

Project GRAD

M A T H E M A T I C S

A System of
Learning & Teaching

2004-2005

Contents

Mission.....	1
Philosophy.....	2
Overview.....	6
Processes.....	11
Support of Existing Curriculum, Programs, and Initiatives.....	13
Curriculum Alignment and Teaching Plan Development.....	14
Sample Curriculum Map.....	25
Sample Teaching Plan.....	26
Teacher Resource Materials.....	29
Evaluation Findings.....	34

Project GRAD Mathematics Mission

Project GRAD Mathematics exists to provide an effective research-based system of mathematics learning and teaching that addresses all levels of mathematics ability.

We provide quality materials, a premier professional development and support model, and a proven implementation process that consistently produces positive achievement outcomes for Project GRAD Schools.

Our system of mathematics learning and teaching is designed to build a strong mathematical and support foundation for all Project GRAD stakeholders so that ALL Project GRAD students exceed achievement expectations while developing the desire and the confidence to reason, communicate and to be fully prepared mathematically to succeed in college preparatory courses.

Project GRAD Mathematics Philosophy of Learning & Teaching

The Project GRAD Mathematics philosophy of mathematics learning and teaching is devoted to raising expectations about mathematics learning from low-level, rote computation and routine use of formulas to higher order understanding and application of concepts at all grade levels. Organized around the National Council of Teachers of Mathematics (NCTM) Principles and Standards, Project GRAD Mathematics uses carefully selected instructional activities, supported by the consistent use of developmentally appropriate manipulatives, to foster the understanding of concepts and processes in mathematics.

Yet teaching for understanding is a complex endeavor. In order to teach for understanding, teachers themselves must have a deep understanding of mathematics concepts and know how to promote and assess students' understanding. Teaching for understanding assumes substantial new learning on teachers' part; it requires change not only in what is taught but in how it is taught. Learning how to involve students actively in the construction of knowledge, how to move beyond fact-based concepts of knowledge and learning outcomes, and how to fashion new classroom roles and relationships involves more than simply sharpening up teaching skills or teachers' professional knowledge base as conventionally conceived.

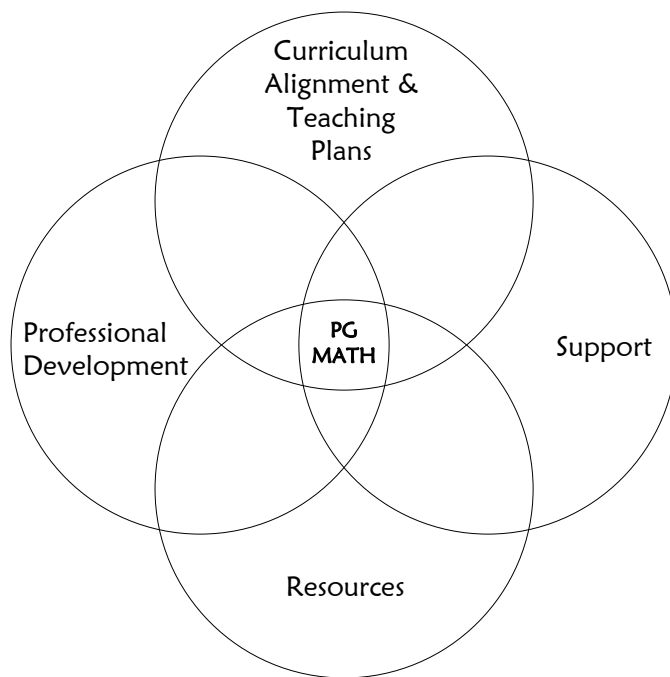
Given the complexity of teaching for understanding, it's not surprising that research about standards-based reform suggests that getting teachers to teach for understanding is a difficult change to implement. Teaching for understanding requires teachers to have comprehensive and in-depth knowledge of subject matter, competence in representation and manipulation of this knowledge.

Despite the challenges, teaching for understanding is worth the effort. Students who understand mathematics are able to generate new mathematics knowledge, remember and reconstruct material, and apply their knowledge to novel situations (Hiebert & Carpenter, 1992). Further, as shown in an analysis of 1996 NAEP data (Wenglinsky, 2000; Grouws & Smith, 2000), there is evidence that teaching for understanding promotes higher achievement. The NAEP analysis indicated that eighth-grade students whose teachers emphasized higher order thinking skills and hands-on activities had higher overall achievement on NAEP assessment than students whose teachers did not emphasize these skills (Wenglinsky, 2000; Grouws & Smith, 2000). Similarly, Knapp, Adelman, et al.'s (1995) study of high-poverty schools found that effective mathematics teachers focused on developing students' understanding. A finding from this study was that teaching for understanding resulted in greater gains for low-achieving students than for higher achieving students. This contradicts the notion that low-performing students are not ready or able to understand more advanced material.

Teachers need support in order to learn how to teach for understanding. To acquire strategies for increasing students' understanding, teachers need access to instructional activities and manipulatives that stimulate higher-order thinking skills, opportunities to learn through professional development that has research based features, and support during their often difficult path towards introducing new content and instructional strategies.

It is the aim of Project GRAD Mathematics to provide teachers with the tools, professional development, and support necessary for transforming their classrooms into environments characterized by students' engagement in mathematical reasoning, non routine problem solving, and mathematical communication. It is our experience, expectation, and belief that students enrolled in Project GRAD Mathematics classrooms emerge with both understanding of critical mathematical concepts and computational fluency.

Project GRAD Mathematics consists of four, overlapping areas.



Curriculum Alignment and Teaching Plans

The alignment of instructional activities to state standards and local district curriculum frameworks is a critical element of Project GRAD Mathematics. Project GRAD Mathematics customizes the content and sequence of instructional activities contained in the Project GRAD Mathematics Teaching Plans for each Project GRAD local site. Project GRAD Mathematics Teaching Plans provide teachers with daily warm-ups, rigorous problems solving, focus lessons, and differentiated instruction activities.

Professional Development

The Project GRAD USA Mathematics Team facilitates a comprehensive series of professional development experiences to empower educators to focus their practice on students' understanding of mathematics. Professional development experiences are designed for school administrators, support personnel, teachers, and local Project GRAD site mathematics staff.

Support

Support personnel, often titled Math Consultants or Math Coaches, are critical to the implementation and maintenance of Project GRAD Mathematics in Project GRAD schools. Employing a range of support activities, Math Consultants have proven to be a critical influence on teacher's ability to adapt instructional strategies to reflect the Project GRAD Mathematics philosophy of teaching and learning. Campus Based Mathematics Facilitators, charged with management of resources and additional teacher support, are also members of the Project GRAD Mathematics support team at most local sites.

Resources

A comprehensive Curriculum Library of mathematics resources is housed in each Project GRAD school. A Classroom Kit of mathematics manipulatives and additional instructional resources is available for use by teachers and students in every Project GRAD Mathematics classroom.

