Alignment of the Developmental Approaches in Science, Health, and Technology Program (DASH)

with the

National Science Education Standards

Grades K–4

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FOREWORD

Alignment of Developmental Approaches in Science, Health, and Technology Program (DASH) with the National Science Education Standards

Developmental Approaches in Science, Health, and Technology (*DASH*), an engaging K–6 inquiry-based program in science, health, and technology, has already been validated by the U.S. Department of Education's Program Effectiveness Panel, awarded a dissemination grant through the National Diffusion Network, and included in the U.S. Department of Education's recently published *Promising Practices in Mathematics and Science*. Primary developmental funding was from the National Science Foundation, the Hawaii State Department of Business, Economic Development, and Tourism, and the University of Hawai'i.

DASH meets the National Science Education Standards and the American Association for the Advancement of Science (AAAS) *Benchmarks for Science Literacy* through ten learning clusters of activities specifically integrating science, health and technology. *DASH* is designed to articulate with language arts, mathematics, arts, history, and geography. Students with various backgrounds and learning styles master concepts and skills in contexts of authentic technological and scientific exploration, invention, and explanation providing models for thinking and problem solving.

The National Science Education Standards is a product of the National Research Council of the National Academy of Science. The standards are designed to enable the nation to achieve its goal of scientific literacy for all.

The following analysis describes how *DASH* addresses the national standards for science content.

INTRODUCTION

DASH INQUIRY

To understand the dynamics of science and technology the *DASH* classroom operates as a technological-scientific community wherein the student is researcher and inventor/builder and the teacher is research director/technological manager. The teacher role is to create the context for knowledge construction, presenting initiating questions and/or problems; assuring that necessary materials and equipment are available and safe; causing the students to share their experience, evaluate the work of the community, develop consensus on perceptions, and organize development of generalizations and explanations; and most important, overseeing the ongoing documenting of common experiences and creations. In all of this the teacher is a stimulator of curiosity and guide in the students' personal knowledge construction.

DASH Pedagogical Model for Guiding Inquiry

For the teacher, the *DASH* model for guiding inquiry involves 1) inventorying the students' present knowledge of a topic; 2) creating direction for new exploration through problems, questions, anomaly, demonstration of new techniques, or encouraging pursuit of inquiry into serendipitous events; 3) helping students apply new and existing knowledge in developing a product, skill, description, or experiment; and 4) catalyzing student development of generalization and explanation and refinement of artifacts. In essence there are four operations:

inventory—> exploration—> application—> generalization/explanation

In the *DASH* classroom the unit of inquiry organization is the activity. Inventory of the concepts and skills that students bring to an activity comes from the teacher's knowledge of students, the use of concept mapping, and student self-inventory. Exploration involves orientation to the parameters of a question, problem, anomaly, demonstration of new techniques, or serendipity that is driving work in an activity. Application involves using extant knowledge mixed with new insight to create and carry out the interactions, inventions, descriptions, or experiments of an activity. Generalization and explanation are products of consensus arrived at by students after extended experience with phenomena, often after engaging in multiple and multi-year activities. At each step in this model, students are immersed in personal knowledge-making, using the methods characteristic of the technologies and sciences, while teachers are supportive, encouraging mentors.

Inquiry as Experienced by Students

In *DASH*, students use the inquiry methods employed by scientists and technologists. *DASH* uses an historical recapitulationist approach to provide the order of its inquiry development. In short, the historical record indicates that the simplest, most functional methods of knowledge generation appeared first and became more complex over time. Productive technologies such as stone chipping, fire and cloth making, and a host of others gave our ancestors first knowledge about and limited control over natural events. Descriptive and explanatory science methods are relatively new ways of making knowledge that evolved with our spoken and written language capacities. Newer still is hypothetical/experimental science that emerged only some 400 years ago. *DASH* students are first introduced to technological and to descriptive inquiry. As language, graphic, mathematical, and logical capacities grow, students are challenged with explanatory and experimental methods.

Technological Knowledge
The fundamental knowledge-generating sequence of technology applicable to producing products, techniques, and services can be reduced to four primary operations.

problem identification --> solution invention --> product design & building --> testing

Testing provides immediate evaluation of the solution, answering the question "Does it or does it not work." In the operations of the classroom, solution invention and product design and building are often indistinguishable operations as flashes of creativity erupt in testable products.

