No Door Left Unopened

Secondary Mathematics Program Audit Report

For

Harrison Central School District

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Introduction

On December 21, 2004, I met with Mr. Louis Wool, Superintendent of Schools, and Ms. Louise Cleveland, Assistant Superintendent for Curriculum and Instruction to discuss the possibility of conducting an audit of the secondary mathematics program. After initial phone contact in early December, I was provided with an article titled *Detracking With Vigilance* in preparation for this meeting. I also perused the district’s website before we met. While my consulting work is focused largely on staff development in mathematics, I found the drive, passion, and energy emanating from this initial impression intriguing. The “opening high-level doors” philosophy was attractive to me from an equity point of view. For this reason I decided to commit to this audit process.

In my conversation with Mr. Wool and Ms. Cleveland, it became clear to me that their leadership is putting the district on a path of change and that they are very cognizant of the tensions and anxieties that come with that process. Change is not just structural, but it is also very personal for all stakeholders. They made it clear to me that their goal with the audit was to provide insight in and recommendations for this complex process in the area of secondary mathematics. Based on our conversation the following goals were set for this audit:

- Identify strengths and areas for improvement in all components related to the secondary mathematics program.
- Identify needs in the area of program and staff development, as well as needs that are structural or logistic in nature.

The district contracted my services for seven days. I completed my visits between January 27 and March 24, 2005. In the remainder of this report I will describe the method that I used for this audit, my findings, and my recommendations. I have thoroughly enjoyed this work and wish to express my gratitude to all who gave so graciously of their time—administrators, Supervisors, teachers, and students—and the high level of professional courtesy I received. Without exception, everyone I talked to was very open, articulate, and forthcoming about their ideas and feelings. I am particularly grateful to Ms. Linda Fusco for all the accommodations she made to assist me in doing an effective and efficient audit. In this report I do not represent the view of any one stakeholder, rather I represent the trends that I have seen in various areas and compare these to educational research on best practices in mathematics education.

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Method

a. Administrators

On my January 27 and February 3 visits I met with the middle school and high school Principals, the Director of Pupil Personnel Services, and the Elementary Supervisor for mathematics and science. I developed a set of questions (see Appendix A) from Steven Leinwand’s book *Sensible Mathematics: A Guide for School Leaders*. This book strongly refers to the implications of the National Council of Teachers of Mathematics’ standards for teaching and learning mathematics. This is particularly pertinent because of the recent adoption of new math standards in our state, which are completely aligned with the NCTM standards. On February 3, I had an extended meeting with the secondary mathematics Supervisor. Ad hoc meetings, initiated by me, with the Supervisor occurred at each consecutive visit. These served, in particular, to get increasing clarity about the current mathematics program and proposed changes to it.

On March 24, I met again with the Assistant Superintendent for Curriculum and Instruction to triangulate some of the understandings that I had developed and to fill some gaps in my understanding from the administration’s perspective.

My first objective was to determine the extent to which the district’s Opening Doors philosophy was shared at the administrative and Supervisory levels at the middle and high school. I also determined this subsequently for teachers and students, however due to time constraints I was only able to do this at the high school level.

My second area of investigation at the administrative level was to determine which expectations and demands the district has placed on the mathematics program and teachers of mathematics.

Third, I wanted to investigate where responsibilities lie and how these are shared for a variety of areas. Traditionally administrators take more responsibility for professional development and forging partnerships, while teachers are more responsible for curriculum design, instructional strategies and materials, and assessment.

Fourth, I wanted to determine what ongoing processes are in place for shifting beliefs about teaching and learning mathematics, increasing professional interaction, enlisting support of other leaders, and for engendering stronger public support for high-quality mathematics education.

Last, I began each interview with four “teacher friendly postulates for thriving in a sea of change” (Leinwand, 2000). These were intended as ice-breakers, to get us talking, but they often ended up taking us naturally through the other questions without a need to ask them.
b. Mathematics Teachers

During my February 28, March 3, 4, 14, and 24 visits, I interviewed those teachers who signed up voluntarily and observed classrooms unannounced. The teachers were aware that I might visit their classroom on any of the above dates. I interviewed 12 teachers and did 10 classroom visits with 13 teachers (three classes had co-teaching). I visited the following types of classes: Math AB-E AIS Incl., Math AB-E, Math AB, Topics in Math B, Math B, Math B-H, Pre-Calculus, Elementary Calculus, and Math Modeling.

I did not take any notes during the classroom observations. This was a choice to maintain trustworthiness. It was not my objective to find out anything in particular about any one teacher. Rather, I wanted to compare what I saw with what teachers would tell me. It is not fair to draw strong conclusions on a limited set of observations, but these did provide me with a good flavor of common practices. I am ever so grateful to the teachers for letting visit their classrooms, freely sharing their notes and handouts with me.

For my interviews with teachers (approximately 40 minutes each) I used a similar set of questions (see Appendix B) as with the administrators. Again, I looked to see to what extent the teachers share the opening doors philosophy, what are the major demands and expectations they see placed on them, and the role and influence of the Regent exams. I asked teachers to identify strengths and weaknesses in their program, and to identify what professional development would be beneficial to them. I was particularly interested in what types of collegial interaction opportunities were available for them and how they use these. I strongly believe that, as it is important to have structured peer to peer interaction in the classroom learning environment, it is equally important to have this at the professional level. I am stating this here, because this is one of my biases toward viewing a learning organization at work. I am very much informed by the work of Bena Kallick and Arthur Costa (Costa and Kallick, 1995) in this area.

c. Students

I met with four groups of five students each during my March 14 and 24 visits. On March 14, I met with grades 11/12 students in two groups. One group consisted of upper echelon, honors or AP courses and the second group of grades 11/12 students of Regents level and other types of courses. On March 24, I repeated this with grades 9/10 students. I developed a set of questions (see Appendix C) that probed into how students view and experience the everyday typical lessons in mathematics, what they like and dislike, how important they view math for their future, whether they feel they are appropriately challenged, and to what extent they feel heterogeneous grouping would be a benefit.