References

- Grouws, D. A., & Smith, M. S. (2000). NAEP findings on the preparation and practices of mathematics teachers. In E. A. Silver & P. A. Kenney (Eds.), *Results from the seventh mathematics assessment of the National Assessment of Educational Progress* (pp. 107–140). Reston, VA: The National Council of Teachers of Mathematics.
- Hiebert, J., & Carpenter, T. P. (1992). Learning and teaching with understanding. In D. A. Grouws (Ed.), *Handbook of research on mathematics teaching and learning: A project of the National Council of Teachers of Mathematics* (pp. 65–97). New York: Macmillan.
- Knapp, M. S., Adelman, N. E., Marder, C., McCollum, H., Needels, M. C., Padilla, C., et al. (1995). *Teaching for meaning in high-poverty classrooms*. New York: Teachers College Press.
- National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: Author.
- Wenglinsky, H. (2000). *How teaching matters: Bringing the classroom back into discussions of teacher quality*. Princeton, NJ: Educational Testing Service.

Project GRAD Mathematics Overview

Project GRAD Mathematics is a Pre-kindergarten through eighth grade instructional and professional development system of learning and teaching that advocates a balanced approach to mathematics instruction where both skills acquisition and conceptual development of mathematics are both emphasized. A core principle of Project GRAD Mathematics is that all children can and want to learn mathematics, given an opportunity to learn and appropriate forms and amounts of support.

Instructional Component: Overview

Project GRAD Mathematics is organized around the five content standards and five process standards of the National Council of Teachers of Mathematics. Within a daily 90-minute time frame for grades 1 through 8 (60 minutes for Kindergarten and 35 minutes for Pre-Kindergarten), Project GRAD Mathematics utilizes daily problem solving, skill development, and selected manipulative materials to develop mathematical concepts.

The daily time available for mathematics instruction is divided into shorter segments, allowing for individual focus, cooperative grouping, whole class instruction, and varied “center” activities (review, extension, practice, individualized instruction). The typical lesson cycle is intended to allow for shorter segments of focused learning followed by reflection or application time. Each day’s instruction is intended to end with reflection to allow consolidation of the day’s learning. A prototypical lesson cycle is summarized next.

Prototypical Daily Structure

The Project GRAD Mathematics daily structure consists of five major components: warm-ups, problem-solving activities, focus lessons, differentiated instruction, and reflection.

Warm-ups

Warm-ups are usually quick (approximately 5 minutes in duration) skill drills. Practice with counting, mental arithmetic, and writing are common, depending on grade level. Numerous activities from many sources (flash cards, puzzles, number guessing games, etc.) are used during the warm-up activity. Some of the specific Project GRAD Mathematics activities include: skip-counting songs, number wheels for the facts, Tap & Tally™ drills, Think Links, and Mad Minute sheets.

Problem Solving

Problem solving typically receives more instructional time (about 10-15 minutes per day) and includes both routine arithmetic problems and non-routine problems. In Project GRAD Mathematics, problem solving is viewed as an integral part of daily mathematics instruction. Daily problem solving is designed to promote the development and utilization of creative strategies to solve engaging problems. All grade levels work with the non-routine strategies on a regular basis. The time devoted to an activity can vary across lessons. Some problem-solving activities may receive attention on more than one day; in other cases, several problems may be completed within a single lesson.

Focus Lesson

The focus lesson is the longest part of the cycle, requiring the most intense planning. In the focus lesson, new mathematical concepts are introduced. The atmosphere is designed to be very student-centered with a great deal of student communication and representation of work. The focus lesson is designed to address all the levels of ability found in the classroom as often as possible and can incorporate whole class activities, cooperative group activities, or partner work.

Differentiated Instruction

Differentiated Instruction is seen as an integral component of Project GRAD Mathematics instruction. Because skills need to be maintained and concept development requires investigation and exploration, students need opportunities to practice skills, to apply what they have learned, and to develop a deeper understanding of mathematics concepts.

Project GRAD Mathematics uses an approach involving centers, which allows individualized attention. Centers are an efficient and effective way to meet those challenges. Centers are organized so that students rotate through activities in a given week. In general, there are five recommended centers for each week: one weekly focus center designed to relate to the current focus lesson; two maintenance centers related to maintaining skills and ideas previously taught; one exploration center activity related to concepts to be taught in the near future; and one intervention center led by the teacher for selected students who need additional support for mastery through re-teaching.

During center time, independent work can be assigned to individualize instruction for those students needing enrichment and extension or to make modifications for other student needs.

Reflection

Reflection occurs in a brief time at the end of a lesson, and it is intended to allow students to think about what they have learned and to summarize the information in their own language. Initially, teachers are encouraged to model and draw out the more thoughtful reflections. Once a routine has been established, a teacher does not necessarily read written reflections daily.

Homework

Homework activities are designed to reinforce skills already covered or presently being taught. Although homework is viewed as important, Project GRAD Mathematics does not require that it be graded as a part of a student's average for the report card. Project GRAD Mathematics encourages teachers to use efficient strategies to check homework during class time to reduce the amount of instructional time spent on this task. Homework correction is usually accomplished through a whole class activity, with partners, or in cooperative groups.

Teacher Support and Professional Development Component: Overview

Project GRAD Mathematics provides strong support for implementation. The support consists of both material and human resources. The material resources include print and physical materials and books to support teachers' classroom instruction. In addition, attention is paid to aligning the Project GRAD Mathematics to local curriculum guides and expectations. The human resources include a school Math Consultant and national consultants who support teachers' implementation of the program on site and in special professional development events.

Teacher Resource Materials

Teacher resources currently provided to support the Project GRAD Mathematics instructional program include: annually aligned Pre-K through 8 teaching plans; grade level specific classroom kits containing an adequate supply of manipulative materials, other instructional resources, and teacher reference materials; a professional development manual; and a school-based curriculum library.

School Math Consultant

An important feature of Project GRAD Mathematics teacher support and professional development is the assignment of a Math Consultant to each school that implements Project GRAD Mathematics. Math Consultants are available to meet and work with teachers in the school on a regular basis. Local Math Consultants receive professional development for their work through participation in the Project GRAD Mathematics Consultant Academy. Consultants are trained in all aspects of the Project GRAD Mathematics intervention, including basic philosophy, curriculum units and materials, and pedagogical approaches. Additionally, Project GRAD Mathematics Consultants are trained with respect to designing professional development aligned with the NSDC standards, using the Concerns Based Adoption Model (CBAM) to determine teachers' levels of implementation, immersion in change theory, and employing Glickman's Clinical Supervision Model.

Initial Professional Development

The initial session of professional development for Project GRAD Mathematics teachers consists of 4 six-hour days of large and small group activities. The presenters for these sessions are experienced math teachers from schools that have implemented Project GRAD Mathematics or are Project GRAD Mathematics Consultants. The focus of this initial professional development is to allow teachers to become familiar with the programmatic elements of Project GRAD Mathematics, understand the resources available, comprehend how these resources are aligned with their state/district curriculum, and engage in instructional strategies using the same materials and resources as their students. Teachers work cooperatively with their peers in an environment that encourages exploration into the deeper meaning of the mathematics they teach, making connections across content areas and questioning.

Ongoing Professional Development

Ongoing professional development sessions are provided for Project GRAD Mathematics teachers throughout the school year. The topics are selected based upon needs of the teachers and fulfillment of goals as determined by implementation visits conducted by the Project GRAD national team of Project GRAD Mathematics Consultants. The implementation visits are conducted once a year and utilize the Concerns Based Adoption Model (CBAM). Use of CBAM is intended to allow local and national consultants to set reasonable goals when working with the teachers to improve their instruction.

