The Foundation – The Elementary Program

CURRENT STATUS

During the five years M-DCPS has participated in the National Science Foundation's Urban Systemic Initiative (USI) in Mathematics and Science, elementary teachers received massive training in the pedagogy of mathematics and science. As a result of this training, there has been an increase in the planning and instruction of mathematics and science curriculum at the elementary level. However, there still remains a need for elementary teachers to strengthen their content knowledge in order to effectively address the instruction of state and national standards in mathematics and science.

There is statistical evidence of a steady increase in student scores on the Stanford-8 subtest in Science and Mathematics Applications, as well as the FCAT mathematics. While these results are promising, M-DCPS students are still not meeting the very challenging state, national, and international standards.

The elementary school programs in mathematics and science provide the necessary, solid foundation for the educational bridge to careers. As a foundation, students obtain crucial requisite skills as they progress from each grade level, K - 5. Literacy in mathematics requires that M-DCPS students receive instruction in all five mathematics strands at each grade level: Number Sense, Concepts and Operations; Measurement; Geometry and Spatial Sense; Algebraic Thinking; and Data Analysis and Probability. Literacy in science requires instruction at each grade level on all eight strands in science: Nature of Matter; Energy; Force and Motion; Processes That Shape the Earth; Earth and Space; Processes of Life; How Living Things Interact with their Environment; and the Nature of Science.

Of equal importance in building the foundation, M-DCPS students need richer educational experiences at each grade level in which they investigate, question, discuss and verify their work in mathematics and science. Such academic experiences begin with practical inquiry about the world in which the students live and the relationships that mathematics and science explain.

In maintaining the efforts in mathematics and science reform in elementary classrooms through the Urban Systemic Initiative, this District Plan, *Mathematics and Science Literacy – Bridges to Careers,* provides a framework for assistance to elementary schools in sustaining the efforts brought about by the reform.

The following goals represent the most important intended outcomes for the elementary program of this District comprehensive plan. These goals should be achieved over the next three years, and sustained as regular occurrences in subsequent years.

GOALS

1. All elementary school sites will develop and implement a mathematics and science instructional improvement team.

2. All feeder patterns will develop and implement feeder pattern support teams in mathematics and science.

3. All students, including those with special learning needs such as LEP and standard curriculum ESE students in grades K-5, will demonstrate performance consistent with the Florida GLE's in mathematics and science.

4. All students will increase their level of mathematics and science literacy, problem solving ability, and ability to communicate their conceptual knowledge of mathematics and science.

5. All elementary teachers will increase their content knowledge and attain a comfort level with the delivery of the concepts of the five mathematics strands and the eight science strands.

6. Elementary feeder pattern educational specialists will disseminate information to parents within the community regarding how the local, state, national and international standards in mathematics and science have increased. This will provide the information for parents to assist their elementary school students with achieving these standards.

7. After-School Care Programs will include structured academic experiences with mathematics and science concepts.

8. All elementary principals and assistant principals will receive professional development designed to support mathematics and science instruction at their school. This support will assist elementary principals and assistant principals in the promotion of mathematics and science careers, and in the improvement of the quality of programs offered at the school site.

9. Instruction and materials that support career awareness in the areas of mathematics and science should be emphasized through schoolwide programs, such as Career Days, mathematics and science clubs, Science, Engineering, Communication, Mathematics Enhancement (SECME) Programs, Kids and the Power of Work (KAPOW), and Career-Shadowing experiences.

The following activities will provide the structure for the development and implementation of a rigorous and sustainable elementary school program across the district.

ACTION PLAN

1. Elementary feeder pattern educational specialists will be assigned and be responsible for facilitating the mathematics and science instructional improvement team at each respective site.

2. Every elementary school will develop a mathematics and science instructional improvement team consisting of at least one representative from each grade level, in order to implement the *Transformative Learning Model* for professional development.

3. Elementary experts who are recent graduates of the M-DCPS/FSU graduate program for mathematics and science will assist specific elementary schools with subject area content on a regular basis. (e.g., Wednesday afternoons, teacher work days and Saturdays).

4. Eisenhower Resource Teachers and Title I Mathematics Specialists will provide content-rich support to school-site teams.

5. District staff from the Division of USI Mathematics and Science and the feeder pattern educational specialists will assist with the development of individual Professional Development Plans for teachers as required by state statute (Sections 231.085; 231.09; 231.29, F.S.).

6. All elementary teachers in M-DCPS will teach a sixty-minute block of mathematics and a thirty-minute block of science daily, or teachers may combine an integrated mathematics and science content into a ninety-minute block.

7. All elementary teachers will deliver nine lessons on each of the five mathematics strands during each nine-week grading period. This will include a spiral of the strands, with an increased intensity of instruction in each consecutive nine-week cycle.

8. All teachers must incorporate effective teaching strategies for mathematics and science, including *Creating Independence through Student-owned Strategies* (CRISS) for mathematics and science and the Reciprocal Teaching Model. These strategies are found in the Science and Mathematics Integrated with Learning Experiences (SMILE) workshops provided by the Eisenhower Professional Development staff.

