guarantee that when students transition to schools within the city, they will not miss any math concepts.

Secondly, the creation of a consistent curriculum will mean that all teachers will have to acquire instructional strategies to reach all learners. Teachers will have to develop a student-centered classroom, will need to understand various types of learning styles, along with how to scaffold activities to make certain that all students are learning the content.

Third, the creation of a consistent curriculum will mean that all teachers will have to understand the content they are teaching. Prior to this, many teachers taught the concepts they were comfortable with or enjoyed leaving out some of the more "difficult" concepts or the ones they did not like. The professional development component will align with the curriculum and will ensure that all students will have teachers who understand the math content.

Process for Change

Teacher input is paramount when creating a district-wide, consistent, coherent, rigorous curriculum (Armstrong, 2003, p. 145). Therefore, tremendous measures were taken to ensure that all SPS mathematics teachers

had an opportunity to participate in the creation of their curriculum. To begin the process of mathematics change in the city, committees of voluntary elementary, middle, and high school mathematics teachers and administrators from each of the schools were organized. The inclusion of administration on the committees was necessary since important decisions would be made about curricular programs, content, and monitoring of implementation.

There were two purposes of these committees. The first was to determine the key concepts that should be taught in each grade at the elementary and middle school levels and in each high school math course. This resulted in the creation of Grade Level Expectations (GLEs) for each K-8 grade and of key concepts for each high school math course. The second purpose was to choose a standards-based math program at the elementary and middle school levels. At the high school level, committee members did not look at programs but began creating syllabi, assessments, activities, and pacing guides.

Consultants from outside the district were used to facilitate the middle and high school committee meetings. Because the work includes a shifting of ideas and beliefs on the part of teachers and administrators, it was thought that it would be better to have people who have already successfully accomplished similar work to facilitate the meetings (Armstrong, 2003, p. 153). These two consultants from a neighboring district, although with different student population make-up, assisted with the meetings and shared their views and expertise with the committees.

During the middle and high school committee meetings (which were held separately), international data were shared showing teachers that most states in the U.S. teach too many math concepts per year when compared internationally. This teaching of many concepts had led to less time to teach for deeper understanding. The data showed most teachers only superficially touched upon each math topic because they never seemed to have enough time for students to develop a conceptual understanding. The first assignment for the SPS committee members was to meet with the math teachers in their building and list the math concepts taught each year. Member reported out at the second meeting discovering that same concepts were taught in 6th grade, 7th grade, 8th grade, and Algebra I, and that all of these concepts were taught as if a student was seeing them for the first time. This had a major effect on student achievement.

Once the committees saw that there was redundancy in the mathematics being taught and that this led to less time to cover the materials for deeper understanding, they wanted to do something about it. This process of listing what was taught in each grade/course provided teachers with an appreciation of why there was a need for change in the district. Committee members, with input from the teachers in their buildings, determined which concepts were appropriate for their grade level/course based on state and national standards. By including all teachers in this process, this ensured that all teachers had the opportunity have their voices heard.

For the high school committee, members began working on the Algebra I curriculum. This would be the first course at the high school level to change. There would be two Algebra I courses; the standard Algebra I course and then an Algebra IA course. The intention for the Algebra IA course was for it to be a double period so that students have twice the amount of time to learn the concepts since students enrolled in this course were those who scored Below Basic on their 8th grade CMT scores. The Algebra I members of the high school committee, sequenced the key concepts, created pacing guides, syllabi, activities, resources, and quarterly assessments for the courses.

Professional Development

According to the National Math Panel Final Report, there is a direct relationship between teachers' mathematics knowledge and students' achievement (U.S. Department of Education, 2008, p. xxi). Therefore, providing professional development for math teachers that incorporate the content they have to teach and providing them with the conceptual understanding would begin to help change mathematics in the U.S and in the district. Prior to the implementation of a consistent, coherent and rigorous curriculum in Stamford, teachers at the elementary and middle school levels received math content training to make sure that they understood the mathematics they were expected to teach.