Teachers also may request short, focused refresher sessions to revisit topics from the initial professional development sessions. Other sessions focus on vertical planning across grades, examination of a particular content standard, or reflection on student work samples from a particular math task. Project GRAD Mathematics teachers often lead these sessions, sometimes with the assistance of their school's Project GRAD Mathematics Consultant. The ongoing professional development activities are structured so that teachers experience the support and guidance of the Project GRAD Mathematics Consultant as frequently as possible.

Project GRAD Mathematics Processes

The institutionalization of eight, research-based processes are critical to the full realization of Project GRAD Mathematics in Project GRAD schools. Local Project GRAD Mathematics leadership is encouraged to measure the support they provide through the framework of the eight processes.

1. Instructional Process:

Teachers implement a balanced approach to mathematics instruction daily, including the following instructional strategies:

skills work, problem solving, differentiated instruction, meaningful questioning, use of appropriate mathematical language, reflection, consistent use of manipulatives at all grade levels, student-student interaction, reasoning, integration of technology

2. Curriculum Alignment Process:

Sub process 2a: Teachers have access to and utilize instructional activities that will prepare children to exceed proficiency in the mathematics curriculum as identified by the state and school district in which the child resides.

Sub process 2b: Teachers have access to and utilize instructional activities that resemble the context in which skills will be assessed on state and national assessments.

Sub process 2c: Teachers have access to user-friendly curriculum documents that identify quality aligned, instructional activities daily.

3. Assessment Alignment Process:

Sub process 3a: Teachers utilize assessments that are aligned with state and school district curriculum.

Sub process 3b: Teachers utilize a diverse set of assessments designed to measure both procedural and conceptual understanding of mathematics.

4. Professional Learning Process:

Sub process 4a: Teachers engage in high quality professional development experiences that build content and pedagogy simultaneously. Professional development should be on-going and job-embedded.

Sub process 4b: Teachers engage in a professional learning community focused on development of content and pedagogical knowledge, instructional planning, and reflection.

Sub process 4c: Teachers are provided the most contemporary research related to mathematics learning and teaching.

5. Support Process:

Teachers are provided continuous support through regular access to a qualified mathematics coach.

6. Data Analysis Process:

Sub process 6a: Teachers are provided with assistance in the analysis of data identified through weekly, biweekly, and quarterly assessments.

Sub process 6b: Teachers utilize analyzed data to inform instructional and professional learning processes.

7. Performance Management Process:

District Administration, building administration, and math coaches are provided useable, consistent tools designed to track all critical measures of performance. Tracking of identified lead indicators of performance on state assessments are of critical importance.

8. Communication Process:

Sub process 8a: District and building administration are provided with a concise, friendly illustration of information related to the status and implementation of processes in their district and building related to mathematics learning and teaching.

Sub process 8b: District and building administration are provided regular, continuous reports of student achievement trends in all Project GRAD schools.

Project GRAD Mathematics Support of Existing Mathematics Curricula, Programs, and Initiatives in a School District

As a result of mandates placed on many districts to adopt some form of school reform to increase student achievement, many districts continuously invest in innovative mathematics curriculum, programs, or textbook series. Furthermore, many districts employ personnel, often titled Math Coordinators or Math Curriculum Specialists, charged with guiding mathematics instruction and learning in their districts. These personnel engage in diverse activities such as preparing pacing guides, developing scope and sequence plans, coordinating and implementing professional development of teachers, following local trends in student achievement in mathematics, and setting instructional and learning goals related to mathematics.

Project GRAD Mathematics is a support system structured to enhance existing standards-based mathematics programs in place in a district. The implementation of Project GRAD Mathematics in a school district does not necessarily indicate a replacement of an existing mathematics program within the district. If a district has recently contributed substantial financial resources to obtain an innovative, standards-based mathematics curriculum, Project GRAD Mathematics provides additional curriculum alignment, professional development, resources, and support to better prepare and develop Project GRAD teachers' ability to implement the existing curriculum or program. **The driving force of Project GRAD Mathematics is to institutionalize the Project GRAD Mathematics Processes in the schools we serve.**

Project GRAD Mathematics is designed to support the work of Math Coordinators or Math Curriculum Specialists in the district. Schools supported by Project GRAD are oftentimes the lowest performing schools in the district, therefore, beyond the support provided by Math Coordinators and Math Curriculum Specialists, additional professional development and services related to mathematics is desperately needed. Project GRAD Mathematics is committed to seamless convergence of the resources provided the district with the additional resources and support Project GRAD provides.

Curriculum Alignment & Teaching Plan Development

Grade Level Expectations

Through careful review of the NCTM standards and state standards from across all Project GRAD sites, Project GRAD USA has developed a set of Grade Level Expectations that guide our alignment of instructional activities with state and local standards and the design of the Project GRAD Mathematics Teaching Plans. Grade Level Expectations (GLE) go beyond describing the mathematics content at each grade level. Grade Level Expectations also describe specifically what large mathematics concepts children should understand as well as illustrate the ways children should be able to use this understanding.

Activities Prior to the Alignment Process

To better understand how Project GRAD Mathematics can readily adapt to any district's mathematics curriculum, it helps to view Project GRAD Mathematics as an instructional sequence. This sequence is composed of a combination of carefully selected activities and best instructional practices found in contemporary research related to standards-based mathematics instruction and learning. While Project GRAD Mathematics does have specific Grade Level Expectations for each grade level from Kindergarten through eighth grade, its strategies, practices, and expectations are often those already found in state and district requirements.

During Pre-implementation, Project GRAD Mathematics collects all documents developed by the school district related to mathematics instruction including curriculum guides, pacing charts and guides, and scope and sequence documents. District developed pacing charts/guides are the foundation of Project GRAD Mathematics Teaching Plans. Project GRAD Mathematics Teaching Plans reflect the sequencing of content and allotted instructional time for specific objectives and standards that is aligned with the needs of children within the district, yet the Project GRAD USA Curriculum staff does not have the familiarity with these needs to determine sequencing and allotted instructional time for specific objectives. Therefore, since each district is unique and curriculum staff at each district generally has a deep understanding of the instructional needs of the children within the district, in the event that pacing guides do not exist, we work in coordination with district curriculum staff to create pacing guides. (We have found in our experience that this activity further enhances district curriculum staff's familiarity with state standards and provides them with an opportunity to see vertical and horizontal connections of state standards across and within grade levels.)

Curriculum Alignment & Teaching Plan Development

The Alignment Process

1. The district's document (pacing guide, instructional guide, etc.) determines the objectives and the sequencing of those objectives in the initial Project GRAD Mathematics Teaching Plan.
2. The state mathematics standards are cross checked to insure that they have all been included in the district's document.
3. These entries are compared with Project GRAD Mathematics USA Grade Level Expectations. Any Project GRAD Mathematics Grade Level Expectations not yet part of the Project GRAD Mathematics Teaching Plan are added.
4. The pacing (amount of time to be spent on each objective) is determined. These decisions are based on the number of state objectives and Project GRAD Mathematics Grade Level Expectations that need to be included, pacing recommended in the district curriculum documents, and the significance of each objective as compared with the others for that grade level.*
5. Lessons are selected and reviewed to insure the activities do reflect the intent and all specifics of the objectives, particularly the cognitive level. If the school district has provided lessons, either from an outside source or from its district mathematics curriculum department, those lessons are considered first for inclusion in the teaching plan. Furthermore, released test items from state assessments are reviewed carefully and included in the Lesson Cycle (see Lesson Cycle below) to insure that students will have opportunities to experience state assessment items throughout the grading period.