I took copious notes of all the interviews and student focus groups. These notes are the basis for my analysis and findings. I will keep these notes secured in my home in a lockable file cabinet.
Findings

a. Sharing the Vision

The district’s leadership has taken “Detracking with Vigilance” (Garrity, 2004) to heart. The inspirational story at Rockville Centre, NY, finds its roots in the institutionalization of a “heterogeneously grouped accelerated math course that starts in 6th grade” in 1989. Fifteen years later this district is clearly and demonstratively reaping the rewards from this decision to provide equity as reported in Garrity’s article. In principle the stakeholders that I interviewed in the Harrison district support the basic equity premises of “Opening High-Level Doors to All.” However, as in the Rockville Centre district, there are some reservations. Often these are rooted in the comfort of the existing situation and also in deep cultural beliefs about the capacity of students. Nevertheless, the idea of teaching all students high-level courses has taken root in the district. To move this idea forward to reality requires the right pace so that all have opportunities to become to believe the power of “opening doors”. It is particularly important that as progress is made, the district evaluate the results regularly and make adjustments involving all stakeholders.

a.1. Administrators

Administrators indicated a thorough understanding of the district’s Opening Doors philosophy. They are also aware that mathematics is often the last subject to go through a detracking process. They indicated that parents often demonstrate the same kind of vigilance for maintaining tracks, particularly for high performing students, as the district shows for detracking. They posit that teachers feel this pressure even stronger. There is a sense of optimism about the decision to offer the accelerated grade six course to all students. The challenge remains what accommodations need to be made, if any, for the very abled students. According to the administrators, teachers experience pressure from the instructional mandates that follow from the consequences of detracking. They claim that this pressure is not the result of any single initiative, but the relative short time in which a series of initiatives is instituted and the teacher’s lack of understanding of the relationship among all the initiatives. Administrators also expressed the wish for the teachers’ union to enter into an educational partnership. There appears to be a need for a deeper and regular dialogue beyond contractual issues.

In an interview with the mathematics Supervisor, it became clear that her role is to execute and give shape to the detracking process as envisioned by the district leadership. The change from department chair to a Supervisor structure has constituted a change in influence. It is clear that the development of the Opening Doors policy and practices makes this administrative change necessary and effective. However, this process has been given a relatively short time frame. This has not allowed the Supervisor to work substantially on buy-in from all the stakeholders. Nevertheless, the Supervisor explained that many efforts have been made to introduce methods and practices to address a question central to detracking, “How do we welcome students into our classroom?” Student Learning Profiles have been developed for each student, as well as Teacher Learning Styles, using Meyer’s Briggs inventory tools. Students who have been
struggling in Math A now get more intensive support—often through co-teaching and additional periods per week—in 3 semesters rather than over a period of 3 years, which has generally shown to be more effective. An analysis of course offerings and needs is ongoing. Other support structures have been made for individual teachers—for example by providing resources for the development of new courses—or the department as a whole.

All administrators indicated a strong need for developing professional learning communities and a deeper dialogue among all stakeholders. They also expressed a need to work more closely together among themselves and to have more clarity about the role of the Supervisor in the administrative cadre.

a.2. Teachers

Teachers are the adults closest to the learning of students. Many of the teachers were in tracked systems themselves when they were high school students, experiencing personal benefits. Many teachers understand that the learning and teaching of mathematics is distinctly different from their own experiences, but almost all agreed that they tend to teach as they were taught.

It seems to me that many reactions of the teachers need to be contextualized by the newnesses that have emerged in the department over the last year and a half: many new teachers with the added question of job security, a mathematics Supervisor rather than a chair from within the department, the prospect of detracking, using data about students such as student profiles, integrating technology such as Smartboards, graphing calculators, and Geometer’s SketchPad, and the implementation of best practices, centered around the concepts of differentiated instruction. This means that some anxiety is a normal part of the process and must be understood in this context. It also needs to be recognized that many of the initiatives are alive and well in the department.

In all my discussions it seems to me that teachers are trying to determine their new place and influence in the process. One or two teachers expressed that some of the reprogramming is due to poor results on past Math-A exams, especially during the year of the “Math-A fiasco.” They also express a push toward diplomas with distinction, which implies passing a Math-B regents exam.

On the other hand at least eight teachers agreed or stated that “kids are more capable than they seem.” These teachers believe that the differences among kids are related to motivation, negative attitudes toward math, and pace or intensity of the courses. Almost everyone feels that all students can complete Math-B successfully, but that many students would need some form of parallel support, such as the current Math B topics or the proposed Math Concepts, or support structures that were in place previously. There is a strong sense not to “let kids take the easy way out.” One special education teacher did not feel that all students in this population would be capable of Math-B. Teachers working in a collaborative fashion and/or co-teaching see more possibilities with the built-in extra periods during the week. At the upper end of the tracking spectrum, one teacher expressed that the district not abandon the sequence toward BC Calculus, beginning with 8AA. Students in this track take BC calculus as juniors and then take a high level college course as seniors.
There is also a clear recognition that not all kids must necessarily use the same path. Four or five teachers feel that the program is set up for all paths to lead to calculus only. While these teachers acknowledge that taking an AP course is an accomplishment in and of itself, it may not be the wisest that all paths must lead to calculus. Two teachers also worried that students are not always aware of the workload associated with AP courses. These teachers also feel that it is more important to keep students involved in mathematics for their entire high school career. To achieve this, they feel alternative applied mathematics courses need to be developed for these students such as the Math Modeling course.

a.3. Students

Two questions were asked (See appendix C, question 7 and 8) to solicit student thinking around this issue. It appeared that across the board students (n=20) were not very aware about what changes were happening and/or proposed in the district related to detracking. It is noteworthy, but not surprising, that students in accelerated or honors classes had strong feelings about keeping the tracks in mathematics. It also appeared to me that many of the non-accelerated and non-honors students had very clear and set vocational plans (musician, chef, horse farm operator) for their future in which they often only saw elementary mathematics as important. All of the accelerated and honors students saw themselves on the path to college, but three or four indicated to me that they would not pursue math any further if they didn’t have to: “Good to have on resume, to get into college. It’s a demonstration of commitment. We have had enough of this kind of math.” It appears to me that student responses are strongly related to their perceived benefits of the kind of instruction they receive. Students seem to predominantly assess these benefits through grades on tests. I have paraphrased the student comments from my notes.

a.3.1 Grades 9/10 non-accelerated, non-honors

Question 7:
Many of us feel they can go higher. The problems are more with our attitude and our lack of motivation. Also how we are tested. If we feel we don’t have a chance we give up.

Question 8:
No, we should not be mixed. Kids learn at different rates. Math B is for college, and if you get in college you can get a good job. But we like more project oriented learning. I will take Math B, but I would also take a course that is more project oriented. I would do both.

a.3.2 Grades 9/10 accelerated, honors

Question 7:
The students in this group did not consider this question, instead they talked about tests:
Tests are more difficult than the class work. Teachers explain to us why that is, but I often can’t finish the test. Review sheets are more helpful toward the test and during extra help they show you the harder problems, which is good for the test.