From the first days of kindergarten, technological sequences are common in *DASH*. Students in the process of inventing, designing, and building, often find ancillary problems that must be solved. For example, in the construction of a car students suddenly are confronted by their self-identified problem, "How do we make wheels?" Then, "How can we attach wheels to our car?" A teacher-initiated problem context is quickly translated into a host of student-generated problems. This kind of problem identification is automatic. Most often, the students invent solutions with little hesitation, attaching new insights to their previous inventory of experience and knowledge.

The problems that can be set in a technological context give students a profound sense of how natural phenomena can be controlled, what kinds of operations will work and what won't work to control them, and allow students to characterize and eventually generalize about materials, events, natural objects, organisms, and artificial things.

Expert Knowledge
DASH uses reports in the literature, statements of authority, and demonstration as primary sources of knowledge. An sequence for expert knowledge acquisition involves:

question formulation —> information/demonstration acquisition —> replication

Much of the knowledge of technological and scientific technique is readily accessible in demonstration. A demonstration is but another set of phenomena observed and understood through replication. Information also is extensively sought in field guides, almanacs, newspapers, and so forth.

Descriptive Knowledge
A scientific descriptive sequence for knowledge generation involves

entity identification ---> description ----> classification/generalization

Descriptions must be invented and students must find out what and how to observe, what records should be kept, what is significant, what are parts and what are wholes, and how are things related. Descriptions may be of events, behaviors, or objects. Objects may be described by their functions and structures, environmental location, and so forth. In time descriptions become generalizations characterizing categories of phenomena. Description of what a field of study includes is a task of early science and generalizations often become first level explanations.

Much of primary *DASH* involves these basic operations, particularly in meteorology, astronomy, and nature study. The keeping of temperature, wind direction, rainfall, and snowfall records and associating them with season sand climate; keeping records of moon phase change, changes in sunrise and sunset times; the path and location of the stars, and planets and associating this with seasons and way finding; characterizing different kinds of plants and animals, associating them with seasons and living environments, and observing how they satisfy their biological needs, are all examples of descriptive knowledge inquiry.

Hypothetical Knowledge
A simple hypothetical knowledge sequence involves

question identification—> hypothesis formation—> evaluation of reasonableness

This is the basic sequence of explanatory knowledge making. Through it new hypotheses are screened by the community using the criterion of reasonableness alone—Does the idea fit with pervious observations, classifications, generalizations, and explanation? There is no surety that the accepted explanation is correct. There is only agreement that it is or is not reasonable.

Many discussions in *DASH* rely on the spontaneous invention of hypotheses and group analysis of consistency. A question or problem requiring a hypothetical explanation may come from encounters with anomaly, from a student's or teacher's query, or other sources.

Experimentation
At its most basic level experimentation has the same structure as a technological invention and testing.

question identification —> solution invention —> test construction —> test

The experimenter has an idea that can be tried without formal rumination. A test is made and the results are evaluated. Much work is done in this straightforward manner. Many *DASH* experiments are of this sort. The experiment is almost completely defined by the question. *DASH* examples are numerous: What will happened to bean sprouts if they are not watered? Is acid consumed in digestion of bone? Can birds be trained to come to a feeder at as specific time? What would happen if we add an acid to a base? What would happen if we did not harvest our radishes?

Hypothetical-Experimentation
A hypothetical-experimental sequence involves:

question identification —> hypothesis invention —> experiment invention —>

experimental design building —> testing and interpretation —> evaluation

As has been pointed out by historians, the explanatory-experimental sequences emerged out a marriage of the technological and hypothetical methods. The canons of explanatory-experimental science are complex, involving some or all of the following: sampling methods, cause-and-effect, deductive and inductive logic, mathematical manipulations of data, public scrutiny of results, and so forth.

By grade 4 students are normally ready for an introduction to hypothetical/experimental work. Developmental prerequisites are 1) confidence in personal inventive capacities, 2) experience in controlling natural phenomena, 3) linguistic ability to describe, classify, and generalize, 4) experience in testing reasonableness of explanations, 5) a developed sense of for logic. temporal sequence, cause-and-effect, and metaphoric thinking, 6) and an emerging capacity for logic.