* Pacing decisions are based on full Project GRAD Mathematics implementation—in other words, the student audience pictured when developing pacing are students entering the specific grade that have been through Project GRAD Mathematics instructional sequence the preceding school years. This is obviously not the case for sites during initial implementation. Teachers may find it necessary to modify teaching plans at that time.

The Daily Lesson Cycle - Elementary

In the early years of Project GRAD Mathematics, developers discovered through teacher feedback that a structured Lesson Cycle would be helpful for teachers in their efforts to implement instructional strategies proven to be associated with teaching for mathematics understanding. The Daily Lesson Cycle is Project GRAD's suggested daily sequence of instructional activities. Due to the unique nature of each Project GRAD classroom, modifications to the Lesson Cycle are natural and expected. However, adherence to the Lesson Cycle insures that coverage of required mathematics content is completed and opportunities for students to engage in activities that have been shown optimize time for mathematics learning is experienced.

The Daily Lesson Cycle is based on a daily 90 minute instructional block and consists of five instructional strategies: warm-ups, problem solving, focus lessons, differentiated instruction, and reflection.

Warm ups

- 5 -7 minutes
- Low cognitive demand/skill emphasis
- Include each skill listed at least once during the week

Problem Solving

- 10-15 minutes, Monday to Thursday (Friday is optional since the Focus Lesson emphasis is problem-solving)
- Student involvement: combination of individual, partner, small group, and whole group assignments
- Teacher role as facilitator
- Shared solutions, multiple strategies as a rule
- Continuation of Action Lists; inclusion of the heuristic

Focus Lesson

- 30-40 minutes
- Very well-planned instruction
- High cognitive demand/concept development
- Instruction: student-centered yet teacher-directed; balanced among partner/small group work, individual assignments, and whole class instruction
- Objectives listed should be presented to the whole class

Differentiated Instruction

- 20 minutes per day
- Differentiated Instruction centers: *Focus Lesson*, *Maintenance*, *Intervention*, and *Exploration*
- Students rotate through listed activities during four days; time on the fifth day is spent giving directions for new activities and sharing work from Differentiated Instruction
- Various levels of cognitive demand
- All students work all activities, including *Exploration*, at least once in the two-week cycle
- *Intervention* is limited to no more than three students for effective remediation or enrichment
- *Intervention* is planned by the classroom teacher, based on formal or informal student assessment
- Does not have to be part of the instructional math block; can be scheduled at any time of the day
- There are days with no *Intervention* so the teacher can informally assess students and be involved in students' conversations

Teaching Plan Development – Elementary

The development of Project GRAD Mathematics Teaching Plans consists of the following activities:

1. The objectives and the sequence of those objectives for **Focus Lessons**, based on state and district requirements and Project GRAD Mathematics Grade Level Expectations, are determined. This process is described earlier, under *Alignment*.
2. **Focus Lessons** are selected that align with the objectives, both in intent and specifications.
 - District mandated or recommended resources are reviewed as well as those from the Project GRAD Mathematics Curriculum Library and Classroom Kits. Lessons are sequenced to develop the concepts effectively at the appropriate cognitive level.
 - The NCTM Process standards must be included in the lessons selected.
 - Lessons from district-provided text books can be included, either as the primary resource or supplemental instruction or practice
 - The complete year of focus lessons is sequenced before selecting the content for the other lesson components to ensure an effective flow and development of the grade level objectives.
3. The daily **Problem Solving** component is sequenced.
 - There are three major considerations when determining the objectives for this component.
 - The first consideration is to provide a logical sequence of operational problems through the third grade and an appropriate mix of operations in the upper grades.
 - Secondly, an appropriate number of non-routine problems must be presented consistently through the year.
 - Finally, application of recently taught objectives and grade level expectations must be included—such as measurement or fraction/decimal problems.
 - It is not expected that the daily problem reflects the objective of the week’s focus lesson since the problem-solving component is an integral piece of the spiraling of objectives for review and application.
 - After the objectives are placed, non-routine problems are often specified, considering both the rigor of the problems and the time limitations of the daily component. Specific problems to reflect the other two categories of problems (operations and application of objectives) are often left to teacher discretion. This

is an appropriate time for teachers to incorporate district test preparation questions as well as word problems from the text book.

- Problem solving may also include open-ended, released items from state assessments.

4. Once the content for the more academically-challenging components is completed, the daily **warm-ups** are written. There are two types of warm-ups to plan.

- The first set of warm-ups is relatively independent of other lesson components' content. This consists of *calendar* and *counting* in the primary grades, and *mental math*, *number sense* and *number of the day/week* in the upper grades. These are sequenced to develop more challenging skills as the year progresses and to review grade level mastery skills through the year.
- The second set of warm-ups is closely connected with other lesson components. One warm-up objective reflects the weekly skill mastery assessment. The other is a significant part of the spiraling of objectives for review. This last warm-up reflects the Focus Lesson objective of the previous week whenever appropriate, or an objective that relates to a grade level expectation that has been presented at any point earlier in the year.
- Warm-ups may also consist of released items from state assessments.

5. Differentiated Instruction

Differentiated Instruction is the most significant part of the spiraling (see *Spiraling* below) of curriculum for review and application as well as allowing time for students to explore new mathematical concepts. When planning the content, different factors affect the different types of centers. For all activities, the time limitations are again considered.

- The ***Weekly Focus*** activity relates to the objective of the week's Focus Lessons, but not as an exact reflection. Activities are structured to help students achieve mastery of the Focus Lesson objectives
- Objectives for the ***Maintenance*** activities must be balanced between review and application of recently presented objectives, and regularly re-visit grade level mastery objectives. Activities should include both cognitively demanding application of learned objectives and practice activities to foster memorization of lower-level skills and procedures. Sometimes a maintenance activity is a review of objectives taught in the previous school year. This is more likely to occur for objectives that may not be presented as Focus Lessons until later in the year.

- *Maintenance* activities may also include released items from the state assessments.
- Objectives for the *Exploration* activities consist of a mix of algebra, geometry, measurement and number objectives. Some activities provide prior experience that builds the foundation for upcoming Focus Lessons. Other times the exploration is exploration for its own sake, allowing students to make their own discoveries and connections.
- The *Intervention* activities are not provided since these are selected by the teacher, based on the needs of students in each individual class. It is expected that this time will be used for remedial work as well as enrichment to help meet students' specific needs.

6. Homework

Objectives for homework reflect the weekly focus lesson, weekly skill mastery assessment, and a specified review item. Details about specific homework assignments, both for content and length, depend on the student needs, teacher discretion, and school district guidelines. The district mathematics textbook is often used as a resource in this component.

