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ABSTRACT

This paper evaluates the mathematics program of the Des Moines (Iowa) Independent Community School district. The mathematics curricula in the Des Moines schools is in a state of transition to meet national standards in mathematics. The national standards are completely in agreement with the district's mission statement, which is to provide a quality educational program to a diverse community of students where all are expected to learn. The mathematics program mission statement promotes an expanded vision of mathematics. The program is assessed by evaluating its educational components: (1) context (societal beliefs, standards, history, current program description, and past needs identified in mathematics); (2) input (budget and revenue, instructional materials, student time allotments, and human resource costs); (3) process (current year goals in math, staff development, instructional methods, management systems, computer-aided instruction, alternative assessment, and course revisions); and (4) product (strengths and deficiencies, standardized test results, district criterion referenced tests, grade marks, awards, cost-benefit analysis, and curriculum management audit). A section on future planning describes plans for the Mathematics Department. Plans addressed include math background of middle school math teachers, achievement of females and minorities, high school math course revisions, and technology. (PVD)

MATHEMATICS PROGRAM EVALUATION
GRADES K-12

Division of Teaching and Learning
Des Moines Independent Community School District
Des Moines, Iowa 50309-3399

Winter, 1996

Focus on Program Evaluation

MATHEMATICS
GRADES K-12

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Mathematics

Evaluation Abstract

CONTEXT EVALUATION

The responsibility of the Mathematics Supervisor of the Des Moines Public Schools is to promote quality mathematics instruction which increases independent thinking and problem solving abilities of all children. This responsibility is delineated through the following organizational tasks: 1) preplanning through research and knowledge of trends and effective practices in mathematics education; 2) planning through leadership of teacher, administrator, parent and student groups which select or refine instructional objectives; 3) implementing through selection and dispersion of appropriate instructional materials to support the learning of instructional objectives and pre-service, in-service, and staff development activities which orient staff to their use; 4) monitoring through observations and evaluations of student responses, program, and staff; and 5) analyzing the evaluation of student achievement through district and standardized testing.

The mathematics curricula in the Des Moines Schools is in a state of transition to meet national standards in mathematics. In 1989 the National Council of Teachers of Mathematics (NCTM) published new standards for math curriculum and evaluation. The mathematics program adopted by the Board of Directors in 1995 follows the grades' K-4 and 5-8 Standards. At the national level, the grades' 9-12 recommendations include an integrated core mathematics curriculum for all high school math students. North High School is piloting an integrated program in anticipation of the district's sequence of adoptions for high school math courses starting in 1999. The national standards are completely in agreement with the district's mission statement.

INPUT EVALUATION

There is no separate district budget for the mathematics program, but the mathematics program impacts the textbook, Phase III, staff development, elementary, and secondary budgets. $980,940 was expended for mathematics textbooks for implementation during the 1995-96 school year. During the summer of 1995 the mathematics department was fortunate to receive a Phase III grant of $45,360 and schools contributed $32,897 for a total expenditure of $78,257 for grade level math workshops. During the 1996 summer, math workshops were approved for the Phase III stipend for a total of $92,000. Human resource costs in mathematics for 108.21 secondary math teachers and 11% of 563 elementary math teachers total $5,959,275 for the 1996-97 school year

The Education for Economic Security Act (EESA) (P.L. 98-377, Title II) has provided the math department with federal funding for staff development in mathematics since September of 1986. $55,040 was used to support professional growth of teachers in mathematics during the 1995-96 school year and $61,601 is budgeted for 1996-97.

PROCESS EVALUATION

For the 1996-97 school year the District Improvement Plan goals that directly involve math are the following: 1. "By the opening of the 1999-2000 school year, 80% of elementary, middle and high school students will achieve at least 70% mastery on all district criterion referenced assessments in the areas of reading, mathematics, language arts, social sciences, sciences, foreign language, and vocational subjects."; 3. "By 1999, the district will develop comprehensive, community-wide school-to-work initiatives to prepare all students to enter and succeed in the changing workplace." and 8. "By the year 2005, the district's plan for technology will be implemented to provide a system of support for teaching and learning and management services."

In an effort to attain district and mathematics program goals, resources have been used to fund staff development and in-service activities. For example, in the period from May, 1995, until September, 1996, the following activities were implemented: 1) grade level June or August

workshops for 710 participants (counts include duplicates for special education and Title I teachers) in 1995, 2) Phase III fifteen hour June or August workshops for 391 participants in 1996, 3) each teacher in grades 1-8 received curriculum guides including optional lesson plans with materials and activities, 4) each teacher in grades 1-6 received COLLAGE materials kits with printed resources, manipulatives, string, Post-its, beans etc., 5) 34 grade level after school support sessions were held, 6) a Mathematics Lead Teacher from each elementary attended six half day information workshops and subsequently shared this information with the rest of the staff in their respective buildings, 7) two temporary math consultants and the Mathematics Supervisor taught demonstration lessons in over 30 classroom, 8) the Board and Community Relations department taped and transmitted half hour cable programs for each unit/module in grades 1-6, 8) these programs were compiled for grade level videos given to new teachers in 1996-97 and available for purchase or loan by buildings, and 9) demonstration classrooms for mathematics and science were established in grades 1-5 and visited by 45 district teachers.

PRODUCT EVALUATION

Mathematics has contributed to the district mission statement in a number of ways. End of the year criterion-referenced tests are disaggregated by minority/non-minority, male/female, and free and reduced lunch designations. Enrollment in math courses is analyzed by gender and racial composition. Special programs are promoted for underrepresented and underachieving populations. The quality of math instruction for all students is constantly scrutinized. Student achievement in mathematics is monitored for improvement. National recommendations and standards to increase the effectiveness of mathematics teaching and learning are implemented. Courses are revised to make them more accessible to a wider audience of students while, at the same time raising achievement standards.

Criterion-referenced tests in grades 2-8 were revised for piloting in 1996 due to changes in objectives and curricular materials. Criterion-referenced test scores since 1992-93 have been disaggregated to monitor student achievement based on a standard of comparison, called a Mastery Metric. Although the target percent for achievement has been met at the elementary level in mathematics overall, it was not met at the secondary level in 1994-95 nor 1995-96. The 1996 Curriculum Management Audit stated, "It is apparent that one of the areas requiring the most attention across all grade levels, mathematics is a critical area for Des Moines Independent Community School District. In almost all instances, minority and low socio-economic students fail to achieve at an acceptable level." It is important to note that this conclusion was based on testing data accumulated before curricular reform initiatives in the Des Moines' schools and is one of the reasons why reform efforts were initiated.

FUTURE PLANS

Future plans for the Mathematics Department include: lobbying for increased instructional time for mathematics for students who need more time to learn, lobbying for adequate preparation in mathematics for middle school mathematics teachers, increasing success for females and minorities in mathematics, analyzing the direction of the early high school mathematics course sequence, increasing access to technology for district math students, collaborating with Children and Families of Iowa on after school tutoring programs, collaborating with the district's School to Work initiative, and exploring performance assessment options for ITBS.

A copy of the complete report is available upon request from the Department of School Improvement, Des Moines Independent Community School District, 1800 Grand Avenue, Des Moines, Iowa 50309-3399. Telephone: 515/242-7839. All evaluation reports are submitted to the Educational Resources Information Center (ERIC) and Educational Research Service (ERS).

DISTRICT MISSION STATEMENT

"The Des Moines Independent Community School District will provide a quality educational program to a diverse community of students where all are expected to learn."

How can "a quality educational program" in mathematics be defined in the Des Moines Independent Community School District? A partial answer can be found in the district's mathematics program statement.

MATHEMATICS PROGRAM MISSION STATEMENT

The Des Moines Independent Community School District's mathematics program will promote an expanded vision of mathematics. Through instructional strategies, models, technology and materials which address different learning styles, all students will be encouraged and enabled to investigate, reason logically, draw inferences, and employ a variety of mathematical methods to:

a) learn to reason mathematically;
b) become mathematics problem solvers;
c) acquire confidence in using mathematics meaningfully;
d) learn to communicate mathematically; and
e) value mathematics.

How do high expectations for all students impact the district's mathematics' program? In the development of curricula and selection of instructional materials this must be a top consideration. Objectives and materials should not stop with lower level skills and be dominated by review of lower grades' skills and concepts. Adopted materials should appeal to a diverse community of students. Disaggregation of test results should lead to strategies for increasing the achievement of all students. Traditionally the high school math program has consisted of two tracks - the general math track and the college preparatory track. These two tracks have had very little content overlap. With high expectations for all students these tracks would be less divergent and therein lies the challenge. How to make mathematics less exclusionary and more inclusive and at the same time enhance standards. This challenge will not be met if we continue in the same way down the road we have always traveled.

MATHEMATICS SUPERVISOR RESPONSIBILITY STATEMENT

The responsibility of the Mathematics Supervisor of the Des Moines Public Schools is to promote quality mathematics instruction which increases independent thinking and problem solving abilities of all children.

CONTEXT EVALUATION

Mathematics is consistently named by the majority of elementary students as their favorite subject and by the majority of high school students as the subject they like the least. What happens to turn this attitude around? Many adults have no compunction about stating publicly that they "were never any good at math in school". At the same time math is consistently accepted as one of the most important school courses and one of the keys to opportunity. Workforce 2000 stated, "the fastest growing jobs require much higher math, language, and reasoning capabilities than current jobs, while slowly growing jobs require less." What is there about mathematics that arouses such contradictions and how do they affect the mathematics program in the Des Moines schools? Although this document will not be able to answer all of these contradictions, its intent is to provide a platform for reflection and discussion. We begin with an analysis of societal beliefs.

Societal Beliefs

Katherine Merseth states in the March, 1993, issue of *Phi Delta Kappan*, "Perhaps the most crippling belief about mathematics in our society is that it is a difficult subject that can be mastered only by a very small minority - those with special gifts or abilities. A predominant view in America is that one either 'has it' or one doesn't. Effort receives little credit for contributing to successful learning in mathematics - or for that matter, in any subject." In "Mathematics Achievement of Chinese, Japanese, and American Children", Stevenson, Lee, and Stigler asked American, Japanese, and Chinese mothers what factors among ability, effort, task difficulty, and luck made their children successful in school. American mothers ranked ability the highest, while Asian mothers gave high marks to effort. The researchers concluded that, "the willingness of Japanese and Chinese children to work so hard in school may be due, in part, to the strong belief on the part of their mothers in the value of hard work."

"The belief in innate ability not only minimizes personal responsibility but also fosters the view that poor performance in mathematics is socially acceptable. Many well-educated individuals proclaim without embarrassment, 'I could never do mathematics!' or 'I never liked the subject!'...These beliefs have shaped the views of many elementary teachers and are particularly damaging because they are communicated, either consciously or otherwise, to impressionable young children." (Merseth, 1993) These beliefs are one of the reasons why mathematics instruction is under reform.