Question 8:
There are different levels of learning. Per grade there should be about three or four levels. I like how it was separated to A and B honors and A and B Regents. Honors goes faster. This gives you lots more time to prepare before the Regents test. We had a lot more practice.

a.3.3 Grades 11/12 non-accelerated, non-honors

Question 7:
Students generally quickly agreed that they were in the best place for themselves, but they felt they did not have many opportunities to know more of their classmates in collaborative opportunities. They added: The school wants to look better with AP. There is a lot of pressure on students to take AP. AP is stressed too much. Guidance makes you feel guilty if you don’t want to take it.

Question 8:
It’s bad for people who struggle to be mixed in, or those who fall in the middle between AP and Regents. There needs to be something in between that is useful with relevant problems. Something with careers or a focus on engineering.

a.3.4 Grades 11/12 accelerated, honors

Question 7:
Students were very pleased with their program placement.

Question 8:
Do not remove the honors level. There is a lack of middle ground for those who are overly challenged in AP, but under challenged in Regents.

b. Expectations and Demands

Under the leadership of the Superintendent, the district developed a Strategic Plan in 2003, available in draft form on the district’s website, and the Board of Education developed their Goals and Beliefs. The Opening Doors philosophy permeates both documents and clear measurable action items were developed to provide equity and excellence in the areas of program and instruction. In the introduction of the strategic plan the Superintendent states, “…the strategic plan defines our current state against our vision for the future – a district where all students are challenged and valued.”

During my visits it became obvious to me that the Superintendent and Assistant Superintendent of Curriculum and Instruction were very serious about implementing this plan. It seems to me that the Supervisors were hired to support the implementation at the school levels (middle and high school). According to the plan they are instrumental in putting key aspects in place to establish progress toward the following goals:
Systemic Instructional Initiatives

- All schools within the Harrison Central School District will meet or exceed performance levels of similar schools in Westchester County and New York State
- All schools within the Harrison Central School District will provide a humane and supportive educational environment for each child
- All schools within the Harrison Central School District will maintain a commitment to the on-going training of all professional and support staff to develop and sustain a common instructional language and practice, and to achieve a coherent educational experience for all students

Middle School Education

- Continue to improve academic performance by establishing the standard of meeting or exceeding performance of similar schools within Westchester County on NYSED assessments
- Exceed performance of similar schools within Westchester County on NYSED assessments at the mastery level
- Review all aspects of the current school organization
- Continue to develop instructional program based on best practices

High School Education

- Continue to improve academic performance by establishing the standard of meeting or exceeding performance of similar schools within Westchester County on NYSED assessments and the percentage of students receiving Regents Diplomas
- Exceed performance of similar schools within Westchester County on NYSED assessments at the mastery level
- Review all aspects of the current school organization
- To develop instructional program based on best practices

Curricular, instructional and supervisory initiatives are tightly focused on opening high-level doors (equity) and on establishing data driven and research based (best) practices. In conversations with the mathematics Supervisor it became clear to me that in the area of mathematics at the secondary level (6-12), differences between honors and/or accelerated courses on the one hand and regular courses on the other were largely an issue of pace and not of significantly different content or depth of content. The Supervisor has started a process of detracking in this area in grade 6 by having one high level grade six course—through implementing best practices and standards based curricular materials that are being selected—and in the high school for Math A, which is supported by additional time and/or co-teaching and by promoting differentiated instructional practices.

b1. Administrators

I posed a variety of questions to the Principals and the mathematics Supervisor regarding expectations and demands on them and the teachers. It was clear to me that they all understood that the district’s demands and expectations matched the goals set
forth in the strategic plan. There is a clear sense that all students should be supported to reach their maximum potential. It was also stated that students need to understand that the minimum is not sufficient and that they should take rigorous mathematics through grade 12.

They did see several challenges that face them toward these goals. The message of having all students perform at high levels, particularly on state assessments and relative to area schools’ performances as well as compared to international comparisons, appears, according to the Principals, in conflict with instructional goals such as teaching for understanding in a concept-based exploratory learning environment. It was identified that teachers are having difficulty reconciling these two goals.

Another challenge that was identified lies in staff development. One aspect, as mentioned earlier, is the experience of programmatic, instructional, and achievement goals as disparate by the teachers, but also that the staff development that is initiated appears to them, to be too voluminous. In addition, the different staff development areas do not appear to always be connected from the Principals’ point of view and training is not always done on an in-time or on-time basis, but sometimes after implementation. My interviews with high school teachers support this impression. Finally, there is a sense that the pace at which programmatic and instructional changes are being made is too high and brings about frustration among the teachers. I was not able to verify this with teachers at the middle school, since I did not have the opportunity to interview them.

Last, it was identified that the transition from grade five to grade six mathematics needs attention. Students come from grade five using an inquiry based approach (Investigations in Number, Data, and Space) to sixth grade, where they see their environment change significantly (Silver Burdett text series). It was suggested that the elementary and secondary Supervisors develop this transition. It is my understanding that the secondary Supervisor is guiding the middle school mathematics teachers through a standards-based textbook review and adoption process, which she indicated has the highest priority in all of the staff development initiatives at the middle school.

b2. Teachers

I posed similar questions (see Appendix B) to teachers regarding expectations and demands. I included the state exams in this. I also probed how teachers experience the staff development initiatives. All the (high school) teachers I interviewed value and see staff development as an important part of their professional growth. Very much like their students, they like it when their learning (staff development) is organized in a timely fashion, at a pace that allows for successful implementation and growth, is on-going, and provides clarity and practical useful strategies that can be replicated.

Teachers do not experience demands and expectations from the district only. They experience these from students (“Pre-calc students just want a ‘this is how you do it’ explanation and they are very frustrated to turn word problems into a procedure, but ninth graders are more open to problem solving.”), parents, and colleagues, and externally from state tests: “All kids must pass exams. There is an emphasis on diplomas with distinction.” However, the teachers I interviewed were in agreement that the state tests were worthwhile. While many teachers expressed pressure from the administration to implement differentiated instructional strategies, several also felt pressure from
colleagues representing the teachers’ union in other, contractually related, directions. This particularly created some uncertainty for the non-tenured teachers I spoke with. Teachers’ reactions and reluctance to fast paced changes must be understood in the context of the complex of influences that they must negotiate: “Teachers are asked to step out of their comfort zone in too many places.” Several teachers expressed a lack of clarity as to when they are part of a decision making process and when they are not.