The Daily Lesson Cycle – Middle Grades

It is our suggestion that Project GRAD middle schools allot appropriate instructional time for students to experience mathematics beyond traditional rote learning, preferably 75 to 90 minutes. Yet schedules in Project GRAD middle schools vary greatly across sites. In some Project GRAD sites, 90 minutes of instructional time for mathematics is scheduled for grades 6, 7, and 8. In other sites, block scheduling is instituted resulting in 90 minutes of mathematics instruction on alternate days, and little to no mathematics instruction on off days. In still other sites, daily mathematics instruction in the middle grades varies from 50 to 70 minutes. Therefore, a consistent 90 minute Daily Lesson Cycle in many Project GRAD middle schools cannot be realistically implemented during the present or coming academic year.

Middle Schools with 75 – 90 minutes of daily mathematics instruction follow the same lesson cycle as the elementary grades. On campuses with less than ninety minutes of instruction teachers modify the time allotments for each component. These changes often vary from lesson to lesson.

Middle schools with 40 – 50 minutes of daily instruction or 90 minutes of mathematics instruction on alternate days incorporate the following lesson cycle over the course of one week.

During four days of instruction:

- Warm-up for 5 minutes
- Problem Solving for 10 minutes
- Focus Lesson for 25 – 35 minutes

The fifth day of instruction:

- Warm-up for 5 minutes
- Formal Weekly assessment for 10 - 15 minutes
- Differentiated Instruction for 25 - 30 minutes

There is no Weekly Focus Differentiated Instruction activity. The activities are either maintenance or exploration. Intervention can still be scheduled at this time.

Time allotment for each component is doubled for schools with block scheduling resulting in alternate days of mathematics instruction.

Teaching plans are created that reflect the limited amount of time available for instruction. Teachers are encouraged to find other opportunities during the school day to schedule additional instruction.

Spiraling within the Project GRAD Mathematics Teaching Plans

Spiraling of objectives refers to the placement of instructional activities related to an objective in warm-ups, problem solving, differentiated instruction and homework after they have been presented in focus lessons. During the focus lessons, the objective should be understood by the students; a foundation has been put in place. Students at that time should be able to pass an assessment on that objective. However, this is not mastery; it is only a measure of short-term comprehension.

The spiraling component of the Project GRAD Mathematics Teaching Plans is in place to ensure that students achieve mastery of those core grade level objectives. The students must still remember and understand the math in the days, weeks, and months after initial instruction. This is mastery. It can only be achieved when students have many opportunities, over time, to practice and apply the mathematics—in other words, when the objective is spiraled through the year.

The following illustrates how one objective could be spiraled for third grade.

Record of Spiraling Content Objectives in Teaching Plans

3.1.2A Identify and label fractional parts of whole regions and sets					
Wk	FL	WU	PS	DI	HW
1... 19					
20	X			X	X
21	X			X	X
22		X			
23					
24					
25				X	
26				X	
27					
28					X
29		X			
30					
31				X	
32				X	
33					
34		X			
35					
36					

The concepts are introduced in Weeks 20 and 21 Focus Lesson and Differentiated Instruction, and practiced for homework.

Week 22: Reviewed in Warm-ups

Weeks 25 and 26: Maintained in Differentiated Instruction

Week 28: Homework practice
Week 29: Warm-up review including skill mastery assessment

Weeks 31 and 32: Maintained in Differentiated Instruction

Week 34 Warm-up review including skill mastery assessment

Frequently Asked Questions about Project GRAD Mathematics Alignment and Teaching Plans

Since the Project GRAD Mathematics instructional sequence does include, but does not limit itself to, the state-mandated grade level expectations, there are some commonly asked questions about Project GRAD Mathematics Alignment. For example:

1. Why do Project GRAD Mathematics Teaching Plans include lessons that do not reflect the state-mandated, tested objectives?

There are two possible explanations:

a. For a number of objectives, the Project GRAD Mathematics instructional sequence moves through the curriculum more quickly than many state guidelines require. Consequently, many lessons are more advanced than state requirements dictate, such as multiplication in first grade or addition and subtraction of any numbers, with re-grouping, in the second grade.

b. Project GRAD Mathematics introduces concepts two school years before mastery is expected. Therefore, every teacher is expected to present exploration opportunities that will enable the students to be successful in the coming years, such as games recording with positive and negative integers in grades 3 and 4.

2. Why do the Focus Lessons in the teaching plans not follow the same pacing as directed by the district/state documents?

Since Project GRAD Mathematics grade level expectations are more rigorous than some state-mandated expectations, there are occasions when students have mastered objectives earlier than the state has scheduled. One example is adding and subtracting fractions with like denominators which is a Project GRAD Mathematics mastery item for third grade, but often is not introduced until fourth grade. Therefore, for example, when the state then recommends three days for this skill in grade 4, Project GRAD Mathematics students do not need that time since they have already mastered that objective. In that case, the skill would be reviewed in that time frame as the students progress to adding and subtracting with unlike denominators.

It is also important to understand Project GRAD Mathematics' application of spiraling of objectives within the teaching plans. Often states or districts recommend a certain amount of time for mastery of a particular item, basing that designated time partly on the fact that it may not be revisited. The Project GRAD Mathematics plans consistently spiral objectives for regular review and application. Consequently, for example, it is not always necessary to spend two weeks focusing on an objective—rather, Project GRAD Mathematics will spend one week to present the objective during Focus Lessons, then review and apply it in many of the weeks to follow.

Another factor to consider is the amount of time involved in the Project GRAD Mathematics math lesson. We expect 90 minutes of daily math instruction in First Grade through Fifth Grade. Within that schedule 30-40 minutes are designated for the Focus Lesson. Consequently we can teach more mathematics in fewer days than in schools scheduling less time for math instruction.

3. Why aren't all the lessons recommended by the site included in the Project GRAD Mathematics Teaching Plan's Focus Lessons?

Project GRAD Mathematics attempts to use as many of district-mandated or district-recommended resources as possible. At times, these recommended activities are better placed in some lesson cycle component other than the Focus Lesson. This is often the case when the activity reflects an objective mastered in a previous grade for Project GRAD Mathematics students. In other cases, the activity neither meets Project GRAD Mathematics standards for expected academic rigor nor is appropriate for a review activity so is not included in the plans.

4. The state/district curriculum guide lists one objective for a given amount of time, so why are many skills and concepts listed in the Project GRAD Mathematics Teaching Plans during that time?

Additional skills and concepts are included since the Project GRAD Mathematics Teaching Plans are written to integrate the spiraling of content through the year. Briefly, a curriculum that spirals allows students to revisit objectives through the year rather than only during a particular 'unit.' Students continually review and apply skills and concepts. For a more detailed description of spiraling refer to the *Teaching Plan Development* section.