SPS teachers needed not only professional development on math content but also on instructional strategies to reach all learners since the expectation by the district is that all students will participate in at least grade/course level mathematics classes. No students will be learning content that is not grade appropriate nor will any teacher be using out of grade level materials. Therefore, teachers will need to learn how to address the various types of learners in their classrooms and also how to scaffold learning activities.

Each teacher received "just in time" training. This means that the training for teachers is given just before they have to deliver the instruction in their classrooms. The elementary and middle schools teachers followed similar models in that their professional development included not only content but also instructional strategies. The high school teachers follow a slightly different model. It was assumed that since these teachers are 7-12th grade certified there was not much need for content training; much of the training that the high school teachers received was on instructional strategies and pedagogy. The Algebra I teachers in particular received six hours of training on

instructional strategies and how to differentiate instruction. Throughout the course of the school year, they received another fifteen hours of training in addition to having the consultant model lessons in their classrooms.

Leaders of Change

All of this change in mathematics could not be done without the development a “central guiding coalition” (Armstrong, 2003, p. 247). This group is able to “lead and manage” the change (p. 245). This group consists of teachers, math coaches, mathematics department chairs, central office personnel, and building administration. These people will lead the change within the schools which will then funnel through the district and into the community. The Stamford Public Schools is working towards creating leaders for mathematics change. At the elementary level, in spring 2009, twenty elementary teachers were training as *Everyday Math* Consultants so as to build capacity in the district. These leaders in elementary mathematics will support current teachers, train new teachers, and assist administration in explaining what to look for in an effective elementary mathematics classroom.

At the middle school level, mathematics coaches have been created. These coaches have received weekly training sessions with Central Office personnel and various consultants in how to effectively work with middle school math teachers on instruction, pedagogy, and math content. The mathematics department heads and the mathematics administrator at the high school levels have also been trained similarly to the middle school math coaches.

Certain schools within the district are schools who have been listed “in need of improvement” for many years according to NCLB. For these schools, additional supports have been provided in that they have additional math and literacy coaches to support teachers in instruction and best practices.

How to Measure the Change in Mathematics

As the implementation of the common, coherent, consistent and rigorous mathematics curriculum proceeds and after the professional development for teachers, there is still a need to monitor the implementation and the collection data to see the effectiveness of the change. The data collected will include student scores on the district-wide common assessments and on state standardized tests, anecdotal evidence from teachers, students and parents, evidence produced by the state during their visit to the district, and evidence from the Central Office math team during their school visits.

The use of the data from the state standardized tests will show an increase in student achievement and therefore will show that the change in curriculum and instruction is working. Monitoring the implementation of the consistent, coherent, and rigorous curriculum will need to be done to see if there is fidelity of implementation. Building administrators and the Central Office math team will make classrooms visits and checks to see if teachers are following the pacing guides, curriculum, and using the instructional strategies learned in professional development sessions. Teacher surveys will continue to be conducted at least twice a year as these anonymous surveys provide teachers with multiple opportunities to give their opinion and feedback about the training they received, the curriculum they were using, and to provide suggestions for follow-up professional development sessions.

Next Steps

Creating a consistent, coherent, and rigorous curriculum is just the first step in changing mathematics within the Stamford Public schools. The next steps are to: create a common grading practice within the district; require the use of math notebooks at all levels; and provide time for teachers to discuss best practices, examine student work, discuss pacing and create assessments. This is a way to provide teachers with the chance to discuss their practice since education seems to be the one occupation where there is professional isolation.

There is a realization developing within the district that the curriculum is never static; it will constantly need to be revised and re-evaluated as students enter high school having participated in a standards-based elementary and middle school mathematics program, as they become better prepared for mathematics, and as the world changes. This is in accordance to the book *Curriculum Today* where it states that “curriculum development must be a continuous process that seeks to assure that instructional programs incorporate the best available contemporary information” (Armstrong, 2003, p. 18). The SPS committees of math teachers and administrators will need to continue in the upcoming years so they can re-evaluate and modify curriculum.