All teachers that I interviewed stated that differentiated instruction has been given the strongest emphasis and that they are expected to implement strategies they learned. Also, all teachers did not feel adequately prepared to implement these strategies, which often appeared too abstract and not practical to them. I did not find the teachers convinced that differentiated instruction is viable in a secondary mathematics classroom. Almost in one voice they said: “I would like to see it, because what I learned in the workshops did not give me enough of an idea what it is supposed to look like.” During my visit I did observe teachers using some of the strategies that were brought to them, such as the technique of using “clock buddies” to organize students in collaborative dyads. I also noticed five or six of the teachers that I observed using the compare and contrast strategy. This strategy was identify as the most effective best practice by Marzano et al. (2001), which seemed to me to belong in the Concept Attainment model of instruction, where examples and non-examples are used to inductively develop an understanding of a concept.

After completing the interviews and classroom visits it seems to me that teachers did not feel that the staff development provided for them matched well with where they were in their own learning and development. The strongest indications were that many teachers could not envision mentally how differentiated instruction could pan out in their classrooms and that the strategies that I observed were either managerial or added onto existing practice. In this way the strategies stood more on their own, rather than be part of a coherent model, such as the Concept Attainment model. In other words, if one tries to implement strategies that function best in an inquiry based environment into an environment that does not match this, it is likely to happen superficially.

Furthermore, it seems to me that the need for differentiated instruction is not as apparent to teachers who work in a tracked system. The current movement toward a more detracked system will increase the need for more diverse strategies. I also wish to state here that I found the teachers that I interviewed to be confident in their abilities to grow and change. I got the distinct impression that they feel and must be convinced that what they implement must benefit their students: “I do what is in the best interest of the kids.” I observed a few student centered practices in the more traditional classroom environments (See Chazan p.5 and also see page 14 of this report). For example, students needed to justify and explain their answers, or students were using graphing calculators to investigate inverse graphs: “What happens when you switch x and y?” I observed mostly junior faculty using lesson structures that were more in line with student centered, inquiry-based methodologies, such as the use of technology to challenge students to investigate concepts on their own first or the use of a variety of writing strategies to develop and express students’ thinking in mathematics. I saw a class under the enthusiastic tutelage of a senior faculty member in which mathematics, science, and technology were integrated and students were actively working in collaborative groups.
Three or four teachers expressed a need to pool resources among each other: “Every teacher has some good ideas.” This resonates with my strong belief that the bulk of staff development should be classroom based in actual practice, where we can “see” how and why it works.

Teachers identified several obstacles toward implementing some of the strategies they learned about. Some of these I have already mentioned. Several other issues they brought up were the lack of written curriculum maps and activity based materials that are linked to the curriculum, some of which is being resolved during the writing of this report; having large class sizes in rooms that do not allow for different configurations to support, for example, group work; and a lack of text book materials in certain courses.

Staff development needs that teachers identified pointed at learning more about graphing calculators, the use of Geometer’s SketchPad; seeing/observing strategies implemented in a classroom; revitalizing a mentoring program; using manipulatives such as AlgeTiles; and how to motivate students who have lost interest in mathematics or who don’t think they can achieve in mathematics.

b3. Students

Students are prominent in the Board of Education Beliefs and Goals document. The board has formulated the following principles:

- Every child who attends the Harrison Central School District deserves a learning environment that is challenging, safe and promotes excellence.
- All decisions and actions of those within the organization must be predicated on what is best for students.
- All students will succeed in a climate where high achievement is fostered and valued.

Therefore, my discussions with high school students deserve a prominent place in this report. In all systems people try to find their place of influence. Students are undergoing this process as well.

I asked a number of questions to get at how students experience the expectations and demands that are put on them. Because I found that differentiated instruction is thought of as a key component toward the goals in the strategic plan, I wanted to get at what students think of mathematics, how they experience mathematics lessons, and in which ways they feel they learn mathematics best.

b3.1 What is math to you?

The non-honors/accelerated students spoke of mathematics as numbers and formulas used in different ways that they might use in a job or possibly never again. They see math mostly as a school subject where you solve irrelevant or non-interesting problems and give answers. They find review boring and suggest that it should be more fun. With fun they mean more activity and project based work with more group work or peer interaction.
The honors/accelerated group expressed much of the same sentiments with some more detail. Mathematics deals with concepts with numbers, logic skills, equations, money, solving problems, measuring, and architecture (grades 9/10). “It’s a class we have to take. It is too test driven to be fun. There is a lack of connection with real life and we’re always rushing to the next topic (grades 11/12).”

b3.2 How important is math for your future?

The non-honors/accelerated students connected the importance of mathematics mostly to vocational areas, which sometimes leads them to think that mathematics is not at all important for their future or that they need just basic math, which they assume mastered at this point. “I want to be a teacher, so I need to know percents [for grades]. I am going to be a chef, so I need to know volume and measurement. Math teachers or accountants or engineers and doctors need math and science. I am going to have my own TV show. I don’t need it.”

The honors/accelerated students saw that besides vocational importance of mathematics, the degree of which depended on the profession, that there were other important aspects of mathematics, such as “It’s good to have on your resume, to get into college. It is a demonstration of commitment. But I have had enough of this kind of math.” These students see mathematics as something to get through but not to stay with.

b3.3 When do you use math?

On the whole students saw a very limited use for mathematics in their lives. Non-honors/accelerated students said, “I use it for shopping, cooking, sport stats, check my grades. Just basic math. Who uses logs? Why do I need to learn this?” One student (9/10) offered a very interesting point of view on the usefulness of mathematics. He suggested that math was useful to him during videogames. He mentioned a game that dealt with spending and saving and investing in stocks. He identified that that mode of learning worked very well for him.

The honors/accelerated 9/10 group voiced very similar views as the previous group. They felt that elementary mathematics was useful for most of daily life, but that “you would only have a use for calculus when you are a rocket scientist.” The 11/12 group did offer other perspectives: “To work my brain. It’s good for reasoning and philosophy.” However they had very strong feelings about mathematics being much decontextualized in their experiences with it. They also felt that the development of mathematics as a subject is very test driven: “Students block things out that are not on the test. This is a matter of conditioning that starts in grade 7 and 8. We need other choices besides calculus and statistics.”

b3.4-5-6 Describe a typical math lesson to me. What do you like/dislike about it? If you could be a math teacher, how would you design your lesson? What way do you learn math best?
In this report I combine the students’ responses on the questions, since they didn’t seem to differentiate any separate issues for the students. As expected, students’ responses to their classroom experiences can be rather emotional. However, I am not reporting on the emotions of the students but rather the content of what they said.

The majority of descriptions were close to a Direct Instruction model and fairly consistent with what I observed in the classroom visits. Intuitively the students lifted out a number of important aspects of the instructional environment. Overall, according to the students, lessons followed the “Do now; Check homework; Introduce new topic; Guided practice; New homework (Independent practice)” format. Some students explained that they had regular quizzes. At the honors level, quizzes and tests tended to be more frequently done outside of class (take-home). Students did not agree on the amount of homework to be too much or too little. But they were unanimous in that the purpose of homework is practice. Overall the students did not describe inquiry-based, student centered environments and I did not receive any comments that pointed toward differentiated instructional practices.