Sample Curriculum Map

Curriculum Map of Georgia Quality Core Curriculum: Fourth Grade 2004-2005

	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
Daily	Problem Solving (PS) QCC 1, 3, 20, 21, 22 Friday: QCC 23	Problem Solving QCC 1, 3, 20, 21, 22, 34 Friday: QCC 23	Problem Solving QCC 1, 3, 20, 21, 22, 34 Friday: QCC 23	Problem Solving QCC 1, 3, 20, 21, 22, 34 Friday: QCC 23
2-3 days per week	Mental Math or Number Sense QCC 4	Mental Math or Number Sense QCC 4	Mental Math or Number Sense QCC 4	Mental Math or Number Sense QCC 4
Week 1	QCC 4, 20, 31, 38 Addition and subtraction	Extension of QCC 38 Fluency in addition and subtraction	QCC 2, 18, 35 Fraction concepts	QCC 27 Probability
Week 2	QCC 16, 17 Numeration	QCC 10, 11, 13, 15 Linear measurement Polygons	QCC 2, 18, 35 Fraction concepts	QCC 24, 25, 26 Data
Week 3	QCC 1, 3, 14, 16, 17 Numeration Estimation	QCC 8, 10 Polygons Lines	QCC 2, 5 Add/subtract fractions and mixed numbers	Integers
Week 4	QCC 16, 28, 29, 30, 31, 32, 34 Factors and multiples	QCC 9, 10 Symmetry Transformations	QCC 2, 6, 35 Decimal concepts	Division with two- digit divisors
Week 5	QCC 33, 36, 37 Multiplication	QCC 7, 10 Coordinates Solids	QCC 14 Add and subtract decimals, money	Geometry extensions
Week 6	QCC 33, 36, 37, 38 Multiplication with larger factors	QCC 12 Perimeter and area	Fraction-Decimal- Percent	Geometry extensions
Week 7	QCC 33, 36, 37, 38 Division with larger dividends	QCC 12 Volume and circles	QCC 24, 25, 26 Data, including circle graphs	Geometry extensions
Week 8	QCC 24, 25, 26, 33, 36, 37, 38 Division Data	QCC 19 Patterns	QCC 11, 13, 15 Weight and capacity	QCC 24, 25, 26 Data
Week 9	QCC 24, 25, 26 Data	QCC 27 Probability	QCC 34 Algebraic notation	QCC 24, 25, 26 Data

Map of objectives presented during the Focus Lesson component of the lesson cycle. Refer to the Spiral Checklist for a complete list of when each objective is reviewed through the year.

**Week 3 of the Second Quarter
Focus Lessons**

**Georgia Quality Core Curriculum
Grade 4**

Geometry & Spatial Sense; Measurement

8 Topic: Geometry

Standard: Identifies and distinguishes among point, ray, line, line segment, and angle.

10 Topic: Plane and Solid Figures

Standard: Makes models of plane and solid figures, sorts and classifies these models according to distinguishing characteristics such as sides, angles, lines of symmetry, faces, and edges (such as triangles, quadrilaterals, circles, cones, cylinders, and rectangular prisms).

Problem Solving

23 Topic: Problem Solving

Standard: Employs problem-solving strategies (e.g., make a chart, graph, or table; make an organized list; guess and check; make a simple problem; look for a pattern; draw a picture; or Work Backward).

Atlanta Public Schools Essential Skills

ES 2-1 Identify and distinguish among point, ray, line, line segment, and angle.

ES 2-4 Make models of plane and solid figures, sorts and classify these models according to distinguishing characteristics such as sides, angles, lines of symmetry, faces, and edges (such as triangles, quadrilaterals, circles, cones, cylinders, and rectangular prisms).

ES 5-4 Employ problem-solving strategies (e.g., make a chart, graph, or table; make an organized list; guess and check; make a simple problem; look for a pattern; draw a picture; or Work Backward).

		Warm-Up		Problem Solving	
Mental Math (QCC 4): Subtract multiples of ten (<u>Mental Math in the Middle Grades</u> , Lesson 6) <u>Number of the Week/Day</u> Select the appropriate symbol to make a mathematical statement true Measure length to the nearest quarter inch Add and subtract in any Land		QCC 3, QCC 20 (ES 5-1), QCC 21 (ES 5-2), QCC 22 Estimate and solve problems with information from bar graphs with “In The Graph D, E, and F,” pp. 4-7 from <u>Groundworks Algebra Puzzles and Problems</u> Display information from the graphs on tables Decide who would use the information provided and write other survey questions that are related to the topics			
Focus Lessons					
Ref #	State/District Standards	Objectives	Resources	Materials	
2-11	QCC 8 ES 2-1	Recognize line segments, parallel lines, and perpendicular lines Combine polygons to create shapes with sets of parallel and perpendicular lines	Geometry and Fractions with Geoboards, “Perpendicular Lines” and “Parallel Lines,” pp. 7, 8, 10, and 11	Geoboards Dot paper HB, Lesson 13.2	
2-12	QCC 8 ES 2-1	Use appropriate terms for lines, line segments, rays, intersecting lines, parallel lines, and perpendicular lines	<u>Hardhatting In Geo-World</u> , “Shaping Up,” pp. 66 – 69	Copies of task	
2-13	QCC 10 ES 2-4	Recognize, create, and classify angles as acute, right, or obtuse	<u>Geometry and Fractions with Tangrams</u> , “Angles of Tangram Pieces,” pp. 9, 12, and 13	Tangrams Recording materials Copies of pages 12 and 13	
2-14	QCC 10 ES 2-4	Use visualization and spatial reasoning to construct and draw two-dimensional geometric figures	<u>Tangram Treasury, Book B</u> , “Paper Folding and Making Tangram Pieces,” pp. B-6 – B-7	Plain construction paper Scissors	
2-15	QCC 23 ES 5-4	Use the Draw a Picture strategy to solve problems	<u>Problem-Solving Experiences in Mathematics</u> , Process Problems 44 and 45, pp. 35 – 36	Copies of tasks	

<p><i>Differentiated Instruction for Review and Enrichment</i></p> <p>Weekly Focus: Create concave and convex figures with “Convex and Concave Polygons” from <u>Geometry and Fractions with Tangrams</u>, pp. 9 (directions) and 14 – 15.</p> <p>Maintenance: Multiply by powers of ten with “Multiplying by Powers of Ten,” from <u>Think Links Whole Numbers</u>, pp. 28 – 30 .(available in the <i>Game Packet</i>)</p> <p>Maintenance: Import and export in any Land with Tasks from <u>Importing and Exporting</u>.</p> <p>Exploration: Investigate the relationships between area and perimeter with “Perimeter and Area of Similar Squares” and “Perimeter and Area of Similar Triangles,” from <u>Geometry and Fractions with Pattern Blocks</u>, pp. 13 (directions) and 28 – 29. If appropriate include the Challenge activity on page 13.</p> <p>Intervention:</p>	<p><i>Homework</i></p> <p>Maintenance: Identify and describe polygons</p> <p>Maintenance: Addition/subtraction of whole numbers</p> <p>Skill: Add and subtract in any Land, with or without manipulatives</p>
<p><i>Skill Mastery</i></p> <p>Skill: Chunk It! Division</p> <p>Evaluation: $79 \div 4 =$ $189 \div 5 =$ $326 \div 3 =$</p>	

Teacher Resources

Teacher resources currently provided to support Project GRAD Mathematics include: grade level specific classroom kits containing an adequate supply of manipulative materials, other instructional resources, and teacher reference materials; a professional development manual; and a school-based curriculum library. Contents of the classroom kits differ by grade level.