Alignment of *DASH* with the National Science Education Standards

National Science Education Content Standards: K-4	Developmental Approaches in Science, Health and Technology (*DASH*)
1. Science As Inquiry	
Abilities necessary to do scientific inquiry (Ask a question about objects, organisms, and events in the environment; plan and conduct a simple investigation; employ simple equipment and tools to gather data and extend the senses; use data to construct a reasonable explanation; communicate investigations and explanations.)	The constructivist model suggests that present knowledge is built out of past experience. To make experience useful the students are regularly engaged in actively conceptualizing what they have done, on the assumption that this provides a basis on which to make predictions about the future. To aid in this process *DASH* students make concept maps, working definitions, and statements of physical rules and generalizations. Prediction based on long term conceptual growth is common in Weather, Astronomy, Decomposition, Seasons, Growth and Development, Animal, and Plant activities. A wide variety of technological tools are used in *DASH*. Measuring tools include are clocks, watches, calendars, thermometers, rulers, metric marked strings, area grid paper, volumetric measuring cups, graduated cylinders, scales, balances, compasses, magnifiers are all used in grades K–6. Students begin making linear measurements in grade K. Weighing and measuring volume are introduced in grade 1. Students make their own balances and volumetric measuring tools starting in grade 2. *DASH* employs a broad range of tools, many of which the students make, including enlargers such as the camera obscura, pin hole cameras, telescopes, and microscopes; impact measuring devices to measure the energy of moving objects; and the tools of photography and record keeping to preserve observations and measurements of slow progressing events. Throughout *DASH* students invent, design, make, and test laboratory tools and tools used in crafting products. In grade 4 where the technological study focuses on the crafts of stone implement cultures, the students chip rocks and makes the tools needed for survival in a simple environment. This gives the student a sense of how natural materials allowed people in the past to achieve many of the same ends that modern materials and tools achieve for us today.

1. Science as Inquiry (Continued)

Understandings about scientific inquiry • Scientific investigations involve asking and answering a question and comparing the answer with what scientists already know about the world. • Scientists use different kinds of investigations depending on the questions they are trying to answer. Types of investigations include describing objects, events, and organisms; classifying them; and doing a fair test (experimenting). • Simple instruments, such as magnifiers, thermometers, and rulers, provide more information than scientists obtain using only their senses. • Scientists develop explanations using observations (evidence) and what they already know about the world (scientific knowledge). Good explanations are based on evidence from investigations. • Scientists make the results of their investigations public; they describe the investigations in ways that enable others to repeat the investigations. • Scientists review and ask questions about the results of other scientists' work.	The *DASH* classroom models the dynamics of the scientific and technological communities. As the students gain insight into the natural and technological worlds around them they are increasingly able to use their organized experience to think about and create explanations. There are 40 multi-grade level thematic sequences of activities including studies of weather, astronomy, agriculture, nutrition, disease, reproduction, decomposition, human growth and development, and mental health found within *DASH*. Many activities are designed to serve multiple functions and encourage multiple interpretations on the part of students which are then used to derive further inquiry. From kindergarten on, the students in *DASH* operate as communities of technologists and scientists. Their investigations and inventions are continually open to reflective discussion. Inventions that do not meet the criterion of functionality are immediately identified and turned back to the inventor/designers to modify or redesign. Investigations that do not support the claims of researchers are sent back for reassessment or further investigation in the lab and field. *DASH* students resolve discrepant observations and diverse interpretations by further observations and experimentation. Replication of experimental investigations in different places with the consequent finding of similar results is common at each grade level. All of the multi-year, longitudinal investigations involve both a validation of previous work and exploration in new areas. All involve multiple sites since classrooms change from year to year. *DASH* involves all students in doing science. Investigations call for different roles, skills, and knowledge. Each *DASH* activity identifies the kinds of professionals who would engage in such work. Teachers are encouraged to have guest speakers talk with students about their jobs, training, salary, and professional obligations.