All students like that teachers provide them with detailed worked out answer sheets to homework problems and other assignments. They like lessons that are very organized and provide them with weekly plans (11/12). They like to be well prepared to be successful with the homework. They like a thorough discussion of the assigned homework. They like worksheet-based packets in which step by step procedures and explanations are given much better than using textbooks. They like extra credit opportunities (11/12). They like that when they cannot do a question they must write what it is that they do not understand, rather than leave the answer blank.

They would like to have significant increase in peer-to-peer learning opportunities. They would like to be able to use their own methods for doing the homework and not just be stuck to one (9/10). They would like to learn topics more fully rather than in bits over a longer period of time. They feel it will help them remember things better. They would like to have more opportunities to get the teacher’s attention (one-on-one time). They would like the teacher to bring more variety in the homework assignments. They would like the teachers to provide them with ideas that may spark their interest for mathematics (11/12).

They dislike that, “In mathematics you are totally dependent on the teacher. In other subjects you can prepare ahead of time. Not in math.” They do not like that tests and sometimes homework assignments are more difficult than what they see in class. They dislike it when the lesson goes too fast and there is no opportunity to ask questions or have a discussion. They dislike it when things appear disorganized or disconnected to them. They dislike it that they often do not know and/or work with all the kids in their (math) class.

c. Sharing Responsibilities

During my interviews I probed at where people thought responsibilities were mainly located in the areas of curriculum, instructional strategies and materials, assessment, professional development, and the forging of partnerships (see appendix A
and B). I found this an important component of my investigation due to the relatively recent replacement of department chairs with subject area Supervisors. During my interviews it appeared to me that these responsibilities were predominantly thought to be located with the Assistant Superintendent for Curriculum and Instruction and the mathematics Supervisor and to a lesser degree with Principals.

c1. Administrators

The Principals viewed themselves in guiding roles and as providing a vision in all the areas. They feel the teachers and the Supervisor are primarily responsible for these areas. In their views teachers see the curriculum pre-determined by the State Education Department through the Regent exams. This was identified as problematic. “Teachers need to own the curriculum. The test is not the curriculum.” Principals also felt that teachers have a responsibility for their own development throughout their career and saw themselves as supporting and facilitating this development.

The elementary, special education, and secondary Supervisors I spoke with concurred that the curriculum design, selection of materials, assessment, and the provision of professional development was a significant part of their responsibility under the guidance of the Assistant Superintendent.

In the area of assessment there appears to be a move to more consistent classroom based assessments. At the time of the writing of this report detailed curriculum maps are being developed at the secondary level under the guidance of the Supervisor and text materials are being selected for the middle school math program that are more aligned with the standards based elementary text materials.

c2. Teachers

In this section I am predominantly representing the thoughts and experiences of tenured teachers. This is because I did not ask questions in this area of non-tenured teachers. The teachers expressed that the Supervisor roles were experienced more as administrative rather than as collegial: “It’s more like an Assistant Principal within the department.” Due to evaluative duties some teachers may not feel totally comfortable to raise issues of curriculum and instruction either for themselves or others. At least three teachers expressed that it was their experience that issues are often not brought to them as questions for their input and that discussion takes place after decisions have apparently been made. These statements were made in their experience with the district administration and not just the Supervisor. They expressed a need to be heard and that “more stock need to be placed into the ideas of the department.” At the same time several teachers also understood and respected that the Supervisor was charged with implementing changes. It seems to me that there is a strong desire on the part of the department to be a partner in the change process. Others saw that the Supervisor role has the advantage of giving support in instructional and material issues speedily and effectively as they arise. They realized that a chair would not be able to provide such in-time direct support: “I feel supported, she is available and focused, but I may hold back with a ‘stupid’ question.” I have highlighted a number of examples earlier in this report.
that are evidence of the responsiveness to teachers who have innovative ideas. This was clearly appreciated and it appears a good path toward empowering teachers with time, staff development, and resources toward asserting their influence in the areas of curriculum design, staff development, assessment, and curricular materials.

d. Ongoing Processes

Implementing new ideas, strategies, programs, and processes will have results only as good as the on-going processes that are in place to support the endurance of these implementations. There clearly is a strong, justifiable, and equitable vision that has taken root in the district. Through the intelligent and forceful work of the Assistant Superintendent and the Supervisors the strategic plan is being implemented in the district in collaboration with the teachers, parents, and community members. In this context I was interested to review what ongoing processes the district has in place that support the successful continuation into the future. As is apparent in the Garrity (2004) article, the changes toward a detracked system through “opening high-level doors to all,” is a longitudinal process (1998 to the present). The foundational development of the strategic plan and its periodic review is well established and functioning in the district under the leadership of the Superintendent. In this report I am taking a closer look at what other ongoing processes were identified by administrators and teachers. I would like to make it clear that I have viewed this part of the investigation very much through the filter of bottom-up processes: staff development, formal collegial interactions, and programmatic assessment and development.

d1. Administrators

The impetus for shifting beliefs processes is in the hands of the Assistant Superintendent, the Principals, and the Supervisors. From my conversations it seems to me that several strategies are used in this process. One is a dialogue with teachers that has been started by the Supervisors. I believe the administrators understand the crucial element of teachers developing these beliefs, because ultimately they are the ones shaping the beliefs into (best) practice. Second, through goal setting for programmatic, curricular, and instructional practices that address the equity principle. The assessment of the progress and effectiveness of these goals’ implementation appears to be predominantly done through teacher observation and debriefing. Some of this takes also place in department meetings under the leadership of the Supervisor. Another avenue that was identified is the sharing of successes during faculty meetings. Programmatically, consolidation of tracks at the middle school and high school has begun and additional steps have been planned for the coming years. The Supervisor shared some promising data that have been collected and analyzed in places where programmatic changes have been made.

While the district is going through a process of shifting beliefs, the parents and students are also going through this as a consequence. It seems to me that Supervisors are the main link to these stakeholders. While they appear to try their best to explain changes
to the community, I was not able to determine a broader effort in this area. Community support is a very important element of a teacher’s ability to change their belief system and subsequent practices.

