III. PROGRAM CONTENT, ALIGNMENT and EFFECTIVENESS: Mathematics

The MISD Supplemental Education Program in Mathematics Grades 2-8 is designed to transcend the *Michigan Curriculum Framework* and the *MEAP Test*. Along with proficiency in mathematics, the goal of the program is to help the child who is left behind become an independent learner. An independent learner is one who knows his learning style and uses this knowledge to become quantitatively literate. "Quantitative literacy empowers people by giving them tools to think for themselves, to ask intelligent questions of experts, and to confront authority confidently." (NCED 2001) "Quantitative literacy" can be defined as the ability to understand and use numerical information in all aspects of life.

Content and Delivery

The ***MISD Supplemental Education Program in Mathematics*** is constructed using the six mathematics content strands of the *Michigan Curriculum Framework* as unit themes. Although all strands are integrated into each unit, a unit's major focus is one of the content strands. In addition, units are developed by grade-level, and activities correspond to the specific grade-level content performance expectations and benchmarks as delineated by the Michigan Departments of Education and Treasury (MDE and MDT) in their 2002 revision of the Framework. Constant attention is given as well to the Framework's *Teaching and Learning* standards, based on research published in *A Guide to Authentic Instruction and Assessment* (Newman, Secada, Wehlage, 1995). These four standards (higher order thinking, deep knowledge, substantive conversation, and value beyond success in the classroom) are continuously reflected in the design and choice of instructional methods and supplementary materials. All Macomb County districts are currently aligning content and achievement standards with the MDE model, and therefore their curriculum should be consistent with the standards of the MISD program.

Each of the grade-level units (strands) in the program contains 20 lessons ranging from 15 to 60 minutes in length. The complete collection of lessons provide 2½ hours of instruction per day for 24 days, 4 days a week for a 6-week summer program or, the 120 lessons can be taught at the rate of 3-5 lessons per week during the school year. Regular use of assessment activities will monitor student progress and provide feedback for students and parents. Summative assessments (exit-exams), modeled after the Grade 4 and 8 *MEAP Tests*, are included at each grade level. To complement instruction, each unit contains interactive Web sites. Many of the lessons are hands-on, and use manipulatives found in most schools. Lessons requiring the use of hand-held calculators are also part of the program. Research shows that students who use manipulatives (including computer manipulatives) in the study of mathematics usually outperform those who do not. (Driscoll 1993; Sowoll 1989; Suydam 1996) Furthermore, attitudes towards mathematics are improved when students are instructed with concrete materials by teachers who are knowledgeable about their use. (Sowell 1989)

Decisions about vital content are research-based. For example, Stanislas Dehaene (1997), in researching how the mind creates mathematics, points out that experimental findings show western numeration systems to be harder to keep in short-term memory, slow down calculation, and make the requisition of counting and of base ten more difficult. Based on this research, a vital component of the program is a set of instructional and maintenance activities focusing on improving mathematical vocabulary and mental computation.

Mental computation will be taught in the program for the following reasons. There is:

1. Heightened sensitivity to the usefulness of mental computation by people in and out of school (Atweh 1982)
2. Growing importance of estimation and recognition of good mental computation as a necessary prerequisite for further study in mathematics (Reys et al. 1981)
3. Recognition that systematic development of mental-computation skills stimulates many higher-level thinking skills in mathematics, providing a foundation for quantitative literacy (Trafton 1978)

4. Expanding research based on mental computation that has implications for elementary mathematics programs (Driscoll 1982; Hope 1984; and Reys 1985)

Assessment

Research indicates that making assessment an integral part of classroom practice is associated with improved student learning. Black and Willian (1998) reviewed about 250 research studies and concluded that student learning, including that of low achievers, is generally enhanced in classrooms where teachers incorporate formative assessment in making judgments about teaching and learning. Assessment activities in the MISD program will be a routine part of the lessons, rather than an interruption or separate entity – many times assessments will be the same as the instructional activity. When the teacher uses assessment techniques such as observations, conversations and interviews with students, or interactive journals, students are likely to learn through the process of articulating their ideas and answering the teacher's questions. (NCTM 2000)

The methods stated previously will be used to monitor student progress as well as provide students with constant and systematic feedback. One means of making this possible will be through the use of interactive television since every district in Macomb County will have at least one distance learning room available. Other possibilities include online courses with real-time assessment, skill maintenance programs with immediate feedback, portfolios, journals and exit exams. For middle school students, the *Lifetime Library*™ will also provide constant and systematic feedback to enhance and monitor learning in reading and writing as well as mathematics.

Instructors of the ***MISD Supplemental Education Program in Mathematics*** will be trained in the use of techniques and materials through intense in-servicing at the MISD. It is hoped that they, in turn, will train more instructors once their initial training is completed. Instructors at each in-service will receive detailed information describing the program, its guidelines and recommended strategies, lists of suggested materials and where to obtain them, and the collection of grade-level lessons (and suggested time frames) to use as a resource. Follow-up "benchmark" meetings will be conducted so that instructors are part of on-going "user" groups – colleagues involved in "lesson studies" – to discuss ways to improve instruction and lesson development of the program. In addition, the Blackboard™ environment will be used as a continuous forum for "electronic" discussion and dialogue.

The progress of the students will be monitored by a variety of methods in various skill levels:

- The use of interactive television will offer classroom support to the teacher and students by MISD Consultants, as well as allow for enrichment and engaging presentations by vendors around the country/world. Interactive TV will also be used as one method of observing classroom instruction and monitoring student performance.
- Blackboard™ courses designed to complement classroom instruction will be used to provide real time and on-going assessment of student progress.
- Skill maintenance programs (paper/pencil and mental computation) with periodic built-in assessments will be used to monitor student progress in those areas.
- Portfolios and journals cooperatively developed with student, teacher and parent will help the student monitor his own progress.
- Summative assessments (exit exams) for each grade level aligned with the *Michigan Curriculum Framework* will be used to monitor yearly progress and may be used as pre/post tests.
- Middle school students will be introduced to the *Learning 2000 Lifetime Library*™. The *Lifetime Library* provides an individualized educational experience through its interactive, multimedia teaching platform with ongoing assessment and feedback.

- Online assessments, aligned with Michigan standards, will be used as pre/post tests and mid-point checks and for reporting to parents.

Although the focus of the ***MISD Supplemental Education Program in Mathematics*** is on developing and improving the understanding of concepts from the six content strands of the *Michigan Curriculum Framework*, opportunities for repetition and reiteration of needed procedural skills do exist. Time is also built into the program to assist the student with his/her daily classwork, if necessary.