Policies, Standards, and Regulations

National Standards

In 1989 the National Council of Teachers of Mathematics (NCTM) published new standards for math curriculum and evaluation. The document is entitled *Curriculum and Evaluation Standards for School Mathematics*. NCTM followed with a companion publication entitled the *Mathematics Professional Teaching Standards* in 1991 and *Assessment Standards for School Mathematics* in 1995.

The standards state five major goals for students. They state that students should:

learn to value mathematics,
learn to reason mathematically,
learn to communicate mathematically,
become confident of their mathematical abilities, and
become mathematical problem solvers.

There are 40 standards for curriculum for K-4, 5-8, and 9-12. Four standards are common to all three levels. They are:

Mathematics as Problem Solving
Mathematics as Communication
Mathematics as Reasoning
Mathematics as Connections

Other standards include: estimation and number sense, number systems and number theory, geometry and spatial sense, measurement, statistics and probability, patterns, algebra, functions, trigonometry, discrete mathematics, conceptual underpinnings of calculus, and mathematical structure. All NCTM standards documents are available from the Mathematics Supervisor.

In Des Moines, as in the rest of the United States, textbooks determine what math is taught and how it is taught in many classrooms. The standards urge reform in traditional mathematics textbooks which have relied on the spiral curriculum approach. James Flanders, in a 1987 study found that in the most commonly used textbooks, between grades K-8, the amount of new material gradually decreased to only 30% in eighth grade and then only if the entire text were taught, a virtually impossible task. Textbook material has also been outdated and outmoded with too much emphasis on computation in isolation and too little emphasis on topics such as estimation, probability, statistical analysis, spread sheets, or practical problem solving.

The mathematics program of the Des Moines district complies with the K-4 and 5-8 Standards. What has caused the most debate nationally and also in our district is the recommendation for an integrated core mathematics curriculum for all high school math students. The NCTM Standards state, "High school graduates during the remainder of this century can expect to have four or more career changes. To develop the requisite adaptability, high school mathematics instruction must adopt broader goals for **all** students...students entering high school differ in many ways, including mathematical achievement, but we believe these differences are best addressed by enrichment and extensions of the proposed content rather than by deletions. The mathematics curriculum must set high, but reasonable, expectations for **all** students." These Standards are completely in agreement with the district's mission statement.

State Standards

The Iowa Department of Education's requirements for mathematics are delineated in "New Standards for Iowa's Schools: Guidelines for Interpretation," published by the Bureau of School Administration and Accreditation, Iowa Department of Education, in October, 1988. The mathematics section is included in the mathematics program evaluation for 1989-90. Iowa is the only state that does not have state mandated curriculum standards for student achievement. Local school districts are responsible for establishing standards.

Historical Highlights

Mathematics has had a prominent place in the curriculum of the Des Moines school district from the beginning. It is interesting to note the pendulum swings of several policies about math such as acceleration and graduation requirements.

1958 Mathematically able 8th grade students allowed to elect Algebra I.

1963 Acceleration via 8th grade Algebra I discontinued.

1969-70 Mathematically able 8th grade students allowed to enroll in Algebra I.

1971-72 I.G.E.(Individualized Guided Instruction) Math at Studebaker and Stowe elementary schools. Graduation requirement in math and science reduced to one year of math or science in grades 9-12.

1977-78 Minimum Competency tests administered to all 8th graders. K-6 objectives-based math tests were administered.

1981-82 Management by Objectives Folder for K-6 used district wide.

1984-85 Collaboration with the University of Northern Iowa (UNI) to increase the mathematics background of elementary and middle school math teachers and permit them to obtain the mathematics approval certification. Math high school graduation requirement increased to two years.

1987-88 Manipulative kits (K-5) and calculator kits (6-8) purchased as part of the K-8 mathematics textbook adoption.

1988-89 Curriculum guides for math (K-8) were implemented.

A complete historical outline is available in the 1989-90 Mathematics Program Evaluation.

Update

1990-91 IMS Plus, a computerized instructional management system for reading and math was piloted in eight schools.

1991-92 IMS Plus was extended to 15 additional schools. 120 before or after school in-services for elementary teachers provided lesson suggestions for implementing the standards and materials to use in the lessons. Algebra enrichment for minorities summer school was initiated

1992-93 IMS Plus was implemented in all elementary schools. Middle school math teachers implemented curricular revisions to implement the NCTM standards by supplementing their existing texts. Middle school teachers met six times for a half day to receive and learn the curricular revisions.

1993-94 Summer school enrichment for minorities was expanded to include a geometry course. High school mathematics teachers and the Mathematics Supervisor presented 29 two hour after school workshops in the period from September 28 to April 21 and additional in-service sessions were scheduled. Algebra enrichment summer school for girls was instigated. Algebra I in 2 years was piloted.

1994-95 Forty-six half day and 10 after school reading/language arts and math integration workshops were given by the Reading and Mathematics Supervisors. IMS Plus was discontinued due to lack of technical support from the vendor. Algebra I in 2 years implemented.

1995-96 Harcourt Brace's **AnyTime Math** - primary, **Houghton Mifflin Mathematics** - grades 3-6 and Prentice Hall's **Middle Grades Mathematics: An Interactive Approach** - grades 7-8 were implemented district wide. Each emphasized problem solving and hands on activities to a greater extent than prior adoptions.

Current Program Description

Content

The current mathematics program is required of all students in grades K-8. High school graduates must earn two years of math credit in grades 9-12. Course titles begin with "Mathematics -- grade K" and continue to "Mathematics -- grade 8" but advanced seventh graders may be enrolled in "Seventh Accelerated" or Pre-Algebra and advanced eighth graders may be enrolled in Pre-algebra, Algebra I or Geometry. All math courses have an extensive list of course objectives and all required courses, up to and including Algebra II, have curriculum guides which include recommended lesson plans. Curriculum guides for Pre-calculus and Calculus will be developed in the summer of 1997. Sample curriculum guides are available from the Mathematics Supervisor.

The curricular goals of the K-12 mathematics program are the following:

1. Utilize problem solving strategies to be able to interpret and solve problems from every day and mathematical situations.
2. Acquire confidence in using mathematics meaningfully in daily living.
3. Discuss mathematical ideas, make and test conjectures, and follow logical arguments.
4. Model situations using oral, written, concrete, pictorial, graphical, and algebraic methods.
5. Recognize and apply deductive and inductive reasoning to draw logical conclusions about mathematics.
6. Develop number sense and compute with whole numbers, fractions, decimals, percents, integers, and rational numbers.
7. Apply estimation when working with quantities, measurement, computation, and problem solving.
8. Select and use an appropriate method for computing from among mental arithmetic, paper and pencil computation, calculator, and computer.
9. Describe, extend, analyze, and create a wide variety of patterns.

10. Interpret and represent relationships with tables, graphs, and charts.
11. Develop spatial sense and recognize and appreciate geometry in the world.
12. Understand and apply geometric properties and relationships.
13. Apply algebraic methods to solve a variety of real-world and mathematical problems.
14. Understand the structure and use of systems of measurement.
15. Make predictions that are based on experimental or theoretical probabilities.
16. Translate among tabular, symbolic, and graphical representations of functions.

These curricular goals help focus the development of course objectives for each mathematics course.

Enrollment

Although just two years credit in high school mathematics are required for graduation, more and more students enroll in math at the high school level. Presently 4 out of 5 high school students are enrolled in mathematics. 1982 was the first year that enrollment topped 60%. It topped 70% in 1987 and has been hovering around 80% for the last four school years:

School Year	Enrollment
1993-94	81%
1994-95	79%
1995-96	79%
1996-97	80%

Math Course Enrollments

	1995-96	1996-97
K-6 Math	all students enrolled	all students enrolled
Math 7	1584	1410
Accelerated 7th	252	207
Math 8	1185	1096
Pre-Algebra	845	868
Middle School Algebra I	287	324
Middle School Geometry	44	40
Introductory Mathematics	574	690
Consumer/Career Mathematics	278	294
Pre-Algebra at East and Scavo	280	300
Pre-Integrated Math at North	NA	285

Applied Math at North	NA	163
Immersion Math at Lincoln	41	35
Algebra I in 2 years	1350	1119
Algebra I	998	913
Geometry	1211	1319
Algebra II	977	926
AP Statistics at Central Campus	NA	18
Radically Accelerated Math at Central Campus	79	59
AP Computer Science at Central Campus	NA	17
Trigonometry/College Algebra (Pre-Calculus)	397	438
Calculus	164	191

Course enrollments have been relatively constant in the past, but individual high schools have modified curricula under site-based management and in the interests of meeting student needs. For example, North High School is piloting an integrated math series beginning with Pre-Integrated Math this year. North is also piloting Applied Math at three levels using CORD Applied Mathematics materials. East High School is using the middle school pre-algebra curriculum with some students. Lincoln High School's lowest math credit course is Algebra I in two years. Middle schools in Lincoln's feeder pattern give their students a test for algebra preparedness and those not prepared take Immersion Math. Math courses at Central Campus help meet the needs of our accelerated math students. In addition to their eighth grade geometry students, one eighth grader is studying Algebra II and two are studying Pre-Calculus. The Radically Accelerated math sequence condenses three years of mathematics into two.

Central Campus Advanced Placement Enrollment

AP Test Year	(AB)*Calculus	(BC)* Calculus	Drake University	AP Prob./Stat.	Total
1993	38	13	7	NA	58
1994	43	16	5	NA	64
1995	57	24	6	NA	64
1996 (Projected)	62	26	0	17	105

* Advanced placement calculus tests are available in two levels: AB corresponds to first and second semester of college calculus and BC to second and third semester.

Title I Math Lab Enrollment

Students in grades 1-5 who need additional assistance in mathematics are identified and served through the Title I Math Lab program. See the following table.

Years	Students Served
1993-94	1,352
1994-95	1,297
1995-96	1,320
1996-97	1,399

Past Needs Identified in Mathematics

1. Calculators

   Lack of calculators was a need identified in the last two mathematics program evaluations. State and national standards require that calculators be readily available in math instruction beyond basic computation. In 1992, through district technology funding, each elementary building was provided two classroom sets of 30 calculators and two overhead calculators to be used when teaching problem solving and math applications. An additional classroom set of calculators was provided with the recent math adoption. Students are still expected to learn their basic facts and algorithms independently of the calculator.

   Middle Schools were provided three classroom sets of four function solar calculators with the mathematics textbook adoption in 1988 and one set of fraction calculators with the math adoption in 1995. These calculators need replacement. Some individual middle schools are replacing them. Recent NCTM recommendations assume that each student will have access to scientific calculators. Each middle school's algebra classroom was provided 20, but graphing calculators are needed.

   Graphing calculators have been provided to high schools as staff development workshops funded with federal Eisenhower moneys have been offered. In 1990, 150 graphing calculators, and six TI-81 view screens were purchased. These are used in the most advanced math courses at the high school level. Many college preparatory students purchase their own calculators, but high schools need a supply for students who cannot afford to do this. These need constant replacement as their life span with students is approximately three years.

2. Classroom Sets of Manipulatives

   Recent adoptions in grades 1-8 have provided teachers and buildings with adequate manipulatives.