9. Teachers will utilize the district-produced pretests and posttests and additional assessment instruments to assess student learning and attainment of the Florida GLE's.

10. All elementary science teachers will utilize kit-based instruction wherever possible. FOSS and Science and Technology for Children (STC) kits provide extensive use of hands-on, inquiry-based science.

11. A research-based mathematics program with a proven record of success in urban districts will be explored for use in elementary schools. Everyday Mathematics is a NSF-endorsed program suitable for implementation. Project MIND, a pilot mathematics project, will be utilized in several schools to enhance foundation skills in mathematics. Annenberg funding will be available for this project. *Mathematics in Context (MIC)* will be utilized in Grade 5.

12. All grade four and five science programs will continue to implement SCI-TV.

13. Each school will provide one Family Math/Family Science Night per semester, to inform the community and parents about the instructional practices, curriculum, and assessments that are currently being used in mathematics and science classrooms.

14. Feeder pattern educational specialists will plan and implement community information meetings for every school within the district, to inform parents and the community about the Third International Mathematics and Science Study-Repeat (TIMSS-R) data, and implications to improve student achievement on the FCAT.

15. Elementary teachers will incorporate hands-on SECME engineering/career-type activities in their classrooms, and increase participation in District-sponsored SECME events.

EXPECTED STUDENT OUTCOMES

Elementary Mathematics-Exiting Grade 5

Elementary mathematics should build on children's curiosity and grow naturally from their experiences. Mathematical experiences for children, if appropriately connected to the real world, challenge young children to apply ideas that include quantitative relationships, geometry and spatial sense, number sense and interpretation of data. These experiences will promote conceptual understanding within each strand of the Sunshine State Standards. Understanding mathematical ideas can stimulate and support the acquisition of skills as well as the ability to solve problems.

A. Number Sense, Concepts and Operations

The foundation of literacy in mathematics begins with this strand – the ability to understand numbers and basic operations with numbers. An important goal of mathematics instruction is to develop students' ability to reason intelligently with quantitative information.

Students should be able to:

- Use their knowledge of numbers in flexible ways, in addition to routine, predictable calculations. Estimation should become an integral part of the students' mathematical skills in order to solve a variety of problems.
- Understand numbers and the relationships among the operations of addition, subtraction, multiplication, and division; select appropriate operations; and compute to solve problems.
- Use basic calculator functions as a part of the program beginning with grade 2 or 3.

B. Measurement

Students must develop their understanding of measurement and systems of measurement through experiences which enable them to use a variety of techniques, tools, and units of measurement. These experiences should include both the standard and metric system.

Students should be able to:

- Estimate and measure quantities in the real world.
- Compare, contrast, and convert within systems of measurement (both standard/nonstandard, and metric).
- Connect measurement with geometry and spatial sense (e.g., units of volume), and data analysis (e.g., units of measurement on graphs).
- Develop understanding and explore the study of length, area, and volume in 2 and 3 dimensional shapes.

C. Geometry and Spatial Sense

Students' knowledge of geometry and spatial sense should be developed through the use of rich, hands-on geometric experiences. These experiences will enable students to improve their spatial sense.

Students should be able to:

- Visualize and illustrate ways in which shapes can be combined, subdivided and changed, using their understanding of congruency, similarity and symmetry.
- Use coordinate geometry to locate objects in two dimensions.
- Determine horizontal and vertical distances.
- Develop the concepts of length, perimeter, area, radius, line segments, angles, volume and their interrelationships.

- Develop their communication skills and make connections between geometry and other branches of mathematics as well as other subjects.
- Develop a mathematics vocabulary, similar to the glossary found in *The Florida Curriculum Frameworks for Mathematics.*

D. Algebraic Thinking

Students must experience progressively more complex opportunities to solve problems involving patterns that can be expressed algebraically and which require critical thinking.

Students should be able to:
- Identify patterns in the world around them.
- Create, describe, analyze, and generalize a wide variety of patterns, relations and functions.
- Use expressions, equations, inequalities, graphs and formulas to represent and interpret situations.

E. Data Analysis and Probability

Probability and statistics permeate almost all disciplines and their study allows students to make sense of their experiences in a wide variety of ways.

***Students should be able to*:**
- Collect, organize, and display data sets, using appropriate graphs, (e.g., pictograph, circle graph, single and double bar graph, and line graph).
- Identify patterns and make predictions from an orderly display of data using concepts of probability and statistics.
- Use statistical methods to make inferences and valid arguments about the real world.

Elementary Science-Exiting Grade 5

A significant focus of the elementary science program is to create the foundation for true inquiry. Actual classroom practices must provide students with opportunities to engage in inquiry and to develop the habits of mind that are necessary to engage students in the scientific process. These include: questioning, planning, conducting investigations, thinking critically about the relationships between evidence and explanations, predicting and analyzing alternative explanations.