Reflection

Looking back on the process of creating a consistent, coherent and rigorous mathematics curriculum for the Stamford Public Schools, there are some successes and some issues that need to be revised. The first issue to be revised is providing consistent class time for mathematics. During the 2008-2009 school year, Algebra IA consisted of both 48 minute classes and 96 minute classes due to scheduling issues. Data were collected to show that those students in the double period classes did better than those students in single period classes. Therefore, for the 2009-2010 school year, all Algebra IA courses will be double periods (96 minutes).

A second issue that was revised was the implementation plan at the middle school level. Originally, the plan was to implement the standards-based math program in 6th grade during the 2008-2009 school year and then

implement both 7th and 8th grade in the 2009-2010 school year. After looking at the implementation of the elementary program (kindergarten, 1st, and 2nd one year and then 3rd and 4th grade the following year), it was discovered that the students and teachers in the 4th grade had a more difficult time with the program than the other grades for a few reasons. For students, one reason there was difficulty was that they have gone through four years of school without a consistent math program. Teachers, parents and students felt a sense of frustration at varying levels. In order not to duplicate that sense of frustration in the middle school, each middle school grade will implement the standards-based program one year at a time.

A third issue was the monitoring of the implementation at all levels. Many of the administrators were not able to monitor the use of the pacing guides, the change in instructional strategies, change in content taught, etc. due to their numerous other responsibilities or their lack of knowledge about mathematics. The Central Office math team is focusing more on providing training and support for administrators in monitoring the curricular changes.

The district was successful in that it provided professional development to teachers which included instructional strategies and pedagogy simultaneously with the change in curriculum. Since the consistent, coherent, and rigorous mathematics curriculum newly created by the teachers and administrators of the Stamford Public Schools meant that teachers had to “teach differently,” many were uncertain about what that meant. Therefore, professional development about the content, program (if one is used), instructional strategies, and pedagogy had to occur simultaneously in order for all the pieces to fit together effectively. The district was also successful in that each and every teacher was provided the opportunity to give input on the curriculum being created. Since not all the mathematics teachers in the district were able to be part of the committees, the committee members were able to share the work with the teachers in their building and were able to ask teachers for feedback and input. In addition to committee members asking for input and feedback, at all the professional development sessions teachers were reminded to provide input to the committee members, to the middle school math coaches, the high school math department heads, or to the Central Office math team.

Another success was the consistency in the mathematics content being taught. Parents, teachers, administrators, and guidance counselors all commented on the fact that students from various schools were working on the same math content. All who commented seemed to feel that this was the correct path for students in the district.

Conclusion The change process followed by the district included steps to gain teacher acceptance of the transformation of mathematics. In the beginning, teachers were asked to analyze their practices and the content taught. Once this was done, teachers saw that there was repetition in the concepts being taught and therefore there was a need for change.

Since the consistent, coherent, and rigorous curriculum means that for the first time all students will be learning at least grade level content, teachers need to learn a variety of strategies in order to meet the needs of all learners in their classrooms. Understanding various modalities of learning is important as well as understanding that the majority of students do not learn the same as students from years past. Continued professional development will focus on how to have a student-centered classroom and a change in instructional strategies focusing on pedagogy. In addition, there will be the continuation of course-alike meetings to look at student work and how it to use it to drives instruction.

To change mathematics in a city such as Stamford will undoubtedly take time; change of any kind takes years. There needs to be continued professional development for teachers and additional opportunities for teachers to talk with one another about the changes in mathematics and in their instruction. The continuation of the teacher leaders and the support for teachers by change agents at the building and district levels will be necessary to support and sustain this change. With the fidelity of implementation and the constant revisiting and re-evaluation of the curriculum, teachers will begin to see that the change in mathematics which is occurring is the best for students in that student achievement in mathematics will increase. This increase in achievement will mean that students from the Stamford Public Schools will be able to take higher level math classes and will be better prepared for the 21st century.

References

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