It is my strong belief that teachers’ growth and development needs to be as close to classroom practice as possible. This growth is fundamentally underpinned by collegial interaction. Principals and Supervisors pointed toward scheduling and contractual hours for professional development, departmental meetings, and common preparation times as processes that support collegial interaction. New ideas that were mentioned that recently emerged, were action research groups and reading/discussion groups. One initiative that is more classroom based is co-teaching. Often co-teaching is done with a combination of a special education background and another with a mathematics background, but I also observed two mathematics teachers co-teaching. Co-teaching is an example of enhancing collegial interaction that is classroom/practice based in which teachers base their interactions on peer-observation, artifacts such as student work, and the like. While the co-teaching has become a prominent element, there did not appear a formal structure for interaction that might and needs to naturally flow from this situation.

The elementary and secondary math Supervisors are in a unique and effectively functioning position to support the transition between schools in the learning of mathematics for students. Previously with the chair position, this appeared to be a much more difficult issue to tackle. School transitions are well known to cause a dip in achievement for the majority of students. While many things need to happen to diminish this effect, aligning math programs and practices between schools is an essential component. The consolidation of grade 6 honors and regular classes into one challenging rigorous standards-based level is commendable. With proper support this will allow all students to increase their knowledge of, skills in, and dispositions toward mathematics.

d2. Teachers

Teachers identified several areas where they had opportunities for collegial interaction. One was the shared area above the library where they were all working in close proximity, which allowed for impromptu and ad hoc interaction. Many spoke of sharing of materials freely within the department.

One math teacher, who co-teaches with a special education teacher, has an “office” in the classroom. This does promote significant interaction in the co-teaching team, but removes the broader collegial support to some extent. This team had the maximal opportunity for planning, implementing, and assessing their practice during the school day. Other teams relied on after school or e-mail and phone communication when no common time was available. In teams where there was more opportunity for collegial interaction, there seemed to be more equity and clarity in the roles during the classes that I observed. This is important for students. When there are two teachers in the room, students must see both as their teachers. This requires a careful balance and shifting of roles. Collegial interaction is essential to developing this, because it is in the reflection on the practice that teams learn. To be able to reflect in the moment of teaching as a team is a rather advanced level of practice. Just as beginning teachers need to learn to reflect in
the moment of teaching and act upon that reflection, so must teams of co-teachers. It is however quite a bit more complex.

Teachers also identified having staff development meetings (2 hours per month) where work was done on mapping curriculum and department meetings, which seem to deal with a myriad of logistical issues. This curriculum mapping work is essential to the detracking process.

The Assistant Superintendent identified to me that the district offers opportunities for collegial work and professional development during the summer months, but that there has been minimal participation on the part of the teachers.
Summary and Recommendations

The title of this report, No Door Left Unopened, reflects the exploratory phase in which I see the district at the moment. It also reflects that, while the district is in the process of “opening doors,” it is important to guard against closing doors that are already open. It is also important to keep in mind that not all doors may lead to one single destination. In order to carefully balance the needs of all stakeholders it is important that this process of change develops at a pace that is within the capacity of the district. Last, the title reflects a sense of optimism about where the change process may lead. From a holistic point of view it has become apparent to me that the district is headed in the right direction and that by and large I recommend that the district stay the course set out by the Superintendent in the Strategic Plan.

The recommendations I make here are not in any specific order of priority. These recommendations are based on my findings. Where, in the process of my investigation, I was aware of my own biases toward certain issues, I explicitly made a statement to that effect. This should assist you in deciding what weight you wish to assign to these recommendations. The recommendations largely fit with the six principles stated by the National Council for Teachers of Mathematics in their 2000 publication Principles and Standards for School Mathematics:

**Equity.** Excellence in mathematics education requires equity—high expectations and strong support for all students.

**Curriculum.** A curriculum is more than a collection of activities: it must be coherent, focused on important mathematics, and well articulated across the grades.

**Teaching.** Effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well.

**Learning.** Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge.

**Assessment.** Assessment should support the learning of important mathematics and furnish useful information to both teachers and students.

**Technology.** Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning.

**Genuine and focused collaboration among teachers and administrators.**

In a climate of relatively many and rapid changes it is nearly unavoidable that some tensions develop. It is important that in order to move the detracking process forward the key players share a minimum set of crucial goals. This means that anyone
who claims a stake in this process must be willing to give some things up for the greater good: Opening Doors to All.

**Recommendation 1:** The Assistant Superintendent for Curriculum and Supervision, the High School and Middle School Principals, the Mathematics Supervisor, and the Mathematics Department should develop a written memorandum of understanding describing the roles and responsibilities of each toward implementing the charges in the strategic plan.

**Guaranteed viable curriculum – that is meaningful and applicable to students’ immediate and future lives.**

While detracking is in motion in the district in grade 6 in the current school year, the State Education Department has made changes, approved by the board of Regents, in the mathematics standard. The mathematics Supervisor presented me with charts that have phased the changes in through 2010-2011, when the current sixth graders will be high school seniors. In addition the Supervisor presented me with a map of mathematics courses for the high school for the 2005-2006 school year. We discussed this at length. It is well known that students’ success after high school is strongly correlated with them taking mathematics in each grade of high school. There is some beginning and clear evidence at the high school that the detracking process is working. This January students, who otherwise were on a track to take Math A after four to six semesters, took this exam earlier than planned. A vast majority of these students passed and is now in a math B course or another advanced course. Data for these students are available from the mathematics Supervisor.

In the context of detracking and opening doors the ongoing processes of curriculum mapping and design are paramount. This work includes developing scopes and sequences of mathematical topics, but is certainly not limited to this. More detail is needed in the essential mathematical objects of study, the essential knowledge, skills, and dispositions students need to develop, as well as in instructional methodologies that are effective for student’s learning. Curriculum maps and design should be organized around essential questions. It is important that teachers are involved in this process since they have the expertise to make curricular and instructional decisions that will benefit all students. Furthermore it is important that teachers are involved in this ongoing process because of the recent changes in the mathematics standard in New York State.

**Recommendation 2:** The district should strive to have a mathematics program that keeps the maximum number of students taking rigorous mathematics courses throughout their senior year. The district might consider requiring that all students take four years of mathematics for graduation.

**Recommendation 3:** A strand of applied mathematics courses should be developed that are rigorous, but relevant to students’ present and future lives [See (2) and (3) on Appendix D]. Two such courses already exist: Explorations in Math and
Math Modeling. A third course College Prep Math [See (4) on Appendix D] may have potential to be developed into this strand. These might be best organized as semester courses. These courses should not be watered down versions of higher level courses, but rather be more thematically organized.

Recommendation 4: Pre-Calculus Honors and Pre-Calculus should be combined into one course [See (1) on Appendix D]. Students can choose to go to AP courses after this or to a to-be-developed applied strand of courses.