The use of accurate measurement techniques must be taught at each grade level for students to progress in their capacity to demonstrate measurement and to use tools to illustrate measurement. Effective use of science kits in every classroom extends educational experiences beyond textbook learning and provides students with opportunities to learn by doing science. Inquiry-based activities allow students actual engagement in the science process skills of classifying, communicating, predicting,

modeling, investigating and hypothesizing. The overall science goal of the K-5 foundation is to provide students with an integration of progressively more complex content knowledge within the science strands and practical problem-solving experiences in which scientific principles are effectively applied.

A. The Nature of Matter

Through observation, comparison, and classification, students can learn the basic properties and characteristics of matter and begin to see the role of matter in the everyday world. Substances differ greatly in mass, volume, shape, density, texture, reaction to temperature and light and in many other ways. Most substances exist in different states or phases.

Students should be able to:

- Describe observable and measurable properties of matter, understand concepts of matter, such as occupying space, having mass and the nature of the states of matter:
- Demonstrate how matter undergoes changes both physical and chemical.
- Knows that different materials are made by physically and chemically combining two or more substances.
- Demonstrate the use of metric tools to calculate the density and measure volume.

B. Energy

Energy is an abstract but fundamental concept in science. Learning about energy is essential to understanding changes observed in natural and human-made systems. Nearly all energy on Earth comes from the sun. Energy exists in many forms such as motion, heat, light, electricity, and sound. Although these forms are different they can be changed from one form to another. Plants use light energy in the food making called photosynthesis. Food is a source of stored energy that can be used to do work such as keeping human body temperature constant, producing body movement, and thinking. Electrical energy is used to run machines and appliances and produce light. Earth's supplies of usable energy sources like coal and oil is limited.

Students should be able to:

- Understand how energy and matter interact, and how models can be used to illustrate how energy flows through a system.
- Understand how model energy systems change throughout the year.
- Identify different heat sources such as friction, solar, nuclear and electric.
- Understand the relationship of food to the need for daily energy intake.
- Participate in real-life energy-related investigations.

C. Force and Motion

Force and motion are essential components of the physical and biological world. The relationship between forces of objects is central to understanding different types of movement that occur in the universe. Force explains starting, stopping, changing direction, floating, falling, and many other types of motion-related phenomena.

Students should be able to:
- Know the amount and direction of the force exerted on an object.
- Know mathematical relationship between force and mass.
- Identify simple and complex machines.
- Make comparisons between potential and kinetic energy.
- Demonstrate that sound travels differently through different media.

D. Processes that Shape the Earth

The physical laws that have governed the entire universe in the past are the same ones that govern material interactions today. Understanding and applying these laws to geological processes provides insight into how Earth formed, how it has evolved, and how it continues to change.

Students should be able to:
- Know that the surface of the Earth is composed of different types of solid materials that are defined in categories such as minerals and rocks.
- Understand the process of erosion.
- Understand temperature pressure and that the topography of the land influences the water cycle.
- Understand that geological features result from the movement of the crust of the Earth.
- Know how organisms adapt in order to survive within their given habitats.
- Recognize that human activity affects the global environment.

E. Earth and Space

The interaction and organization of matter and energy in the solar system and the universe is central to an understanding of earth and space. The organization of the solar system, the galaxy, and the universe is fundamental to the study of Earth and Space Science.

Students should be able to:
- Describe orbital movements such as rotation and revolution.
- Classify planets by their properties.
- Understand celestial phenomena.
- Understand the cycles of the moon and the effect of the moon's orbit on the Earth.

F. Processes of Life

A fundamental goal of the biological sciences is to understand the essential processes of life on earth. Central to an understanding of these processes are the patterns of structure and function in living things. By examining the characteristics of organisms, animals and plants can be associated with their environment, e.g., algae and pond, cactus and desert.

Students should be able to:

- Understand how body systems interact and are related.
- Understand that similar cells form different kinds of structures.
- Know the relationship between animals and plants.
- Understand that many characteristics of an organism are inherited from the ancestors of that organism.
- Know that some characteristics result from the organism's interactions with the environment.

G. How Living Things Interact with Their Environment

Living things depend upon one another and their environment. Specific relationships exist among organisms: the kinds of physical conditions that organisms must endure, the kinds of environments created by the interaction of organisms with one another, and with their physical surroundings.

Students should be able to:

- Explain the interdependence of plants and animals as shown in food chains and food webs.
- Understand the concept of adaptation of organisms to their environment.
- Know that all living things must compete for limited resources.

H. The Nature of Science

Students should recognize that science, technology, and society are interwoven and interdependent. Collecting things, designing and conducting simple experiments, making predictions, asking questions about their observations, classifying things, and observation, making generalizations, and discussing their findings with peers are among typical behaviors. Science is related to real-world issues. It requires a thoughtful critique of all aspects of investigations, as well as extensive opportunities for setting up, executing, and designing investigations to answer questions.

Students should be able to:

- Plan and conduct simple experiments that include the process skills of observing, classifying, communicating, questioning, measuring, predicting, collecting and recording data, making models, investigating, experimenting, identifying and controlling variables, hypothesizing, interpreting data and inferring.
- Understand that the solutions to one scientific problem can create another problem.
- Construct models to compare objects in science.
- Understand the importance of communication among scientists.