3. Mandatory Math Background for Middle School Math Teachers and Departmentalized Elementary Math Teachers.

   The mathematics background of middle school math staff was a concern in the last program evaluation and continues to be. Thirty-five of sixty-nine (51% - compared to 41% in 1993)

middle school math teachers are teaching math with neither a major nor a minor in mathematics. Very few departmentalized elementary or Title I Math Lab elementary math teachers have more than the minimum college graduation requirement in mathematics. All teachers need to have studied content beyond that which they are teaching, but math methods courses are particularly useful in providing teachers with techniques and materials for diagnosis of and meeting individual needs. Middle school teaming assignments have made the problem more acute.

4. Computers and Appropriate Software Demonstrations in Math Classrooms and Computer Labs - Available (in the same way as media centers) for Math Classes.

   State and national standards require that computers be available for "use as standard tools in problem solving." Recent advances in technology have changed the way math should be taught. For example, factoring has been replaced by computer solutions for solving quadratic equations. Technology must be available to meet these changes in instruction.

5. Minority and Female Enrollment in Pre-Calculus and Calculus

   A comparison of the racial composition of the district enrollment compared to senior level math course enrollment for the 1995-96 and 1996-97 school years is as follows:

Percent of Minority Enrollment in Senior Level Math Courses
Compared to District High School Minority Enrollment - 1996-97

	District	Pre-Calculus	Calculus
American Indian or Alaskan Native	1%	0%	0%
Asian or Pacific Islander	6%	12%	19%
African American not Hispanic	13%	4%	3%
Hispanic	4%	1%	0%
White not Hispanic	76%	84%	78%
Total Minority	24%	16%	22%

A comparison of gender percentages for the district compared to senior level math course enrollments for the 1996-97 school year is as follows:

Male/ Female Percent of Enrollment in Senior Level Math Courses

Compared to District Enrollment - 1996-97

	District	Pre-Calculus	Calculus
Male	51%	46%	59%
Female	49%	54%	41%

Although females predominate in Pre-Calculus and Asians are prominent in Calculus in 1996-97, the percentages of females in Calculus and other minorities in both courses is not consistent with district percentages. This is not satisfactory, nor has the situation improved since the last mathematics program evaluation. Approximately 50% of the secondary math

staff is female, but minority math teachers are still needed. Qualified minority math teachers are highly solicited by the district, but at present there are only three out of 108 at the secondary level. Two of the initiatives to correct the disproportionate enrollment patterns are the ISU Science Bound collaboration and algebra enrichment summer school programs. The recent adoption in grades 1-8 meets a variety of learning styles as well as raising standards and should help address this situation in the future.

6. Better Homework Study Habits for Secondary Math Students

   Lack of completion of math homework is a continuing concern voiced by secondary math teachers. More effort is needed in this area, but mathematics teachers cannot do it alone. It will take the collaboration of parents, administrators, and, most importantly, students. A recent collaboration between the Des Moines schools and the Mr. Willie Heggins, the Educational Services Coordinator of Children and Families of Iowa should help with homework completion. Although a voluntary program, tutoring services will be available in all middle schools in our district.

7. Disparity between majority and minority students on end of year criterion referenced tests

   This is also a continuing concern and will be addressed in the product section of this report.

INPUT EVALUATION

Budget and Sources of Revenue

There is no separate district budget for the mathematics program, but the mathematics program impacts the textbook, Phase III, staff development, elementary, and secondary budgets. During the summers of 1995 and 1996 the mathematics department was fortunate to administer a considerable portion of the Phase III budget. The mathematics department received a Phase III grant of $45,360 and schools contributed $32,897 for a total expenditure of $78,257 for grade level math workshops in the summer of 1995. During the 1996 summer, math workshops were approved for the Phase III stipend for a total of $92,000.

Expenditures from EESA Funding

The Education for Economic Security Act (EESA) (P.L. 98-377, Title II) has provided the math department with federal funding since September of 1986. Expenditures from EESA funds since 1992-93 are as follows:

1993-94 $48,940. High school mathematics was the principal focus. A team of high school mathematics teachers and the Mathematics Supervisor presented 29 two hour after school workshops in the period from September 28 to April 21. Additional sessions were presented during Fall Conference, Martin Luther King Day, and March In-Service Day. Course offerings were in response to a needs assessment completed by district high school math teachers. Technology was a principal emphasis. The reaction of the attendees was very positive. Sixty-one percent of the high school math teachers participated to some extent. Participants received staff development credit and materials of their choice. Ten after school workshops featuring the NCTM Addenda booklets for elementary teachers were held in March and April. Leaders were classroom teachers at each grade level. Participants received grade level Addenda booklets and materials to implement the teaching suggestions.

1994-95 $49,595. The focus of math staff development efforts during this school year was on-going in-service sessions in integrating math, language arts, and reading for elementary teachers in grades K-5. Forty-six half day workshops for grade level teachers were delivered by the Reading/Language Arts and Mathematics Supervisors in the first semester. After a moratorium on substitute teachers, ten optional (but paid) workshops were held after school. The last ten workshops featured activities from textbook submissions under consideration by the Mathematics Curricular Adoption Committee. When the workshops were held during the school day, attendance was better than 95% of the potential attendees. When the workshops were held after the school day, attendance was approximately 60%.

1995-96 $55,040. New curricular materials in grades 1-8 necessitated massive in-service efforts. In the period from May, 1995, until September, 1996, the following activities were implemented: 1) grade level June or August workshops for 710 participants (counts include duplicates for special education and Title I teachers) in 1995, 2) Phase III fifteen hour June or August workshops for 391 participants in 1996, 3) each teacher in grades 1-8 received curriculum guides including optional lesson plans with materials and activities, 4) each teacher in grades 1-6 received COLLAGE materials kits with printed resources, manipulatives, string, Post-its, beans etc., 5) Thirty-four grade level after school support sessions were held, 6) a Mathematics Lead Teacher from each elementary attended six half day information workshops and subsequently shared this information with the rest of the staff in their respective buildings, 7) two temporary math consultants and the Mathematics Supervisor taught demonstration lessons in over 30 classroom, 8) the Board

and Community Relations department taped and transmitted half hour cable programs for each unit/module in grades 1-6, 8) these programs were compiled for grade level videos given to new teachers in 1996-97 and available for purchase or loan by buildings, and 9) demonstration classrooms for mathematics and science were established in grades 1-5 and visited by 45 district teachers. Although Phase III moneys provided stipends to teachers, Eisenhower moneys funded the materials and tapings.

1996-97 $61,601. This year's Eisenhower funding will support workshops for Pre-Calculus and Calculus teachers and two Marilyn Burns Math Solutions Workshops. The Pre-Calculus and Calculus workshops will lead potential teachers of these courses through the curricular materials to be implemented in the Fall of 1997. The Math Solutions Workshops are designed to help teachers increase their problem solving skills and skills in teaching problem solving.

Instructional Materials

Curricular Materials in Use

Course title	Text	Copyright	Use Period	Total Cost
Primary Math	HBJ's *AnyTime Math*	1995	95-03	128,615
Grades 3-6	*Houghton Mifflin Mathematics*	1995	95-03	352,708
Grades 1-5	D.C. Heath's *Everyday Counts*	1994	95-03	52,387
Grades 7-8	Prentice Hall's *Middle Grades Mathematics: An Interactive Approach*	1995	95-03	130,837
Pre-Algebra	Prentice Hall's *Pre-Algebra*	1992	92-00	38,110
Introductory Math	Addison Wesley's *Essentials of Mathematics*	1992	92-00	31,426
Algebra I - 2 yr.	*Addison-Wesley Algebra*	1990	90-99	55,560
Algebra I	*Addison-Wesley Algebra*	1990	90-99	54,727
Geometry	*UCSMP Geometry*	1993	94-02	52,696
Algebra II	D.C. Heath's *Algebra 2*	1993	94-02	45,973
Pre-Calculus	West Publishing's *Pre calculus with Unit Circle Trigonometry*	1990	91-97	17,765
Calculus	D.C. Heath's *The Calculus with Analytical Geometry*	1990	91-97	10,790
AP Statistics	W.H. Freeman's *Introduction to the Practice of Statistics*	1993	96-04	2,568

Consumer/Career Mathematics	Holt's *Practical Mathematics* and HBJ's *Consumer Mathematics*	1988	90-98	6,778
			Total	**$980,940**

Manipulatives in Use

Manipulative kits are available in grades K-6 through the textbook adoption budget. They include many items. The principal materials are connecting cubes, Attrilinks (materials for logical classification and geometry), Pattern Blocks, balances, color tiles, geoboards, measurement materials, base 10 blocks, fraction circles, and protractors. As of the 1992-93 school year each middle school has school sets of instructional materials for decimals, fractions, geometry, measurement, and other math topics. The total budget for these materials was $6,000 and its source was EESA funding.

Average Student Time Allotments for Math*

Grades	Minutes per week
K	100
1-2	200
3-5	225
6-8	215
9-12	250

* Elementary time allotments are being studied during the 1996-97 school year.

Human Resource Costs

Mathematics Supervisor (1.0 FTE)	$58,858	
Mathematics Secretary (.5 FTE)	$9,490	
Secondary Teachers (108.21 FTE)	$3,746,663	*
Elementary Teachers (563 FTE)	$2,144,264	**
Total	$5,959,275	**

* Based on the average teacher salary ($34,624)

** Based on the average teacher salary ($34,624) and the percent of the elementary day of allotted time for math instruction (11%).

PROCESS EVALUATION

Current Year Goals/Objectives in Math

National Goal

Mathematics figures prominently in a national educational goal for the year 2000. "By the year 2000, United States students will be first in the world in science and mathematics achievement."

The accompanying objectives for that goal are the following:

- "Math and science education will be strengthened throughout the system, especially in the early grades.
- The number of teachers with a substantial background in science and mathematics will increase by fifty percent.
- The number of United States undergraduate and graduate students, especially women and minorities, who complete degrees in mathematics, science, and engineering will increase significantly."

District Goals

For the 1996-97 school year the District Improvement Plan goals that directly involve math are the following: 1. "By the opening of the 1999-2000 school year, 80% of elementary, middle and high school students will achieve at least 70% mastery on all district criterion referenced assessments in the areas of reading, mathematics, language arts, social sciences, sciences, foreign language, and vocational subjects"; 3. "By 1999, the district will develop comprehensive, community-wide school-to-work initiatives to prepare all students to enter and succeed in the changing workplace;" and 8. "By the year 2005, the district's plan for technology will be implemented to provide a system of support for teaching and learning and management services."