Recommendation 5: Curriculum mapping and design should continue and reviewed regularly in the district using tools such as TechPaths. Teachers should have a central role in these processes in collaboration with the math Supervisor and the Assistant Superintendent for Curriculum and Instruction.

Over the past decade or more, teaching the traditional topics of algebra, geometry and trigonometry has shifted from symbolic manipulation and memorizing proofs (if any) in Algebra, Geometry, and Trigonometry toward other approaches that allow teachers to make mathematics more relevant for and a subject to be explored by students. This is, not in the least, due to the development and wide availability of hand-held and computer technologies. For example, in algebra there is a movement toward a function-based approach (see Chazan, 2000; and Heid et al., 2004). The mathematics department is well aware of these changes and appears ready to move forward in this area. One piece that seems to be lacking is curricular materials that support such a movement in Harrison high school. The standards-based materials that have been established in the elementary schools and are being implemented in the middle school will need to be followed up in the high school. There is a unique opportunity with the changing of the New York State mathematics standard—which is now completely matched with the NCTM standards—to address this issue.

Recommendation 6: During the next two school years the district should consider, develop and/or purchase curricular materials that are more suited toward teaching mathematics for understanding in the high school. Plans for staff development should be included in the development of a budget for this purpose.

Instruction that focuses on conceptual understanding and reinforced by procedural rules and application to real life problem solving.

In the near future the students that will enter Harrison high school have been learning mathematics through coming to understand it, often first from their own points of view. Curricular materials and instructional strategies that accompany these have been implemented in the K-5 grades and standards-based materials are being selected for grades 6 through 8. These students will not just want to know how to do mathematics, but also why it is done that way or another way. These students will be more flexible in the procedures they use and be focused on how to apply their knowledge and skills.
Over the past 20 year or so, much research has been done into what constitutes effective teaching, particularly considering the equity principle. Carpenter and Lehrer (1999) identified five forms of mental activity that help students gain mathematical understanding as it emerges in learners over time:

- Constructing relationships
- Extending and applying mathematical knowledge
- Reflecting about experiences
- Articulating what one knows (Explicating)
- Making mathematical knowledge one’s own (p.20).

Linda Darling Hammond (2005, pp.2-3) describes what we know about effective instruction across all disciplines:

Effective teachers use many different tools to assess how their students learn as well as what the students know. They use this information to help all students advance from where they are to where they need to be. They carefully organize activities, materials, and instruction based on students’ prior knowledge and level of development so that all students can be successful. They know what conceptions students bring with them about the subject and what misconceptions are likely to cause them confusion—and they design their lessons to overcome these misinterpretations. They adapt the curriculum to different students’ needs; for example, making content more accessible for students who are still learning English and for those who have special educational needs.

Effective teachers engage students in active learning—debating, discussing, researching, writing, evaluating, experimenting, and constructing models, papers, and products in addition to listening to and reading information, watching demonstrations, and practicing skills.

They make their expectations for high-quality work very clear, and they provide models of student work that meets those standards. They also provide constant feedback that helps students improve as they continuously revise their work toward these standards.

They design and manage a well-functioning, respectful classroom that allows students to work productively. Finally, they involve parents in the learning process and help create strong connections between home and school so that students have fewer obstacles and more supports for their learning. And they do all of this while collaborating with other teachers and administrators to create a seamless curriculum and a supportive environment throughout the school.

Recommendation 7: The district should continue to use current materials, student profiles, and professional development practices to assist teachers in further developing differentiated instructional practices. In addition, these practices should become more holistically integrated in inquiry based or student centered models of instruction and not seen as a menu of options.
The following are recommendations from Malloy (2004) for instructional practices that provide access to high level mathematics for students. I include these as a corollary to the above recommendation.

- Instruction should purposefully use students' improvisational thinking in classroom discussions. This means that teachers listen to students' thoughts and musings that do not seem to be related to the topic at first glance but after deeper questioning become apparent. Often this questioning reveals that students were on a trajectory to reach appropriate mathematical conclusions.

- Instruction should have students narrate human events by creating problems based on life experiences that exemplify concepts they are learning or by solving problems that are related to struggles students and their families encounter economically and socially, such as the placement of toxic dump sites in low-income areas, the redlining of insurance rates, mortgages in low-income and minority areas, and so on. Instruction should present a variety of strategies and approaches to solve problems and should welcome correct solutions that are original. Students should be allowed to solve problems holistically and analytically and support their conclusions through a spectrum of means including guess-and-check verifications and algorithms. Instruction should encourage students to work on projects that require interdependency—the use of others' knowledge.

- Instruction should assess students through methods that require verbal and written demonstration of knowledge.

- Instruction should allow students to demonstrate knowledge through small and large productions that provide opportunities for the teacher, students, and parents to laud and acknowledge students' achievement. (p.12)

  Recommendation 8: The district should develop a comprehensive evaluation instrument for assessing teaching for understanding. The district might consider using Danielson (1996) as a starting point.

From student comments it appears that the role of homework, which I believe is a very important part of the learning environment in high school, is exclusively one of practice. This fits in the Direct Instruction model that the students described as typical in their classes. Students also indicated that the place where they would encounter more difficult problems was on tests or quizzes. In my observations and from the hand-outs that teachers gave me, it was clear to me that practice was not the exclusive use of homework, however mostly. Some homework asked students to reflect on their learning and other work asked them to solve a novel problem. While I agree that students need to practice a skill from time to time, it is also important to recognize that if there is to be a broader movement toward teaching for understanding then what constitutes homework ought to play an important role in this area.

  Recommendation 9: Teachers develop strategies to use homework and provide feedback on homework for the practice of procedures, reflection on
understanding of mathematical ideas, the synthesis of concepts, the application of existing mathematical knowledge, and the analysis of novel situations.

Collegial Interaction and Professional Development

Overall, it appeared to me that much of the collegial interaction was not formally structured, but rather ad hoc. While this interaction is significant and important, it seems to me that in order to guide the district through its change process, teachers’ practice should take central stage. I find that there is significant capacity within the mathematics department to address changes in this area. This is best supported by changing some of the ad hoc opportunities in more structured opportunities where teachers can pool resources and reflect collaboratively. A good number of teachers identified that they would like to see practices to assist them in implementing these themselves. Earlier in the report I have advocated for classroom based staff development. In addition, teachers should have opportunities to reflect on student work, particularly during the implementation of new practices.

Recommendation 10: Whenever possible teachers should be scheduled to have common preparation periods for the purpose of the sharing of resources and collaborative reflection, such as the discussion of student work. The district might consider that teachers keep a log of their common work and submit this at regular intervals to the mathematics Supervisor. Teacher common preparation time should be scheduled in interest groups, which does not necessarily mean by course. Co-teachers should have priority, whenever possible, to have common preparation time.