Sample Fourth Grade Classroom Kit (one kit housed in each classroom)

Item Description	Quantity
Groundworks, Gr. 4	1
Groundworks, Gr. 3	1
Mental Math in the Middle Grades	1
Geoboards (square/circular)	25
7 Column Abstract Fair Lands Game Boards	1
4 Column Ten Land Game Boards	1
Squared Materials (class set)	2
Fraction Cakes (full set)	25
Geometric Solids	1
Pattern Blocks (bucket)	2
Color Tiles (bucket)	1
Geobands (bag)	2
Tangrams (bucket)	1
Hexagram Weight Set (bag)	2
Base 10 Blks - Place Value (class set)	2
Primary Rocker Balance	2
Centimeter Cubes (bucket)	1
Two-Color Counters (bag)	2
Snap Cubes (1000)	1
EquaBeam Math Balance	9
Number Line	1
TI-12 Math Explorer Calculator	12
Double Nine Dominoes (bucket)	1
Playing Cards (6 decks)	1

Sample Fourth Grade Classroom Kit (cont.)

Paper Punch Geometric Solids	1
3rd Game Package	1
4th Game Package	1
Money (class set)	1
Clocks (clas set)	1
AlgaBeam Mats (class Set)	1
Problem Solving Experiences In Math, BLM, Gr. 4	1
Math Games & Activities Vol. 1	1
Math Games & Activities Vol. 2	1
The Balance Book	1
Importing & Exporting	1
Instructional Packet, Gr. 3	1
Constructing Ideas- Large Numbers, Gr. 3-6	1
Multiplication Motivation (cassette)	1
Mad Minute	1
Think Links Math & Language Arts	1
Think Links Math & Reading Readiness	1
Problem Solving Experiences In Math, BLM, Gr. 3	1
Fair Lands Blocks Monster Instruction	1
Instructional Packet, Gr. 4	1
Instructional Sequence : Equals As Balanced	1
Instructional Sequence : Real Fractions	1
Fact Practice Resource : Multiplication & Division	1
Constructing Ideas Multiplication & Division	1
OH Geoboards	1
OH Double Nine Dominoes	1
OH Tangrams	1
OH Color Squares	1
OH Fraction Cakes	1
OH Pattern Blocks	1
OH Base Ten Blks	1
OH Two-Color Counters	1
OH Color Tiles	1
OH Playing Cards	1
OH Money, coins	1
OH Money, bills	1
OH Clocks	1
32 Qt. Bins	2
66 Qt. Bins	2
96 Qt. Bins	2
Dice (package)	1
Pawns (package)	1

**Sample Elementary School Curriculum Library
(one library housed in each school)**

Item Description	Quantity
Mathematics..A Way Of Thinking	1
Kids Are Consumers Too!	1
Favorite Problems	1
Developing Skills In Estimation Book A	1
In All Probability: Investigations	1
Family Math	1
Math + Science: A Solution	1
Pieces And Patterns	1
In The Balance: Algebra Logic Puzzle-4-6	1
Graphing Fun For Everyone	1
Tangram Treasure Book B	1
Tangram Treasury Book C	1
Box Cars & One-Eyed Jacks Vol Ii	1
Beginning Algebra Thinking For Gr 5-6	1
Geometry & Fractions W/ Pattern Blocks	1
Hands On Algebra	1
Nctm Principles & Standards For School Math	1
Sir Cumference & Great Knight Of Angleland	1
Mathematics Their Way	1
Grandfather Tang's Story	1
What Comes In 2's 3's & 4's?	1
How Many Snails?	1
Each Orange Had Eight Slices	1
Developing Number Concepts Set	2
Problem Parade	1
Place Value Connection	1
Fraction Circle Activities	1
Fifty On Zebra/Cincuenta En La Cebra	1
Math On The Menu, Gr 3-5	1
Fall Into Math And Science	1
Glide Into Winter With Math + Science	1
Jawbreakers And Heart Thumpers	1
Hardhatting In A Geo World	1
Overhead And Underfoot	1
Primarily Bears	1
How Many, How Many, How Many?	1
Sea Squares	1
Splash! A Penguin Counting Book	1

Sample Elementary Curriculum Library (cont.)

Math Literature Big Books, K Beginnings 1	1
Math Literature Big Books K, Operations	1
Math Literature Big Books, Gr 1 Measure & Geo	1
Math Literature Big Books, Gr 1 Operations	1
Math Literature Big Books K, Beginnings 2	1
Math Literature Big Books, Gr1 Pattern & Alg	1
Box It Bag It Math- Teacher Guide Gr 1&2	1
Box It Bag It Math, Intro To Measuring	1
Box It Bag It Math-Understand Measure	1
Box It Bag It Math, Money Packet	1
Box It Bag It Math, Place Value Counting	1
Box It Bag It Math, Teacher Guide K	1
Games & Activities With Base Ten Blocks-1	1
Games & Activities With Base Ten Block-2	1
Tangram Treasury Bk A	1
Your Days Are Numbered In Calendar Math	1
The Doorbell Rang	1
Box Cars & One-Eyed Jacks Vol I	1
Beginning Algebra Thinking For Gr 3-4	1
Sir Cumference & The Dragon Of Pi	1
Sir Cumference & The First Round Table	1
Three Bear Family Activity Book	1
Intermediate Mathlinks Cubes Activities	1
How Big Is A Foot?	1
Zero To Ninety-Nine:Problem On A 100 Sq	1
The Greedy Triangle	1
M & M's Counting Book	1
Navigating Through Algebra Pk-2	2
Navigating Through Algebra Gr 3-5	2
Navigating Through Geometry Pk-2	2
Navigating Through Geometry Gr 3-5	2
Mental Math In Primary Grades	1
Spaghetti & Meatballs For All	1
The Crayon Counting Book	1
Telling Time	1
Dealing With Addition	1
The Coin Counting Book	1
The Big Buck Adventure	1
Sold!	1
Once Upon A Dime	1
Alice In Pastaland	1
Used Numbers:Stats, Mid, Mean & In-Betwn	1

Sample Elementary Curriculum Library (cont.)

Navigating Through Data Analysis & Problems Pk-2	2
Navigating Through Data Analysis & Problems 3-5	2
Connections Gr 5	1
Let's Tell Time	1
Fun With Money	1
Math Readers Red Level A	1
Math Readers Yellow Level B	1
Geometry, Spatial Sense And Measurement	1
Geometry & Fractions W/ Tangrams	1
Geometry & Fractions W/ Geoboards	1
Funny Fairy Tale Math	1
Twizzlers Percentage Book	1
The Grapes Of Math	1
The M&M's Count To One Hundred Book	1
Mathematics Assessment	1
Trundle Wheel	12
Exploring With Color Tiles	1
Dot Paper Geometry	1

MOVE IT Math™ Evaluation Findings

Data for the achievement outcomes of MOVE IT Math are available for three feeder patterns in the Houston Independent School District (HISD). Dr. Kwame Opuni, a researcher at the Center for Research on School Reform, University of St. Thomas, has conducted yearly evaluations of the Project GRAD school reform model implemented in the HISD feeder patterns. The summaries provided here regarding MOVE IT Math's impact on mathematics achievement in the HISD are excerpted from Dr. Opuni's Project GRAD yearly evaluations. In all reports, HISD data on students' mathematics achievement was examined in three ways: the extent to which students experiencing the MIM program achieved state grade-level expectations, the extent to which students experiencing the MIM program achieved national grade-level expectations, and the extent to which students experiencing the MIM program outperform a comparison group in a quasi-experimental analysis.