Mathematics Department Goals

The 1996-97 math department goals are the following:

1) Decrease mechanization and increase independent reasoning in mathematics teaching and learning by:
   a. analyzing instruction during observations.
   b. stressing a "thinking approach" in all staff development/in-service sessions.
2) Promote methods for increasing the success of minorities and females in middle and high school mathematics through:
   a. supporting the ISU science/math minority mentor program.
   b. continuing the implementation of algebra enrichment for minorities and females summer school.
   c. stressing the provisions for differing learning styles in adopted materials.
   d. providing strategies for decreasing math failures in middle and high school math classes.
3) Assist elementary and secondary buildings that have specifically named mathematics and the buildings that have named general achievement gains in building objectives by:
   a. assisting with the implementation of building action plans
   b. conducting in-service sessions, particularly on test analyses and computer courseware.
4) Review tests and assessment of student achievement and accountability systems by:

a. finalizing end of the year criterion referenced assessments.
b. piloting a performance assessment for in-coming second graders for Title I selection.
c. analyzing assessment results.

5) Support staff and students in math education by:
   a. being visible in buildings and accessible by phone to requests from staff, parents, and students.
   b. providing in-service meetings as needed.
   c. developing staff development classes on the use of technology in Pre-Calculus and Calculus.

1996-97 Staff Development / In-Service Objectives for Mathematics

In addition to the math department's objectives, there are specific staff development objectives for mathematics. They are the following:

1) To help math teachers of grades 1-6 become more comfortable with new math curriculum
2) To identify classroom/materials management techniques for the new mathematics curricular materials for grades 1-6
3) To identify the structure for key lessons in the new math program for grades 1-6
4) To demonstrate an understanding of the assessment options for the new math program for grades 1-6
5) To expand use of the supplementary options (Every Day Counts calendar, MathKeys software)
6) To develop strategies for helping parents/guardians support their children's growth in mathematics
7) To prepare Pre-Calculus and Calculus teachers to teach new curricular materials using graphing calculators

1996-1997 Staff Development/In-Service Supporting Activities

1. Teachers in grades 1-6 will attend a fifteen contact hour summer workshop for their grade level.
2. Half hour video tapes for each unit/module will be revised and ready for teachers to use on an on-going basis.
3. Math Lead Teachers will attend four half day meetings and a Fall Conference session in order to help other teachers in their buildings with test analyses, helping parents, software, and alternative assessment.
4. Summer workshops for Pre-Calculus and Calculus teachers will be developed an implemented.
5. Math Solutions workshops for teachers in grades K-8 will be offered in the district.

In-Service / Staff Development

In-service and staff development are integral to the responsibility of the Mathematics Supervisor. The distinction between staff development and in-service is that staff development is outside of the contract school day/year, is usually in increments of 15 contact hours, and teachers receive staff development credit for advancement on the salary schedule. In-service is during the contract day/year, can be any length of time, and teachers do not advance on the salary schedule.

In- Service Activities

In an effort to attain mathematics program goals, resources have been used to fund staff district in-service activities. For example, in the period from September, 1994, until September, 1996, the following activities were implemented:

1) During the first semester of the 1994-95 school year, forty-six half day workshops for grade level elementary teachers were presented by the Reading/Language Arts and

Mathematics Supervisors. After a moratorium on substitute teachers, ten optional (but paid) workshops were held after school in the second semester. The last ten workshops featured activities from textbook submissions under consideration by the Mathematics Curricular Adoption Committee.

2) In-Service for the new curricular materials were focused on the first unit/module through grade level June or August (1995) one day workshops for 710 participants. (Counts include duplicates for special education and Title I teachers.)
3) Thirty-four grade level after school support sessions were held during the first year of implementation of the new curricular materials for grades 1-6.
4) A Mathematics Lead Teacher from each elementary attended six half day information workshops during the same implementation year and subsequently shared this information with the rest of the staff in their respective buildings.
5) The Board and Community Relations department taped and transmitted half hour cable programs for each unit/module in grades 1-6.
6) These programs were compiled for grade level videos given to new teachers in 1996-97 and available for purchase or loan by buildings.
7) Demonstration classrooms for mathematics and science were established in grades 1-5 and visited by 45 district teachers in 1995-96 and are available for visits in 1996-97.
8) Demonstration classrooms have been expanded to middle school grades for 1996-97.
9) Mathematics Lead Teachers will meet four half days in the 1996-97 school year;.
10) Each year the Reading/Language Arts, Social Science, Science, and Math Supervisors conduct a curriculum in-service for new teachers during Fall Conference.
11) Also during Fall Conference the Mathematics Supervisor led teachers through analyses of results from end of the year criterion referenced tests.
12) In-service sessions for technology demonstration sites (Meredith and Hoyt) on Math Keys and Interactive Math Software were held in December, 1996

In addition to district in-service activities many buildings request on-site in-services. For example, Math ITBS analysis for Garton, January, 1995, and Lucas, March, 1994; Differentiating Curriculum for Jackson, May, 1993, and Studebaker, April, 1993; Problem Solving for King, April, 1994, Moulton, August, 1994, Stowe, January, 1994, Longfellow, February, 1994, Mann, February, 1994, and Lucas, October and November, 1993; New Curriculum Trends for Lovejoy, April, 1994 and Merrill, April, 1993; Teaching the Basic Facts for Stowe, October, 1996; Howe, November, 1996, Granger, November 1996; and Brooks and Lovejoy, December, 1996: and Criterion Referenced Test Analysis for Studebaker, October, 1996 and Granger, November, 1996; Math Keys for Findley, Lucas and Lovejoy, fall of 1996.

Staff Development Courses since 1992-93

1) In 1993-94 high school mathematics was the principal focus. A team of high school mathematics teachers and the Mathematics Supervisor presented 29 two hour after school workshops in the period from September 28 to April 21. Teachers could combine workshops to total 15 hours and receive one hour of staff development credit for every 15 hours. Course offerings were in response to a needs assessment completed by district high school math teachers. Technology was a principal emphasis. The reaction of the attendees was very positive. Sixty-one percent of the high school math teachers participated to some extent.
2) Phase III fifteen hour June or August (1996) workshops for 391 participants provided teachers in grades 1-6 with the opportunity to revisit the new math curricular materials, learn about additional resources, and share with each other about what worked and what did not. Participants were overwhelmingly enthusiastic, voiced and increased confidence level and have reported that their students this year are better prepared.
3) Each summer primary teachers attend a two credit workshop, "Developmental Activities Program" (DAP) where attendance averages thirty teachers.
4) During the summer of 1997 two Marilyn Burns Math Solutions Workshops will include staff development credit.

5) Summer workshops for Pre-Calculus and Calculus teachers will be held during the summer of 1997.

Professional Meetings Attended by Staff

Each year there are two state meetings attended heavily by district math staff. They are the UNI Fall Math Conference in September and the Iowa Council of Teachers of Mathematics Conference in February. Through Eisenhower funding math teachers also attend regional and national math conferences sponsored by the National Council of Teachers of Mathematics. Attendance at regionals varies, but attendance at nationals averages 25 teachers for each conference.

Instructional Methods

Instructional methods in mathematics were described extensively in the prior mathematics program evaluation. A noteworthy addition is the promotion of cross curricular integration. For example, the NCTM Standards of communication (through written and oral descriptions of thought processes) and connections (between math and science and math and art, etc.) figure prominently in recent curricular revisions. The integration of instructional courseware is also being emphasized, particularly in the technology demonstration sites of Wright, Lucas, Findley, Lovejoy, Hoyt, and Meredith.

Management Systems

From 1990 until 1995 the district used a computerized management system for mathematics and reading in grades 2-5. The management system (IMS Plus) was designed to help educators plan and assess instruction and learning. It provided a system for keeping track of both demographic data and individual student progress in meeting prescribed objectives. Students took multiple choice tests. These tests were scanned into the computer. From the scanned data a large variety of reports were generated. The vendor discontinued support for this system in 1995, but the district has purchased an update, Abacus, which will be used in mathematics.

Computer Aided Instruction

Computers are used in math instruction at all grade levels. At the elementary level, the courseware is entitled *MathKeys*. The courseware consists of a series of utility packages which support the adopted curricular materials. Demonstration schools use the software at a teaching station which includes a large group display device (either a large screen television or and LCD- liquid crystal display). As the teacher or student demonstrates using the computer, children respond orally, through hand signals, manipulatives, or in writing. The computer has a number of advantages: the pictorial stage is part of the transition from the concrete to the abstract and the computer also permits movement of the pictures, the variety of models available and these models can change color; objects removed in subtraction leave a ghost image; creating models on the computer is quicker than cutting and coloring; blackline activities for a subsequent grade level can be provided G/T students who can use them while the class is studying what the G/T student already knows; time consuming probability experiments can be simulated very quickly on the computer; and the teacher doesn't need to work upsides down when demonstrating with manipulatives. As a general rule, work on the computer would follow work with manipulatives.

Middle school demonstration schools will use MECC/ Houghton Mifflin's *Math Keys* and Prentice Hall's *Multimedia Math* courseware to support their curriculum. Although high school geometry teachers use the *Geometric Sketchpad*, high school math teachers prefer the technology of the graphing calculator to the computer since more students have hands on access.

Alternative Assessment

Nationally many educators are questioning multiple choice tests as indicators of student achievement. The mathematics department has instituted several types of alternative assessment. At

the primary level students are identified for Title I Math Lab service on the basis of teacher recommendation and then an oral performance assessment. Teacher questions and prompts are standardized. Criterion referenced tests in grades 3-8, Pre-Algebra, Algebra I, Geometry, and Algebra II all include performance assessments. The Mathematics Department is also interested in pursuing available performance assessments in the ITBS.

Course Revisions

As courses are revised on the district textbook adoption cycle, recommendations from the NCTM Standards are being incorporated. The mathematics curriculum revision and materials adoption committees study these Standards, assessment results, research, teacher surveys, student surveys, and national parent surveys before revising curricula. This process takes two years. Due to the district's adoption cycle, grades 1-8, Pre-Algebra, Pre-Calculus, and Calculus and to a certain extent, Geometry and Algebra II have all been revised to incorporate a higher level of rigor, practical applications, increased problem solving, and enhanced use of technology. Curricular materials in Algebra I are drastically out of date since they were written before national standards were published. This is a problem for us since Algebra I is in the middle of our sequence. Due to budget constraints, Algebra I will not have new curricular materials until 1999. Since Geometry and Algebra II will follow in subsequent years, this will be the appropriate time to examine the integrated core high school mathematics curriculum proposed by NCTM. In this sequence, the content of algebra, geometry, probability, statistics, functions, trigonometry, discrete mathematics, etc. would be integrated and separate courses for Algebra I, Geometry, Algebra II etc. would not exist. North High School is presently piloting an integrated math program. This is the program that is used in the majority of countries around the world and increasingly in the United States.

Math Competitions

At the same time that efforts are made to assure the success of all students, district students with the most mathematics aptitude are challenged to excel to higher and higher levels. Des Moines math students participate in a number of mathematics competitions. These include the following: 1) Math Olympiad at the elementary level; 2) Math Counts, the state Math Bee, and the American Junior High School Mathematics Exam at the middle school level; and 3) Wartburg Math Field Day, 4) UNI Math Scholarship Competition, 5) the American Scholastic Mathematics Exam, and the American High School Mathematics Exam at the high school level. A district Math Counts competition was initiated in 1990-91 and has continued since then. All of these competitions reflect national math standards.