2. Physical Science

Properties of objects and materials • Objects have many observable properties including size, weight, shape, color, temperature, and the ability to react with other substances. Those properties can be measured using tools, such as rulers, balances, and thermometers. • Objects are made of one or more materials, such as paper, wood, and metal. Objects can be described by the properties of the materials from which they are made, and those properties can be used to separate or sort a group of objects or materials. • Materials can exist in different states—solid, liquid, and gas. Some common materials, such as water, can be changed from one state to another by heating or cooling.	Properties of matter are identified as components of good descriptions. *DASH* carefully introduces and uses descriptive and explanatory language. Students record their own evolving definitions in the Working Dictionary. (Examples: K.1.7 Same And Different, K.1.8 Physical Characteristics Of Things, K.1.10 The Working Dictionary And Working Definitions) *DASH* students make products of their own design from common materials. It becomes obvious that the possible products that could be made from these materials are nearly infinite. (Examples: 3.5.4 Preparing The Class Feast, 3.9.5 Fall Unearthing And Burial, 3.9.6 Spring Unearthing And Burial, 3.10.12 Acids And Bases, 3.10.3 Acid And Base Reactions, 3.10.4 Diluting Acids And Bases, 3.10.5 Acid And Base Interaction, 3.10.6 Dissolving Things, 3.10.7 Things In Liquids, 3.10.8 Crystals, 4.5.5 Digestion Games, 4.5.6 Preserving Foods, 4.6.6 Things That Burn, 4.10.13 Air And Fire, 4.10.14 Fire And Oxygen, 4.10.15 Properties Of Gases.) *DASH* includes study of the response of materials to various treatments in different contexts. Biological vs. non-biological response to water as a growth agent; decomposition of different biological and non-biological materials is studied in K.9.1 Decomposition, 1.9.4 Decomposition And Unearthing, 1.9.5 Decomposition And Reburial, 2.9.1 Fall Unearthing, 2.9.2 Fall Burying, 2.9.3 Spring Unearthing, 2.9.4 Spring Burying. Heating and cooling and their effect on matter are investigated in a range of studies including those of cooking, changes in state, weather, curing of pottery, flammability of substances, etc. (Examples: 3.2.2 Temperature, 3.2.4 Wind, 3.2.5 Rain And Snow, 3.2.6 Humidity, 3.5.4 Preparing The Class Feast, 3.5.7 Pickling Foods, 3.10.6 Dissolving Things, 3.10.7 Things In Liquids, 3.10.8 Crystals, 3.10.9 Rain In A Jar, 4.5.6 Preserving Foods, 4.10.12 Fire And Pottery, 4.10.13 Air And Fire, 4.10.14 Fire And Oxygen.)

2. Physical Science (Continued)

Position and motion of objects • The position of an object can be described by locating it relative to another object or the background. • An object's motion can be described by tracing and measuring its position over time. • The position and motion of objects can be changed by pushing or pulling. The size of the change is related to the strength of the push or pull. • Sound is produced by vibrating objects. The pitch of the sound can be varied by changing the rate of vibration.	Types of movement are investigated in several kinds of activities. (Examples: K.7.7 Home Location, 1.7.1 Pacing, 2.7.4 Roads, K.8.3 Making Things Stop, 2.7.3 Racing And Modifying Cars). Ways of moving things are introduced in kindergarten. (Examples: K.8.2 Making Things Move, K.8.2 Making Things Stop, 1.7.7 The Great Regatta, 2.7.3 Racing And Modifying Cars) Force and its effect on objects is introduced in Kindergarten and formally studied from grade 4 through grade 6, including studies of the effect of the same force on different masses. (Examples: 3.7.2 Propeller-Driven Message Center, 3.7.3 Propeller Driven Boat, 3.8.3 Wind Pulls And Pushes, 3.8.4 Propellers Driving Propellers, 3.8.5 Waterwheels, 3.8.6 Propellers In Water, 4.8.1 Push-Pull Measuring Tool, 4.8.2 Friction, 4.8.3 Streamlining, 4.8.5 Energy Of Falling Objects, 4.8.6 Circles And Speed, 4.103 Mass Measurement.) Gravity as a down-pulling force is introduced in grade 2. Gravity is seen as a force acting at a distance. (Examples: K.8.1 Energy, K.8.2 Making Things Move, 1.8.4 Energy Sources, 2.4.7 Moving Water With Gravity; 4.8.1 Push-Pull Measuring Tool, 4.8.5 Energy Of Falling Objects, 4.8.6 Circles And Speed, 4.10.3 Mass Measurement. Effects of gravity are investigated beginning in kindergarten. *DASH* students work with speeds as fast as lightning and light and as slow as erosion of mountains into soil. As part of their study of the solar system they make a relative speed line on which they attach the speeds of different things. (Examples: 3.2.4 Wind, 3.2.11 Eclipses, 3.3.10 Hatching Chicks, 3.3.11 Chick Growth, 3.6.1 Growth Chart, 3.6.2 Tooth Chart, 3.6.3 Breathing Air, 3.6.7 Breathing And Pulse Rates, 3.7.3 Propeller-Driven Boat, 3.9.2 Watching Compost, 3.9.5 Fall Unearthing And Burial, 3.9.6 Spring Unearthing And Burial, 4.2.4 Wind Speed, 4.2.21 Making A Sundial, 4.2.22 Using A Sundial, 4.2.23 Seasons And The Sun, 4.2.24 Moon Phases And The Sun, 4.2.25 Eclipses, 4.6.1 Growth Chart And Area Measurement, 4.6.2 Tooth Chart, 4.7.2 Wind And Sails, 4.8.6 Circles And Speed) Sound is studied thoroughly in grades 5 and 6. It is included in 1.8.4 Energy Sources.