Davis Feeder Pattern

The MIM curriculum was initially adopted in the Davis Feeder Pattern (DFP) in 1994-95. The DFP consists of 7 elementary schools and one middle school in the HISD. Davis schools serve a high-poverty student population. In 2000-2001, almost all schools in the DFP had at least 95 percent of students qualified for free or reduced lunch; the exception was Jefferson Elementary with 88 percent qualified. DFP schools are also linguistically and ethnically diverse. At each of the 8 schools in the DFP, about 75 percent of the students are Hispanic.

MIM and state grade level expectations

State grade level-expectations are measured using the Texas Assessment of Academic Skills (TAAS). Scores are reported in terms of the percent of students passing in each subject. There was intense competition among district schools for recognition and better ratings under the Texas Education Agency and Houston ISD Accountability Systems during the 1990s, therefore TAAS performance in mathematics improves district-wide. In elementary schools in the Davis Feeder Pattern where the MIM curriculum was implemented, students' mathematics performance increased at an even greater rate than that recorded for the entire HISD, despite the fact that DFP schools tend to serve more students living in poverty and to have higher student mobility rates than the district as a whole.

Marshall Middle School also experienced steady improvement in the percent of students passing the TAAS since MIM implementation in 1995-1996. In 1994, only 28 percent of students at Marshall passed the TAAS Math; whereas, 80 percent passed in 2001.

MIM and national academic expectations

In 1997-98, HISD began administering the Stanford 9, a nationally norm-referenced achievement test. During that year, HISD began administering the Aprenda to students with limited English proficiency. The 1997-98 Stanford 9 and Aprenda test results in DFP elementary schools indicated that about 30 percent of students were at or above grade level in mathematics. By 2000-01, the proportion of DFP elementary school students at or above grade level in mathematics was at least 50 percent in all schools, and it had increased to 75 percent in some schools. Across all DFP elementary schools, the percent of students who scored at or above grade level in mathematics in 2000-01 was nearly double the corresponding percent in 1997-98.

In 1997-98, Stanford-9 and Aprenda scores showed that 27 percent of students at Marshall Middle School were at or above grade level in mathematics. In 2000-01, 35 percent of students at Marshall Middle School were at or above grade level in mathematics – an increase of 30 percent relative to 1997-98 scores.

MIM's comparative effectiveness

Quasi-experimental comparisons were conducted to determine differences in mathematics achievement between students experiencing the MIM program and a comparable group of students who experienced a non-MIM curriculum. For the purposes of these comparisons, students in the DFP schools were divided into two cohorts, lower primary (grades 1-3) and upper primary (grades 3-6). Comparisons of the MIM group and non-MIM group were conducted at both cohort levels. 1998-99 Stanford 9 and TAAS scores were analyzed to determine differences in mathematics achievement.

Analyses reveal that DFP students significantly outperform the comparison group on both cohort levels. In the DFP schools, the lower primary cohort outperformed the comparison group lower cohort; in particular, the average Stanford 9 math score of the DFP lower primary cohort was equivalent to a score at the 75th percentile in the comparison cohort. A comparison of the upper primary cohorts revealed a similar finding; the DFP upper primary cohort average Stanford 9 math score was at the 70th percentile of the comparison cohort. The large effect sizes obtained in the two comparisons (0.69 and 0.65, respectively) indicate substantial differences between the groups.

Yates Feeder Pattern

Initial implementation of the MIM curriculum in the Yates Feeder Pattern (YFP) occurred in 1996-97. The YFP consists of 12 elementary schools and 2 middle schools in the HISD. For 2000-01, the demographic characteristics indicate that an overwhelming majority of students in the YFP experience economic hardship.

Free or reduced lunch qualification rates exceed 80 percent. The ethnicity of the Yates Feeder Pattern is predominately African-American, but a relatively large enrollment of Hispanic students exists at three of the elementary schools.

MIM and state grade-level expectations

Since MIM implementation, schools in the YFP have experienced steady gains in percent of students passing the TAAS. In 2001, 84 percent of students in elementary schools in the YFP passed the TAAS Math, compared to 70 percent in 1996. Cullen Middle School witnessed a dramatic increase in TAAS passing rates, rising from 39 percent passing the TAAS Math in 1996 to 76 percent in 2001. Ryan Middle School passing rates on the TAAS Math have also increased -- from 55 percent in 1996 to 77 percent in 2001.

MIM and national grade-level expectations

In 1997-98, 33 percent of students enrolled in YFP elementary schools scored at or above grade level in mathematics as measured by the Stanford 9 or Aprenda. In 2000-2001, 49 percent of YFP elementary school students scored at or above grade level in mathematics. The proportions of students who scored at or above grade level in mathematics in 2000-01 indicated a 49 percent rate of increase, relative to the corresponding percentage in 1997-98.

MIM's comparative effectiveness

A quasi-experimental comparison of YFP students and a non-MIM comparison group was conducted after the 3rd, 4th, and 5th year of MIM implementation. At the end of each year, Yates Feeder Pattern students outperformed the comparison group on the Stanford 9 Math. All differences between Yates Feeder Pattern students and the comparison group were statistically significant.

Wheatley Feeder Pattern

The Wheatley Feeder Pattern (WFP), which consists of 14 elementary schools and 2 middle schools. Initial implementation of the MIM curriculum occurred in the WFP in 1999-2000. With the exception of Isaacs Elementary School, all WFP schools have free or reduced lunch qualification rates of about 90 percent or greater. The ethnicity of the student population at WFP schools is primarily African-American and Hispanic students.

MIM and state grade-level expectations

The proportion of WFP students passing the TAAS Math has steadily increased since MIM implementation in 1999-2000. About 64 percent of students in WFP elementary schools passed in 1999-2000. After only one year of MIM, the TASS Math passing rate in WFP elementary schools had risen to 87 percent. WFP middle schools also saw an increase. At Fleming Middle School and McReynolds Middle School the percent of students passing the TAAS Math increased from 72 and 76, respectively, in 1999-2000 to 85 and 82, respectively, in 2000-01.

MIM and national grade-level expectations

Stanford 9 and Aprenda scores indicate that 37 percent of Wheatley Feeder Pattern elementary school students scored at or above grade level in mathematics in 1997-98. By 2000-01, 60 percent of WFP elementary school students scored at or above grade level in mathematics.

Fleming Middle School and McReynolds Middle School experienced more modest rates of increase. At Fleming Middle School and McReynolds Middle School the proportion of students at or above grade level in mathematics increased from 26 and 29 percent, respectively, in 1997-98 to 29 and 35 percent, respectively, in 2000-01.

MIM's comparative effectiveness

A quasi-experimental comparison of WFP elementary students and a comparable non-MIM student group was conducted. At the end of the second year of MIM implementation, Wheatley Feeder Pattern elementary students scored significantly higher than the non-MIM comparison group.