PRODUCT EVALUATION

Mathematics has contributed to the district mission statement in a number of ways. End of the year criterion referenced tests are disaggregated by minority/non-minority, male/female, and free and reduced lunch designations. Enrollment in math courses is analyzed by gender and racial composition. Special programs are initiated for underrepresented and underachieving populations. The quality of math instruction for all students is constantly scrutinized. Student achievement in mathematics is monitored for improvement. National recommendations and standards to increase the effectiveness of mathematics teaching and learning are implemented. Courses are revised to make them more accessible to a wider audience of students.

Strengths and Deficiencies

As with most things, the greatest strength and the greatest weakness involve people. The greatest strength of the math program is a solid core of creative, dedicated math teachers. With limited planning time, teachers meet diverse needs with intense caring. Many teachers purchase or make their own instructional materials, they carry armloads of work home with them every night, they agonize when students have personal problems they cannot help solve, they are constantly modifying lesson plans to maximize student learning, and they overcome the frustration they feel when students do not work up to their potential, complete their homework, or retake tests when given the opportunity and celebrate the successes of students who do so. Of special note are the Mathematics Lead Teachers, a representative of each elementary school. These teachers meet approximately once a month with the Mathematics Supervisor. Many Math Lead Teachers, by their own initiative, have gone beyond the initial intent of acting as an in-house resource. They have led team planning sessions, held after school family nights, taught demonstration lessons, inventoried resources, etc. They also distribute math resources from the Mathematics Supervisor, promote math and get others excited about teaching it, act as an in-house resource for math, lead grade level team planning sessions during collaboration time, coordinate teacher needs, analyze math test data (under the direction of the Mathematics Supervisor), set up in-house in-service sessions in math, and, in general, are advocates for math.

Other strengths of the math program are talented math students who are able to accelerate their math instruction one or more grades, struggling students who work hard at grade level and ultimately make sense out of something abstract, and average students who keep up with the ever changing demands of society. Also contributing are Title I Math Lab assistance for students who need more time to learn math; improving test scores; recently adopted textbooks and other instructional materials; classroom sets of manipulatives in grades 1-8; and an increasing number of calculators and computers at all levels. Enrollment in middle and high school elective math courses, particularly Pre-Calculus and Calculus is improving. National standards are well defined and supported by federal funding for staff development in math (and science).

Deficiencies in the math program are the prevalent math anxiety of Americans including some teachers and many parents; the limited math background of some K-8 math teachers; outmoded instructional techniques of some; the limited staff development time during the teachers work contract and consultant support for teachers. The most critical deficiency in math instruction is the lack of time to teach math. Most teachers say that the elementary daily time allotment of 45 minutes in grade 3-5 is not sufficient. Field trips, assemblies, music lessons and other interruptions cut this minimal time. Many students who need more time to learn math do not receive extra time. Title I Math Lab students used to all be served with additional time. Because Title I service now includes in class assistance during the math class, fewer and fewer students now receive additional time. This is in spite of the results which favor additional time delivery modes. (See appendix A). Middle school time allotments are even less than 45 minutes daily. At the middle school level, initiatives in teaming, have led to under qualified teachers teaching math and to time taken away from the adopted curriculum for special projects where many times the math component is reduced

to lower level skills such as counting. All of these initiatives and interruptions benefit children in many ways, but if overall student instructional time were increased, a daily protected math class of one hour would be very beneficial to their math background. Middle school math teachers have no leverage for students who refuse to do the work, if parents can't help. Even if students fail, they are usually passed on. The quality of instruction and student engagement in many classrooms can be improved. Mandatory staff development, peer coaching, and teacher collaboration in teaching math would help many math phobic teachers and increase the instructional strategies of those who drone on in lecture without making sure that students are learning or even attentive.

These deficiencies also contribute to underrepresented populations in advanced math courses, to inequity of achievement between minority and non-minority populations, and to poor achievement in high school math courses. Technology in math is inadequate, including the lack of computer demonstration setups and graphing calculators. Poor homework completion rates of too many students lead to prevalent D and no-pass grades in high school math courses. And finally, unfavorable comparisons on international tests between students in the U.S. and other countries are prevalent and affect attitudes.

As can be seen strengths and weaknesses are two-sided coins. People are the greatest strength and the greatest weakness.

Standardized Test Results

Standardized tests used extensively in the district are the Iowa Tests of Basic Skills (ITBS), Iowa Test of Educational Development (ITED), and American College Tests (ACT).

ITBS/ITED

Table 1 shows ITBS results since the last test revision.

Table 1
Iowa Tests of Basic Skills
National Percentile Ranks
Student Norms

	1993-94	1994-95	1995-96
Grade 3	61	60	58
Grade 4	62	60	62
Grade 6	59	54	58
Grade 7	60	57	58

In order to show the progress of students, this table needs to be read on the diagonal (Table 2).

Table 2

Iowa Tests of Basic Skills
National Percentile Ranks
Student Norms

1993-94	1994-95	1995-96
Grade 3 - 61	Grade 4 - 60	
	Grade 3 - 60	Grade 4 - 62
Grade 6 - 59	Grade 7 - 57	
	Grade 6 - 54	Grade 7 - 58

As can be observed in Table 2, ITBS test results went down in the period from 1993-94 to 1994-95, but back up in the period from 1994-95 to 1995-96.

Table 3
Iowa Tests of Educational Development
National Percentile Ranks
Student Norms

	1993-94	1994-95	1995-96
Grade 10	69	72	67

In the opinion of the Mathematics Supervisor there are several reasons for this fluctuation. They are the following:

1) Students with deficiencies are receiving less assistance (in the way of additional time for learning) through Title I Math Lab.
2) New curricular materials heightened the attention and the time that elementary teachers gave to mathematics - both in planning and instruction.
3) New curricular materials are a better match with national standardized test revisions.
4) The homework study habits of middle school and high school math students are not improving.
5) More teachers without a math major or minor are teaching mathematics at the middle school level.

The Mathematics Supervisor has compared district objectives with ITBS items. A list was compiled of the test items which test the objectives that should have been taught by the year and month of testing in the district. Based on that list, there is a 73% match of objectives and items at third grade, a 78% match at fourth grade, a 89% match at sixth grade, and 89% match at seventh grade. The list is available from the Mathematics Supervisor. This appears to be a comfortable match considering that the ITBS test developers try to have about one third of the items below grade level, one third on grade level, and one third above grade level. This is also an improvement from the cross referencing done with our previous objectives. For 1996, our students scored well on the mathematics sections compared to the Core Total. (See Appendices C and D). More improvement is a goal. This comparison has not been done for the ITED due to the fact that students at the high school level are taking a variety of different math courses.

When ITBS Mathematics Total Scores are disaggregated to show the percent of students scoring at or above the 50th percentile, which would indicate average grade level ability, (see Appendices C and D), a number of observations can be made:

1) Although more females than males score at or above the 50th percentile on the Core Total of ITBS in grades 3, 4, 6, and 7, this is not the case in mathematics where a higher percentage of males than females score at or above the 50th percentile.

2) A greater percentage of non-minority students (62.6) on the Grade 3 Math Total, score at or above the 50th percentile than minority students (40.0). This pattern is repeated throughout all the grades tested. See the following table.

1995-96 ITBS Results: District Math Totals

Grade	%≥P50 - All Students	%≥P50 - Females	%≥P50 - Males	%≥P50 - Non-minority	%≥P50 - Minority
Grade 3	57.6	57.0	58.2	62.6	40.0
Grade 4	60.5	58.3	62.7	66.0	40.3
Grade 6	58.2	55.3	61.6	63.4	39.8
Grade 7	58.5	56.5	60.7	63.8	38.9

This has direct implications for the district mission statement and indicates that additional effort needs to be given to address this discrepancy.

American College Tests

Below is an update on the average scores of Des Moines students taking the ACT. In the 1996 graduating class, 853 students completed the ACT assessment. The average score for mathematics was 20.4 out of 36. This compares favorably to the national average of 20.2, but is a decrease since the last program evaluation and shows a gradual decline since 1993-94. It should be noted that more of our students are taking the ACT, however.

School Year	Number of Students	Math Score
1993-94	779	20.6
1994-95	859	20.5
1995-96	853	20.4

There is a consistent difference in the male and female performance on the ACT. For example, for the graduating class of 1996, the mean math score for males was 21.6 and for females 19.5. Although this difference is also evident nationally, it is an area of concern locally.

Advanced Placement Calculus Test Results for AB and BC Levels

Each year virtually all eligible Central Campus students have taken the AP examinations and in every case have scored well above the national average for each year. Averages (on a scale of one to five) are shown in the following table.

Advanced Placement Calculus Score Comparisons (Central Campus to National Averages)

Year	AB - Central Academy Ave.	AB National Ave.	No. of Students	BC Central Academy Ave.	BC National Ave.	No. of Students
1993	3.62	3.54	32	3.80	3.64	10
1994	3.74	3.10	27	3.64	3.49	17
1995	3.26	3.10	35	3.47	3.49	15
1996	3.20	2.88	45	3.79	3.76	19

As more and more Central Academy students take the AP tests, it is probable that our average will be closer to the national average since a broader spectrum of students are represented. Other AP offerings at Central Campus are AP Computer Science and AP Probability and Statistics.

District Criterion Referenced Tests

Criterion referenced tests are of special import to the District Mission Statement because they are tied to the District Improvement Plan, Goal Number 1. Mathematics is not presently on track to meet this goal, particularly at the secondary level. (See Appendix F). The 1996 Curriculum Management Audit stated, "It is apparent that one of the areas requiring the most attention across all grade levels, mathematics is a critical area for the Des Moines Independent Community School District. In almost all instances, minority and low socio-economic students fail to achieve at an acceptable level." It is important to note that this conclusion was based on testing data accumulated before curricular reform initiatives in the Des Moines' schools and is one of the reasons why reform efforts were initiated.

Overall Average Percent Correct

Appendix G shows the overall average percent correct for each mathematics test for 1993-94 and 1994-95. Although results start high in grade 2 (84%), they decline with each successive grade level. It should be noted that at the middle school level, our brightest students start differentiating through the math courses they take. For example, through our Radically Accelerated Mathematics Summer School, most of our most advanced mathematics students at the sixth grade level take Pre-Algebra. A larger percentage of our seventh graders take Pre-Algebra at that grade and by the eighth grade, over half of our students take a more advanced course than eighth grade math. We are working towards everyone taking Pre-Algebra or higher at the eighth grade level. Recent curricular changes in grades 5-7 should better prepare all of our students to be able to do so. Since the weakest and least motivated eighth graders are taking eighth grade math, test results reflect that. The strongest and most motivated students are taking Pre-Algebra and Algebra. Test results reflect that also. This is also the case with high school math courses. Never-the-less these results are of great concern and need an extensive plan - not only a math department plan, but also a district plan, as the Curriculum Management Audit would indicate.