Recommendation 11: Teachers’ staff development should be, as much as possible, classroom-based. An example of such a staff development model is Lesson Study. Appendix E describes a proposal for such staff development.

Recommendation 12: The district should continue to evaluate the effectiveness of staff development through observation and debriefing procedures.

References


Draft Strategic Plan 2003 (http://www.harrisoncsd.org/pdf/plan1103.pdf)


Appendix A

Could you give me your ideas/reactions to the following statements?

- Mathematics Teachers are asked to teach in distinctly different ways from how they were taught and learned mathematics.
- The traditional mathematics curriculum was designed to meet societal needs that no longer exist.
- It is unreasonable to ask a professional to change more than 10% a year, but it is unprofessional to change by much less than 10 percent a year.
- If you don’t feel inadequate, you are probably not doing the job.

I understand that the central administration and the board of education have a philosophy of “Opening Doors.” What is your understanding of this vision and to what degree do you share this vision?

What do you see as important expectations for district-level mathematics program leaders (including yourself)?

What are the major trends in demands upon teachers of mathematics that you see?

In your view who is responsible (and what are these responsibilities) for:
- Mathematics curriculum design?
- Instructional strategies and materials?
- Assessment?
- Professional Development
- Forging of partnerships?

What is your vision of high quality mathematics education?

What is the influence of the state-wide tests on the mathematics program? Do you see this as an obstacle or a gateway to increased student performance?

What ongoing processes do you have in place to shift beliefs about mathematics and teaching mathematics?

What ongoing processes do you have in place to significantly increase professional interaction?

What ongoing processes do you have in place to enlist the support of other school leaders and BOE members?

What ongoing processes do you have in place to engender stronger public support for high-quality mathematics education?

What processes do you have in place to provide school and mathematics program transitions for students and teachers?
Appendix B

Could you give me your ideas/reactions to the following statements:

- Mathematics Teachers are asked to teach in distinctly different ways from how they were taught and learned mathematics.
- The traditional mathematics curriculum was designed to meet societal needs that no longer exist.
- It is unreasonable to ask a professional to change more than 10% a year, but it is unprofessional to change by much less than 10 percent a year.
- If you don’t feel inadequate, you are probably not doing the job.

I understand that the central administration and the board of education have a philosophy of “Opening Doors.” What is your understanding of this vision and to what degree do you share this vision?

What do you see as important expectations for district-level mathematics program?

What are the major trends in demands upon you that you see?

What is your vision of high quality mathematics education?

What would you identify as the strengths/weaknesses of the mathematics program in Harrison? What would you change, what should not be changed?

What is the influence of the state-wide tests on the mathematics program? Do you see this as an obstacle or a gateway to increased student performance?

In what areas do you feel you and/or the department would benefit from professional development? What types of professional development do you prefer?

What opportunities do you have for collegial interaction to improve your practice? What opportunities would you like?

How would you describe the role of the school leaders (supt., asst. supt., Principal, math supervisor) with regard to your department? Could you comment on how productive you feel the relationships between these leaders and you and/or the department are. What sort of changes would you propose?

What changes do you believe you are asked to develop/implement in your program and/or instruction? To what extent do you agree/disagree with this and why?

How would you describe the student population in your classes?
Appendix C

Student Questions Harrison

- What is Math to you?
- How important is math to you for your future?
- When do you use math?
- Describe a typical math lesson to me. What do you like/dislike about it?
- If you could be a math teacher, how would you design your lessons?
- What way do you learn math best?
- Do you feel you are in the best possible class/program in math? Tell me why or why not and if not what would be better for you?
- Do you think all students should be mixed in similar classes? Why? Why not?
The Math department will propose offering some new advanced electives starting for the 2006-07 year. These may include courses such as linear algebra, number theory, mathematics of finance, econometrics and time series forecasting, or mathematical microeconomics. These courses may be 1/2 credit classes.

Harrison High School (2005-06)
Mathematics Courses
APPENDIX E

Research Lessons

Premise: The teachers involved in this project are willing to take instructional risks in their classrooms with the understanding that this risk-taking will be supported by the district and Dr. de Groot in a non-evaluative, but rather reflective environment.

The idea behind the research lesson model (used extensively in Japan and increasingly in the United States) is to hone what is already present. The model works as follows:

A group of three to five teachers work as a team. We will do three to five rounds respectively of the following process for the team.

1. A team member prepares a lesson with the support of Dr. de Groot (degrootc@newpaltz.edu) that aims at students demonstrating understanding of some mathematical idea. The lesson design is based on an inquiry model using one or more best practices for instruction. A special focus will be on addressing a variety of learning needs within the classroom. The plan will be distributed to the team. The teacher will receive feedback, possibly several rounds if time allows, and make improvements in the plan. This work happens via e-mail in asynchronous communication, using MS-Word documents in which the feedback can be noted directly with the Comments feature.

2. The day of the lesson:
   - Teacher and Dr. de Groot pre-conference (45 minutes to 1 hour). Practice the lesson, go over fine points, and develop foci and parameters for team members’ observations.
   - Execution of the lesson. During the lesson the teacher can take time-out(s) to consult with team and Dr. de Groot or ask for help from the team. Team observes/supports with teacher’s foci in mind. Teacher sets parameters for how team members are present during the lesson.
   - Debriefing immediately following the lesson. Teacher and Dr. de Groot. (45 min. to 1 hour)
   - Team debriefing at the end of the day (about 1 hour). Further fine-tuning of the lesson. Next steps.

3. The observing team members agree to implement the final version of the lesson in their own classes and maintain a written reflective log of their experiences. The team should come together to debrief the experiences without Dr. de Groot, ideally before the next round. Logs should be written with the understanding that some or all of it may be shared with Dr. de Groot and/or team members. Further honing of the lesson may take place at this time.

This process will be repeated for each team member. The process of lesson study should continue for this team without Dr. de Groot’s support after all rounds have been completed. This should become an ongoing classroom based professional development
structure in which teachers can implement and assess new strategies for instruction and assessment.

The main benefits of the lesson study model are that teachers can see in each others classrooms “what it looks like.” Furthermore, by its ongoing nature teachers can hone their craft over time at a realistic pace of implementation. If a team of five consistently works together in this fashion for three years, it is possible to generate about 30 well developed lessons. This will have a major impact on overall learning. This is because well developed and deeply honed lessons assist the teacher in anticipating student thinking and learning. This empowers the teachers involved to deal with a greater variety of learning needs and styles in their classrooms.

It is proposed here that the lesson design and reflection work with Dr. De Groot that takes place outside the regular workday be enumerated with inservice credit as per contract.