2. Physical Science (Continued)

Light, heat, electricity, and magnetism • Light travels in a straight line until it strikes an object. Light can be reflected by a mirror, refracted by a lens, or absorbed by the object. • Heat can be produced in many ways, such as burning, rubbing, or mixing one substance with another. Heat can move from one object to another by conduction. • Electricity in circuits require a complete loop through which an electrical current can pass. • Magnets attract and repel each other and certain kinds of other materials.	Energy is a major theme of *DASH* from grades K–6 and is a topic of special consideration in Cluster 8, Energy and Communication. Students also study the storage of energy as part of Conservation, Recycling, and Decomposition activities. Throughout *DASH* a growing list of energy sources are identified and associated with household uses including cooling and house warming. (Examples: K.8.1 Energy, 1.8.4 Sources Of Energy, 1.10.18 Warming And Cooling The House, 1.10.19 Lighting The House, 2.5.10 Energy From Food). Study of the sun as a warming agent, is the basis of many studies in *DASH*. (Examples: 1.8.1 Temperature Of Things, 2.2.1 Temperature, .K.2.8 Seasons, 1.2.8 Night And Day, 1.2.9 The Sun, 1.2.10 The Seasons, 2.2.3 Sunrise, Sunset, And Seasons) Energy transformation is extensively investigated. Light, electricity, chemicals, friction, and mechanical energy are all investigated as ways of producing heat. (Examples: 3.8.2 Wind And Heat, 3.8.10 Energy Definitions, 3.10.3 Acid And Base Reactions, 3.10.4 Diluting Acids And Bases, 3.10.5 Acid And Base Interaction, 3.10.6 Dissolving Things, 4.2.9 Lightning, 4.6.5 Making A Fire, 4.6.6 Things That Burn, 4.8.2 Friction, 4.10.12 Fire And Pottery, 4.10.13 Air And Fire, 4.10.14 Fire And Oxygen.) Heat transfer and temperature equilibrium are studied in the measurement of the caloric values of foods. Radiant energy and warming of objects at a distance are investigated in the water cycle studies and the study of fire. (Examples: 3.8.2 Wind And Heat, 3.10.3 Acid And Base Reactions, 3.10.4 Diluting Acids And Bases, 3.105 Acid And Base Interaction, 3.106 Dissolving Things, 3.8.10 Energy Definitions, 4.2.9 Lightning, 4.8.2 Friction, 4.6.5 Making A Fire, 4.6.6 Things That Burn, 4.10.12 Fire And Pottery, 4.10.13 Air And Fire, 4.10.14 Fire And Oxygen) Heat insulators and conductors are investigated in the study of fire and heat. Insulators are used as safety devices in handling hot materials, and to retain low 0°C water in the standardizing of thermometers. (Examples: 3.5.4 Preparing The Class Feast, 3.10.13 Safety Equipment, 4.6.3 Safety Gear, 4.6.4 Safety And Putting Out Fires, 4.6.5 Making A Fire, 4.6.6 Things That Burn, 4.10.12 Fire And Pottery, 4.10.13 Air And Fire, 4.10.14 Fire And Oxygen.) Moving air and water are extensively studied in grade 3. Here students make wind mills, water wheels, paddle wheels, and propellers. This equipment is used to propel boats. The study of wind and water driven machines is returned to in grade 5. (Examples: 3.7.2 Propeller-Driven Message Center, 3.7.3 Propeller-Driven Boat, 3.8.1 Shadow, Light, And Bubbles, 3.8.3 Wind Pulls And Pushes, 3.8.4 Propellers Driving Propellers, 3.8.5 Waterwheels, 3.8.6 Propellers In Water.)