Disaggregation of Test Scores

With the District Improvement Plan in 1995-96 and beyond, reporting of test results has changed. Appendix E reflects this change. Now instead of overall percent correct, results indicate the percent of students scoring at or above 70%. It is dangerous to develop conclusions for many of the tests listed on Appendix E, since over half of the math tests given in 1996 were pilots. The Mathematics Department's philosophy on pilots is that items are piloted, not tests. More items than will be in the final tests are piloted and final formats will change. For example, although Algebra II was given in

1996 at the end of the year, it was written to be administered as two semester tests and will be administered that way in 1996-97. The Geometry tests were re-piloted in 1996, since objectives writers and test writers made significant changes after having taught the course one year. More emphasis was given to space geometry/measurement in the revisions. Grade 2 results are not shown. The test was administered as a consumable which was sampled and scored centrally. Since only 50% of the students results were scored, conclusions were not made by the Department of School Improvement as to the percent of students scoring above the Mastery Metric of 70%.

For the tests where conclusions can be made, Pre-Algebra, Middle School Algebra, Intro. Math, Intro. Algebra, Algebra I, and to a more limited extent Algebra II, the same inequality evident in standardized test results between non-minority and minority is evident and is of the same concern.

Each year the Mathematics Supervisor does test analyses for all criterion referenced tests in mathematics. Each test, each strand, and each item are analyzed. These results (in a printed form - see sample in Appendix H) are shared with district teachers. Recent efforts are being increased to ensure that teachers have the time to compare their individual results (test, strands, and individual items) with district and building results. The Mathematics Supervisor scheduled time during Fall Conference the last two years with secondary math teachers - 1995, High School and 1996, Middle School. Teachers were asked to bring the computerized print outs provided by the Department of School Improvement to a meeting where they were provided a comparison form and shown how to interpret results and use the form. It was interesting and somewhat discouraging to note that many teachers/schools had difficulty locating these print outs. Teachers tend to interpret the results as old news about students they no longer have in class, but they should also interpret the results as an indication of their teaching the prior year. Teachers are encouraged to identify items which are relative strengths and weaknesses and determine whether in their estimation they spent enough time on the objectives which reflect item weaknesses. Perhaps time can be switched from objectives which reflect item strengths. Elementary Math Lead Teachers were also provided in-service training in how to do this same process with their own building staffs, especially during Collaboration Time. Several have done just that and the Mathematics Supervisor also offered to do this in their buildings. Both Studebaker and Granger have taken advantage of this offer. Time, as always, is a critical factor for this analysis.

Survey Results

Senior Survey

The "Senior Survey" of 1996, includes average ratings for math curriculum and instruction. Students were asked to rate several items on a scale of 1 (strongly agree) to 5 (strongly disagree). The results are as follows:

Appropriate classes provide information about careers.	2.4
Classes provide a variety of meaningful learning activities	2.4
Classes use materials that treat students equally regardless of race and sex	1.9
Classes provide for different abilities/learning styles	2.5
Classes provide preparation for further study or training	2.1
Students receive frequent, timely feedback of their progress	2.3
Class sizes are appropriate	2.1

The responses are in the positive range, but providing for different abilities/learning styles is the lowest rating.

Summaries of Observations by Math Supervisor

The 1995-96 school year was a traumatic one for many math teachers in grades 1-8, particularly 1-6 since curricular materials adopted for those grades were quite different and required extensive planning time for the teachers to prepare for teaching. Teachers this year have voiced great relief that teaching the new materials is much easier the second time around and that students are also much better prepared to use the new materials. Most teachers are still in a phase of transition from the teacher as the center of instruction (in lecture mode) to the students as the center (in hands on investigation mode). Many teachers need to grow in their abilities to individualize, examine each

child's thinking, and summarize and clarify after the students do the hands on activities. Teachers also need to use the text as a resource, not the Bible and supplement with other resources when necessary.

A continuing frustration for the math department and math teachers is the lack of return on homework assignments. Teachers report that this is the biggest reason why math grades suffer since the distributed practice contributes to their understanding and retention. Teachers also base part of their grading system on homework completion. This topic was discussed in more depth in the last two program evaluations.

Grade Marks

The grade distribution for high school math courses for the second semester of 1995-96 showed the following percentages of grades for the district.

Math Course	Enrollment	Percentage of Total Grades Received					
		A	B	C	D	NP	Other*
Intro. Math	314	7	11	28	33	15	6
Algebra I - 2 yr.	1037	11	18	28	22	19	2
Consumer/Career	148	9	14	32	28	9	7
Algebra I	804	14	25	27	21	12	0
Geometry	1105	16	24	32	19	8	0
Algebra II	796	20	28	27	20	5	0
Pre-Calculus	421	38	33	21	6	3	0
Calculus	140	36	38	20	4	1	1
Overall	4765	17	23	28	20	11	1

* pass or audit

As can be observed from the prior chart, there are too many students who receive grades of D and no-pass in math classes. Teachers have been engaged in a long term project to improve math grades since the 1988-89 school year when the percentage of students receiving grades below a C was 33%. These total percentages are virtually the same as for the last program evaluation, so we are not making any progress in improving this situation, although more students are taking math courses. Math teachers rely on all students to do their homework assignments consistently, and this is not happening. This emphasizes the challenge mentioned earlier - that of making advanced mathematics more accessible to more students and at the same time raising standards for achievement so that the U.S. is more competitive. We are trying to move toward all students taking Algebra in high school, but the Mathematics Department is concerned about students passing this course, if required. Middle school math grades are of even more concern. For 1995-96, the percentages were the following: A - 5%, B - 20%, C - 30%, D - 27%, and F - 17%. This reemphasizes more than ever why math reform at the lower grades was needed, but it also is an indication that middle school grading, retention, and summer school policies need to be reexamined. Middle school math students figure out very quickly that although middle school is the

only level with a failing grade on the report card, very little happens when failure occurs. The student still moves on.

Student Awards

Teams from the Des Schools Central Academy have placed in the top 10% in the nation each of the past 6 years on the American Scholastic Math Association (ASMA) and the National Mathematics League (NML) exams. Erik Johnson, a Central Academy student from Urbandale ranked 8th in the nation in the National Math League Calculus competition in 1996. In addition, the American Regions Mathematics League (ARML) team from Iowa has a majority of Central Academy students. In 1996, 89 teams from across the nation and world competed. The Iowa team finished eighth place in a very close competition.

Staff Awards

Michael Link, math teacher at Central Campus was selected as the state secondary math Presidential Award (winner) for Excellence in Math and Science Teaching in 1995. Sue Bartlett, Stowe, is presently a pre-liminary finalist at the elementary level for that same award.

Update from the Last Program Evaluation

Two components of an extensive long range plan for mathematics were highlighted due to their immediate affordability. They were the following:

1. "Implement entry level math competency tests for teaching math at the elementary, middle school, and high school levels. These tests could be administered to applicants and to any teacher requesting a transfer to teach at a different level. This program would need minimum funding for printing and administering tests, but would require a commitment from the district." **This has not been done.**

2. "Further adoption of developmentally appropriate math programs. Appropriate programs are being phased in as teacher enthusiasm grows. These staff development efforts in the summer are being partially funded by EESA ($6000) each year." **This has been implemented with the recent primary math adoption.**

Costs Versus Benefits

The resources described in the input section have contributed to the benefits of increasing student achievement as demonstrated on standardized tests, but results of criterion referenced testing are unsatisfactory. More and more students are enrolling in the most advanced mathematics courses, but grades for secondary math students are not improving, nor are the inequities in achievement of females and minorities. Teachers are more aware of national standards and are implementing them in recent curricular adoptions. The Math Lead Teacher project has proved very successful, according to elementary principals who requested that it be continued during the 1996-97 school year. New curricular materials for grades 1-8, although a difficult adjustment for teachers in the first year of implementation, are receiving a much more positive rating from teachers during the 1996-97 school year.

Curriculum Management Audit

A Curriculum Management Audit (CMA) was conducted during the time period December 5-8, 1995, using data collected prior to the 1995-96 school year. Curricular quality control examines the congruence of the written, taught, and tested curriculum. The Mathematics Department does several things to promote the congruence. For example, teachers are provided curriculum guides which key each objective to adopted curricular materials and each page in adopted curricular

materials to district objectives. (See sample pages in Appendix I.) As previously described, each year criterion referenced test analyses are prepared which provide teachers feedback on how well their students perform. (See Appendix H.) Each test item is keyed to a district objective. These analyses are only as useful as teachers have time to compare their own results with district results. The CMA did suggest several things that were not being done and that will be in the future. For example, curriculum guides have not included tested objectives within the actual guide. Although in the test analyses, they were not in the guides. Pre-requisites for each course were not stated in the guides either. Although the High School Uniform Course of Studies Guide includes the pre-requisites, including them with the curriculum guides will be done with future guides. Instructional use of technology also needs to be included with the guides and will be in the future. The Mathematics Department curriculum guides help teachers pace themselves the first time through the curriculum. Although it is difficult to have all the pieces in place for the first year, the additional pieces can be added to a three ring notebook as soon as they are available. For example, teachers are reluctant to write criterion referenced test items reflecting adopted curricular materials until they have used them once. Therefore having the tested items indicated in curriculum guides for the first year is not workable, but this can be added the following year.

Although the CMA expected that objectives would be classified according to Bloom's Taxonomy, higher order thinking skills are prominent in the planning and actual writing of mathematics objectives, but have not been coded on Bloom's Taxonomy. Never-the-less, the CMA (page 33) shows that percentages of mathematics objectives at the synthesis and evaluation levels would seem to be adequate: 22% in elementary, 19% (misprint in the CMA) at middle school and 10% at the high school level. Some mathematics curriculum guides were lauded during the audit (page 37), but in the opinion of the Mathematics Supervisor other mathematics curriculum guides would have received the same rating with minor changes, such as adding course pre-requisites. Two notable exceptions are guides for Pre-Calculus and Calculus which in the past have consisted just of course objectives. These courses are being studied presently for adoption and plans have been made to include curriculum guides. The CMA committee did not have access to advances in mathematics curriculum guides, namely video tapes for each unit/module for grades 1-6. As has been stated earlier, the CMA stated that secondary mathematics students are not meeting district goals with respect to the Mastery Metric. **"It is apparent that one of the areas requiring the most attention across all grade levels, mathematics is a critical area for the Des Moines Independent Community School District. In almost all instances, minority and low socio-economic students fail to achieve at an acceptable level."**

FUTURE PLANNING

Funding for Title II Dwight D. Eisenhower Mathematics and Science Education Act has been increasing every year. Since there is no district math budget, this funding source is indispensable in planning for the future, in acquiring technology and hands on materials, and in familiarizing teachers with their use. This funding source has helped address the needs stated in the last two program evaluations for mathematics. The following plans are in priority order, but not in order of affordability.

Increased Time for Math Instruction/Learning

Although difficult to predict costs, if the overall student instructional time were increased, a daily protected math class of one hour would be very beneficial to their math background. District time on task studies have demonstrated that time on task is directly related to achievement. In order to increase instructional time a restructured school year where intercessions provided times for field trips, an extended school day for students where academic classes were protected, a new class period at the middle school level for interdisciplinary projects, mandatory after school or Saturday classes for students who fall behind with their homework would all help student math achievement.