2. Physical Science (Continued)

	Conservation of energy is another theme of *DASH*. Beginning in kindergarten, students are aware of the need to conserve energy as well as other resources. (Examples: K.8.4 Turning Things Off, K.8.5 Turning Things On, 1.9.2 Conservation Of Energy) Magnetism is introduced with the compass in grade 1 and making magnets by induction in grade 2. It is extensively studied in grades 5 and 6. (Examples: 1.2.1 Sky And Weather Watch, 2.2.2 Wind)

3. Life Science

Characteristics of organisms • Organisms have basic needs. For example, animals need air, water, and food; plants require air, water, nutrients, and light. Organisms can survive only in environments in which their needs can be met. The world has many different environments, and distinct environments support the life of different types of organisms. • Each plant or animal has different structures that serve different functions in growth, survival, and reproduction. For example, humans have distinct body structures for walking, holding, seeing, and talking. • The behavior of individual organisms is influenced by internal cues (such as hunger) and by external cues (such as a change in the environment). Humans and other organisms have senses that help them detect internal and external cues.	*DASH* activities on physical characteristics and behaviors of animals emphasize the diversity of nature. They provide models for human anatomy and physiology. (Examples: K.3.2 Classroom Animals, K.3.3 Caring For Classroom Animals, K.3.8 How Bugs Walk, K.3.9 Parts Of Bugs, K.3.10 Parts Of Mammals, K.3.11 People, 1.3.4 Animal Keys, 1.3.5 Animal Needs, 1.3.9 Class Pets, 2.3.2 External Anatomy Of Fish, 2.3.3 Biological Need Of Fish, 2.3.14 Classroom Pets.) Throughout *DASH* students make and use tools to enhance their senses including weather instruments, microscopes, telescopes, and a wide variety of measuring devices. (Examples: 3.2.4 Wind, 3.10.12 Measuring Devices, 4.2.1 Rainfall, 4.2.2 Snowfall, 4.2.3 Wind Direction, 4.2.4 Wind Speed, 4.2.21 Making A Sundial, 4.10.1 Linear Measurement, 4.10.2 Volume Measurement, 4.10.3 Mass Measurement.) *DASH* uses animal models to open discussions on biological needs that humans share with other animals. (Examples: K.3.12 Animals And Food, K.3.13 Animals And Water, K.3.14 Animals And Air, K.3.15 Animals And Waste, K.3.16 How Animals Keep Warm, K.3.17 How Animals Keep Cool, K.6.4 Exercise, 1.3.5 Animal Needs). *DASH* students continuously compare similarities and differences among themselves, other humans, and other animals. (Examples: K.6.1 Growth Chart, K.6.2 Tooth Chart, 1.6.1 Growth Chart, 1.6.2 Tooth Chart, 2.6.1 Growth Chart, 2.6.2 Tooth Chart, K.3.9 Parts Of Bugs, K.3.10 Parts Of Mammals, K.3.11 People, 1.3.4 Animal Keys, 2.3.2 External Anatomy Of Fish). Human needs are dramatized in the building or the cardboard house. (Examples: 1.10.12 Cardboard House Plan, 1.10.13 Making A Cardboard House, 1.10.15 Furnishing The House, 1.10.18 Warming The House, 1.10.19 Lighting The House). Environmental adaptability of plants and animals is part of all ecological field work. (Examples: K.3.6 Animal Environments, K.4.2 Plant Environments, 1.3.3 Animal Survey, 1.4.2 Plant Survey, 2.3.5 Finding Insect Eggs, 2.3.9 Collecting Spiders, 2.4.3 Soil And Plants.)