All children can learn mathematics. They just don't all learn at the same pace. The Des Moines School District must have mechanisms in place which provide children who need it, additional time to learn mathematics. All children should have an hour of uninterrupted math instruction for at least 160 of the 180 school days, but children who are behind should have more - either more minutes each day through Title I assistance or computer assistance or more days each year through a restructured school year with intercessions for academic work or at the very minimum, a restructured, mandatory summer school which would give those who need it a head start on their learning. If the district truly promotes multiage instruction, then all students shouldn't exit the elementary school at the same chronological age. If a ten or eleven year old needs to work at the third grade level and does, then simply sending him/her on to middle school the next year just passes on the problem. By the same token, an elementary student who needs to work at the middle school level should be able to do so. This happens in mathematics with the assistance of the Gifted and Talented Department.

Math Background for Middle School Math Teachers

The Mathematics Supervisor will continue to lobby for adequate preparation in mathematics for everyone teaching at least one class of mathematics in middle schools. The costs would be negligible, but would require the commitment of the middle school principals who have placed a higher priority on scheduling for teaming.

Achievement of Females and Minorities

The math staff will continue to strive for increasing success for females and minorities in higher level mathematics courses. A publication of the U. S. Department of Education, **What Schools Can Do to Improve Math & Science Achievement by Minority & Female Students** recommends several strategies involving: teacher interplay, alternative techniques, making instruction relevant, ensuring cooperation and encouragement, equal access to computers, examination of curricular materials, linking to practical applications, career days, involving parents etc. Many are already being done in most classrooms, but several will be included in future planning for the Mathematics Department and are cost negligible. They are:

1) Involve students who are not participating in classroom discussions;
2) Monitor achievement of all students, including minority and female students, on a daily basis;
3) Communicate belief in the potential of minority and female students in math and science;

4) Make sure instructional strategies are appropriate for all students;
5) Encourage students with language difficulties to verbalize or reword math procedures before undertaking an assignment;
6) Try different methods of instruction;
7) Make math relevant and useful;
8) Construct math word problems that are useful to students;
9) Allow students to select topics in some study units;
10) Provide opportunities for students to work cooperatively;
11) Try "peer teaching";
12) Consider alternative testing methods;
13) Consider activities which stress thought processes rather than exclusive reliance on single answer responses;
14) Encourage activity-based and hands on programs;
15) Assess the amount of time allocated to math instruction;
16) Provide staff development programs on teacher expectations, especially for minority and female students, and their role in student achievement;
17) Provide necessary equipment to assist students;
18) Help parents understand their role in encouraging their children's interest in math.

High School Math Course Revisions

As courses are scheduled for review prior to textbook adoptions, changes called for in the NCTM Standards are incorporated in district curricula. Since the last program evaluation the district has implemented extensive reform in elementary and middle school mathematics and in the most advanced high school mathematics courses, but the first years of the high school math sequence need to be examined extensively. The costs would not exceed the usual curricular material adoption costs.

Technology

In the last two evaluations the need for a district commitment for the implementation of technology was expressed. This would permit math student access to computer and calculators. Through centralized district curricular materials funds and EESA funds, calculators have been purchased, but more are needed and computer access for students/teachers is still very limited. State technology funding and funding from 2005 should help alleviate this lack of technology.

Homework Habits and Assistance

Middle school math teachers complain about the need for consequences for lack of homework completion for middle school students. Consequences for lack of homework completion would vary from the cost of Saturday class teacher salaries to subsidized summer school for students. The Mathematics Supervisor will collaborate with Mr. Willie Heggins, Educational Services Coordinator of Children and Families of Iowa to establish and support after school tutoring programs in all middle schools and some elementary schools. Children and Families of Iowa grants will cover the costs involved.

School-to-Work

Goal number 3 of the District's Improvement Plan calls for developing "comprehensive, community-wide school-to-work initiatives to prepare all students to enter and succeed in the changing workplace." The Mathematics program is helping and will be helping to meet this goal in a number of ways. Recent curricular adoptions in mathematics are designed to increase the perception of relevance of mathematics to students' present and future lives, to develop their flexibility of thinking, to help student learn how to learn by making instruction more student centered rather than teacher centered, to help students learn how to work and contribute in groups, and how to communicate orally and in writing about mathematics. The Mathematics Department will be continuing to work with Ray Klein, Private Sector/Apprenticeship Coordinator, New

Horizons Program, and members of the local construction industry to develop and implement a two-semester course to provide students introductory hands-on knowledge of the commercial construction industry as well as the math skills necessary to successfully begin an apprenticeship in the construction industry.

ITBS Performance Assessment

The Iowa Tests of Basic Skills organization has developed performance assessments for mathematics which parallel the new adopted curricular materials in mathematics and reflect national trends in assessment. Although costly to contract for their scoring, they would provide a picture of student knowledge that is presently missing. In order to sample 1000 students at each of grades 3, 4, 6, and 7, the cost estimate for ITBS performance assessment implementation, including scoring by ITBS trained personnel would be approximately $27,000.

Appendix A

Title I Delivery Modes

1995-96 Math Objective Based Average Percent Correct by Delivery Code

	Count of Students	Average Percent Correct
Delivery Code: BA	2	52%
Delivery Code: IC	316	56%
Delivery Code: IP	7	51%
Delivery Code: PO	547	59%
Delivery Code: SW	386	57%

BA -- before and after

IC -- in class

IP -- in class pull out

PO -- pull out

SW -- school wide

Appendix B

The Iowa Tests of Educational Development (ITED)

The 1994 school year was the first assessment using a revised form of the ITED. The entire battery includes tests in the areas of vocabulary, content area reading, correctness and appropriateness of expression, quantitative thinking, interpretation of literary materials, analysis of social studies materials, analysis of science materials, and use of sources of information. Scores of 483 district 10th grade students who took the ITED in 1996 are shown in Table 3, along with scores from the 1993 and 1994 assessments.

ITED Mean Percentile Scores by Subtest
National Student Norms

Subtest	Average Percentile Score		
	1993-94	1994-95	1995-96
Vocabulary	67	67	64
Content area Reading	65	75	67
Reading Total	67	70	68
Expression	65	68	64
Quantitative Thinking	69	72	67
Core total	69	73	68
Literary Materials	66	66	66
Social Studies	71	71	68
Science	72	75	72
Sources of Information	70	69	64
Composite	71	72	68

1995-1996 ITBS Results: District

School	Grade & Subtest	% ≥ P50 All Students	% ≥ P50 Females	% ≥ P50 Males	% ≥ P50 Non Minority	% ≥ P50 Minority	N Tested All Students	N Tested Females	N Tested Males	N Tested Non Minority	N Tested Minority
District	Grade 3 Core Total	51.9	54.5	49.2	57.3	32.7	1985	1015	970	1548	437
District	Grade 3 Language Total	52.9	58.4	47.1	56.2	41.2	2031	1038	993	1579	452
District	Grade 3 Math Total	57.6	57.0	58.2	62.6	40.0	2010	1026	984	1567	443
District	Grade 3 Reading Total	52.6	54.0	51.2	58.7	31.6	2033	1040	993	1580	453
District	Grade 3 Sources of Information Total	57.8	59.9	55.5	62.3	41.8	2015	1028	987	1568	447
District	Grade 4 Core Total	56.9	57.9	55.9	62.0	38.2	2136	1070	1062	1678	458
District	Grade 4 Language Total	55.9	61.1	50.8	59.7	42.3	2154	1081	1069	1688	466
District	Grade 4 Math Total	60.5	58.3	62.7	66.0	40.3	2150	1078	1068	1688	462
District	Grade 4 Reading Total	54.5	54.8	54.3	60.0	34.8	2158	1084	1070	1689	469
District	Grade 4 Sources of Information Total	58.2	56.6	59.9	63.0	40.7	2152	1083	1065	1688	464

1995-1996 ITBS Results: District

School	Grade & Subtest	% ≥ P50 All Students	% ≥ P50 Females	% ≥ P50 Males	% ≥ P50 Non Minority	% ≥ P50 Minority	N Tested All Students	N Tested Females	N Tested Males	N Tested Non Minority	N Tested Minority
District	Grade 6 Core Total	55.6	55.8	55.5	60.8	37.1	1816	952	863	1422	394
District	Grade 6 Language Total	55.1	59.3	50.5	59.7	38.8	1853	974	878	1443	410
District	Grade 6 Math Total	58.2	55.3	61.6	63.4	39.8	1844	966	877	1439	405
District	Grade 6 Reading Total	54.5	51.7	57.8	60.8	32.4	1861	977	883	1451	410
District	Grade 6 Sources of Information Total	55.9	54.9	57.1	60.9	38.3	1825	956	868	1428	397
District	Grade 7 Core Total	56.2	56.9	55.4	61.5	35.8	1804	942	861	1430	374
District	Grade 7 Language Total	57.3	62.3	51.8	61.8	40.2	1827	950	876	1446	381
District	Grade 7 Math Total	58.5	56.5	60.7	63.8	38.9	1828	954	873	1440	388
District	Grade 7 Reading Total	55.6	55.2	56.1	61.6	33.2	1837	957	879	1449	388
District	Grade 7 Sources of Information Total	55.9	56.0	55.7	60.9	36.0	1801	936	864	1434	367

1995-1996 Criterion Referenced Test Results: District Mathematics Courses

School	Course	% ≥ 70% All Students	% ≥ 70% Females	% ≥ 70% Males	% ≥ 70% Non Minority	% ≥ 70% Minority	N Tested All Students	N Tested Females	N Tested Males	N Tested Non Minority	N Tested Minority
	ELEMENTARY										
District	Math 3 Pilot	59.9	60.3	59.6	63.8	47	2107	1056	1051	1622	485
District	Math 4 Pilot	52.6	52.4	52.9	57.1	36.4	2213	1105	1108	1735	478
District	Math 5 Pilot	41.3	39.6	42.9	45.5	28.2	2134	1060	1074	1613	521
	MIDDLE SCHOOL										
District	Math 6 Pilot	16	14.4	17.7	18.7	6.1	1673	893	780	1310	363
District	Math 7 Pilot	35.7	37.3	34	38.9	24.8	1532	800	732	1185	347
District	Math 8 Pilot	19	17.8	20.4	21.6	10.7	751	398	353	573	178
District	Pre-Algebra, Form 2	63.7	60.5	67.2	66.7	46.4	755	392	363	645	110
District	MS Algebra	68.9	64.3	74.1	67.2	81.4	351	185	166	308	43
District	CC Geometry Pt. 1 (re-pilot)	88.2	100	81.8	88.2	NA	17	6	11	17	0
District	CC Geometry Pt. 2 (re-pilot)	82.4	83.3	81.8	82.4	NA	17	6	11	17	0
	HIGH SCHOOL										
District	Intro Math	15.4	9.3	20.3	21.8	8.5	241	108	133	124	117
District	Intro Algebra	27.6	24.4	30.9	29.1	20.7	163	82	81	134	29
District	Algebra I	29.7	28.4	31.3	32.4	20.9	993	539	454	763	230
District	Geometry Pt. 1 (re-pilot)	43	39.7	47.4	44.8	33.3	881	501	380	746	135
District	Geometry Pt. 2 (re-pilot)	37.4	36.1	39.1	37.8	35.5	917	523	394	776	141
District	Algebra II S1	37.7	39	35.9	38.8	32.1	674	390	284	562	112
District	Algebra II S2	24.9	26.4	22.7	26.3	17.4	704	409	295	589	115

Appendix F

Mathematics

Percent Achieving 70% Mastery

	Elementary		Middle		High	
Year	Target	Actual	Target	Actual	Target	Actual
1992-93	65	72.7	47	35.7	40	42.1
1993-94	65	70.2	50	54.4	40	40.5
1994-95	68	70.3	56	48.9	50	33.0
1995-96	71		62		60	
1996-97	74		68		70	
1997-98	77		74		75	
1998-99	80		80		80	

Appendix G
Criterion Referenced Tests
Overall Percent Correct

1993-1994 **1994-1995**

	All Students		Females		Males		Non-Minority		Minority		Free & Reduced		Non Free & Reduced	
	93-94	94-95	93-94	94-95	93-94	94-95	93-94	94-95	93-94	94-95	93-94	94-95	93-94	94-95
Grade 2	84.1	**84.0**	82.8	**84.0**	85.2	**84.1**	87.2	**87.7**	71.1	**71.5**	74.2	**75.0**	91.7	**92.3**
Grade 3	76.2	**75.2**	78.0	**76.5**	74.6	**74.3**	80.4	**79.3**	61.4	**61.4**	66.3	**64.9**	84	**84.2**
Grade 4	62.4	**60.5**	61.0	**61.6**	63.8	**59.4**	66.4	**65.5**	46.6	**43.7**	47.5	**48.6**	73.0	**70.4**
Grade 5	55.7	**60.1**	54.6	**58.7**	56.9	**61.5**	58.9	**63.8**	43.4	**56.5**	41.8	**44.0**	66.1	**71.6**
Grade 6	*	**58.6**	*	**57.8**	*	**59.3**	*	**63.6**	*	**39.9**	*	**44.1**	*	**68.5**
Grade 7	*	**41.0**	*	**39.9**	*	**42.2**	*	**47.0**	*	**22.1**	*	**29.6**	*	**48.6**
Grade 8	*	**27.8**	*	**22.6**	*	**32.9**	*	**30.4**	*	**20.1**	*	**22.0**	*	**31.9**
Pre-Algebra	54.4	**63.6**	53.3	**61.5**	55.6	**65.9**	56.5	**64.2**	42.5	**59.8**	41.7	**56.0**	57.7	**65.4**
M.S. Algebra	62.6 (Pilot)	**71.8**	63.9	**70.2**	61.4	**73.2**	62.4	**72.1**	64.9	**68.4**	41.0	**60.7**	65.0	**73.1**
Intro Math	17.6	**24.0**	15.2	**17.2**	19.4	**29.6**	22.6	**27.0**	7.6	**17.1**	10.4	**20.9**	22.0	**26.1**
Intro Algebra	42.9	**47.6**	38.4	**48.5**	47.8	**46.8**	42.3	**47.0**	47.1	**52.0**	45.2	**43.3**	42.2	**49.6**
H. S. Algebra	37.3 (Pilot)	**33.7**	39.1	**31.6**	34.8	**36.3**	39.0	**34.6**	29.8	**29.9**	30.9	**30.8**	39.0	**34.4**
Geo-metry	55.8	**38.4** (Pilot)	54.3	**36.1**	57.3	**41.5**	57.5	**39.0**	48.7	**33.6**	52.2		56.4	
Algebra II	30.6	**23.3** (Pilot)	25.5	**20.1**	36.3	**26.8**	32.0	**21.9**	25.2	**28.8**	37.7	**29.8**	29.7	**22.3**

*Curriculum Revisions, no test available.

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Appendix H
Sample Test Analysis

DES MOINES SCHOOLS' OBJECTIVE BASED MATHEMATICS TESTS
Algebra – 1996
70 ITEMS
OVERALL AVERAGE PERCENT CORRECT
75 Middle School and 61 High School

STRAND ANALYSIS

	STRAND NAME	% CORRECT MS	% CORRECT HS	ITEMS BELOW 70%
I	Operations &Their Properties	77	63	8*,9*,10*,11,16*,32, 40*,50*
V	Rationals	63	49	12*,13,46
VI	Equations	86	71	27*,52*,53*, 58*,59
VII	Applications and Prob. Solving	66	49	1*,2,3,4,5,7,61*, 62,63,64*
VIII	Graphing	65	53	34*,35,36,37,39,65, 66*,67,68*,69,70
IX	Systems of Equations	73	59	56,57
X	Polynomials	85	75	19*,21*,22*,42*,54*
XIII	Quadratics	53	34	29,30

*High School, not middle school

Circled Items Are < 70%

Item	Objective	Description	% Correct H.S.	% Correct M.S.
1.	VII-3	Performance item - non-routine problem solving	50	76
2.	VII-4	Performance item - application of percent	43	59
3.	VII-3	Performance item - non-routine problem solving	41	56
4.	VII-4	Performance item - application of percent	42	62
5.	VII-3	Performance item - non-routine problem solving	36	55
6.	VII-2	Performance item - problem solving -linear system	65	87
7.	VII-3	Performance item - non-routine problem solving	23	34
8.	I-2	Order of operations	64	75
9.	I-2	Order of operations	60	71
10.	I-3	Evaluation of open expression	56	77
11.	IV-3	Absolute value	41	60
12.	V-1	Identify rational number	58	78

13.	V-2	Rename decimal as a fraction	54	65
14.	X-4	Add like terms	92	93
15.	X-4	Add like terms	94	96
16.	V-3	Recognize the distributive property	69	82
17.	X-5	Distributive property	93	96
18.	X-5	Distributive property	71	77
19.	X-8	g.c.f.	63	75
20.	X-9	Factor trinomial, lead coefficient =1	77	87
21.	X-11	g.c.f. and difference of squares	62	81
22.	x-9	Factor trinomial, lead coefficient ≠1	64	72
23.	VI-3	Solve one step linear equation	90	93
24.	VI-4	Solve one step linear equation	93	97
25.	VI-5	Solve two step linear equation	76	87
26.	VI-5	Solve two step linear equation with distributive property	77	85
27.	VI-4	Solve one step linear equation	66	87
28.	VI-5	Solve two step linear equation, variable on both sides of the equation.	84	92
29.	XIII-2	Quadratic formula	23	46
30.	XIII-2	Quadratic formula	44	60
31.	I-3	Evaluate open expression	81	91
32.	V-3	Identify commutative property	41	53
33.	X-5	Apply distributive property	91	95
34.	VIII-1	Recognize quadrant	66	73
35.	VIII-8	Identify graph for linear equation	50	62
36.	VIII-8	Identify graph for linear equation	47	55
37.	VIII-9	Identify linear equation for graph	33	45
38.	VIII-9	Identify linear equation given slope and intercept	67	82
39.	VIII-9	Identify linear equation given two points	33	50
40.	XII-1	Simplify radical	69	88
41.	X-5	Product of two binomials	78	90
42.	X-5	Binomial times a trinomial	62	86
43.	X-5	Product of two binomials	83	92
44.	X-6	Trinomial divided by a monomial	71	87
45.	X-6	Binomial divided by a binomial	74	72
46.	XI-4	Simplify algebraic fraction	36	47
47.	III-1	Product of powers of a variable	78	92
48.	X-5	Monomial times a monomial (with exponents)	74	83
49.	III-1	Power of a power	76	81
50.	III-1	Power of a power times a monomial	53	77
51.	VI-1	Word problem - area of a triangle	81	96
52.	VI-6	Apply formula for circumference	57	85
53.	VI-6	Solve for length in rectangle perimeter formula	52	74
54.	X-9	Factor quadratic equation	54	81
55.	IX-2	Solve linear system	76	86
56.	IX-2	Solve linear system	54	69

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APPENDIX I
SAMPLE CURRICULUM GUIDE FORMAT

Grade 4

	OPENING ACTIVITY/ PURPOSE	DEVELOPMENTAL ACTIVITIES	CLOSING ACTIVITY
	Teachers, please read pages T28-29. Before beginning each module, it is a good idea to review the end of module test so that teachers know what will be emphasized in the assessment. (See page 48A.)	**Note the clocks for each activity which estimate the time needed for the activity. Activities labeled "optional" may be skipped if the pacing is slowed. The Math Power logos can be used as sponge activities. (See pages T38-39.)**	**Journals should be used as much as possible. The activities are classified as whole group, (with your class), small group (with your group), paired (with your partner), or individual (on your own). Teachers should stress the importance of looking at the book's photos and illustrations.**	**Math lab teachers may want to use the Alternate Strategies and their respective worksheets and/or the MathKeys software. The "Extra Practice" is recommended for homework practice.**
Day number: 1 Date: Objective: Orientation Pages 1-3	Introduction to book and On-going investigation Page T43	x i v - x v i (optional)	Pages 1-3 Students should cover their books.
Day number: 2 Date: Objective: G2, G3 Pages 4-6	Math Minute p. 4 (Put on chalkboard or overhead as an opener. It is recommended that students write their answers in their student journals.)	Module 1 Lesson 1 Activities 1 and 2 Use rulers or Fraction Tools and colored pencils or crayons.	
Day number: 3 Date: Objective: G2, G3, G4 Page 7	Put Maintenance Math (see enclosed) on chalkboard or overhead as an opener	Activity 3	Extra Practice Page 409 (a)

Grade 4

	OPENING ACTIVITY/ PURPOSE	DEVELOPMENTAL ACTIVITIES	CLOSING ACTIVITY
Day number: 4 Date: Objective: G2, G3 Pages 8-9	Maintenance Math	Activity 4 Use Gameboard 1, 6 counters per player, and dice. Four colored gameboards are provided by Houghton Mifflin. Additional game boards are in COLLAGE kits.	Try It Page 9 Journal Opportunity Page 9 in Teacher's Edition.
Day number: 5 Date: Objective: C2, CN4, G2, G3 Pages 10-13	Math Minute Page 10	Module 1 Lesson 2 Activities 1-3 Use Transparency 13 oaktag, colors, scissors, construction paper, and glue.	Try It Page 13 and/or Extra Practice Page 409 (b)
Day number: 6 Date: Objective: C2, CN3, CN4, G1, P1 Pages 14-17	Math Minute Page 14	Module 1 Lesson 3 Activities 1-2 Use Transparency 14.	Try It Page 17 and/or Extra Practice Page 410 (a)
Day number: 7 Date: Objective: G2, G3, M2 Pages 18-21	Math Minute Page 18	Module 1 Lesson 4 Activities 1-2 Use geoboards and string.	Try It Page 21 and/or Extra Practice Page 410 (b)

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