3. Life Science (Continued)

	Instinctual behavior of animals is compared to the intentional learned responses of humans. Ground work is started in grade 1 studies of insects and progresses through grade 6. (Examples: 3.3.1 Classroom Pets, 3.3.3 Raising Insects, 3.3.4 Importance Of Insects, 3.3.5 Natural Habitats Of Frogs Ant Toads, 3.3.6 Making Habitats For Frogs And Toads, 3.3.8 Importance Of Frogs And Toads, 3.3.9 Toads And Insects, 4.3.1 Pet Care, 4.3.2 The Unincubated Egg, 4.3.3 Chick Embryology, 4.3.4 Raising Small Mammals, 4.3.8 Reproduction Of Pet Mammals, 4.3.9 Pet Baby Care, 4.3.10 Our Early Years, 4.3.11 The First Grade Child, 4.3.12 Growth, Development, And Behavior Of Young Pets, 4.3.13 Human Growth And Development, 4.3.22 Migration And Hibernation, 4.3.23 Fall Birds, 4.3.24 Winter Birds, 4.3.25 Spring Birds.) *DASH* nutrition studies investigate the three primary functions of foods in the body-energy production, building and repair, and body regulation. In studies of the digestive tract the bodies processing of foods is studied from its entry into the mouth to the discharge of fecal waste. (Examples: 3.5.1 Food Selection, 4.3.18 Modeling Our Digestive System, 4.3.19 Our Digestive System In Two Dimensions, 4.3.20 Digestive, Circulatory, And Respiratory Systems, 4.3.21 Length Of The Digestive Tract, 4.5.1 Nutrition Messages, 4.5.2 Mechanical Digestion, 4.5.3 Chemical Digestion, 4.5.4 Food Groups, 4.5.5 Digestion Game.) The process of breathing is first studied in grade 1 and continued through grade 6. Oxygen is identified by the students as the gas in air involved in breathing in grade 4. (Examples: 3.6.3 Breathing Air, 3.6.4 Anatomy Of Breathing, 3.6.5 Lung Model, 3.6.6 Lungs And Smoking, 3.6.7 Breathing And Pulse Rates, 4.3.20 Digestive, Circulatory, And Respiratory Systems, 4.10.13 Air And Fire, 4.10.14 Fire And Oxygen.) The skin as a barrier against infection is first introduced in grade 2. As a barrier against disease it is further studied in investigations of sexually transmitted diseases in grade 5 and 6. (Examples: 3.6.10 Disease Transmission, 4.6.4 Safety And Putting Out Fires.) The brain as a central information processor is introduced in grade 4. Its association with the senses is a focus in grades 5 and 6. (Examples: 4.3.13 Human Growth And Development, 4.3.3 Chick Embryology, 4.3.16 Cleaning Fish: Internal Anatomy.)

3. Life Science (Continued)

Life cycles of organisms • Plants and animals have life cycles that include being born, developing into adults, reproducing, and eventually dying. The details of this life cycle are different for different organisms. • Plants and animals closely resemble their parents. • Many characteristics of an organism are inherited from the parents of the organism, but the other characteristics result from an individual's interactions with the environment. Inherited characteristics include the color of flowers and the number of limbs of an animal. Other features, such as the ability to ride a bicycle, are learned through interactions with the environment and cannot be passed on to the next generation.	The life cycles of numerous animals and plants are studied in detail in grade K–6. Birth, growth, and development, and death are not uncommon among the animals that are kept in the classroom. Plants are studied over several seasons, so that the natural cycle of planting growth and death in annuals and biennials is seen. (Examples: Animals 3.3.1 Classroom Pets, 3.3.2 Preparing To Raise Insects, 3.3.3 Raising Insects, 3.3.4 Importance Of Insects, 3.3.5 Natural Habitats Of Frogs And Toads, 3.3.6 Making Habitats For Frogs And Toads, 3.3.7 Frog Metamorphosis, 3.3.8 Importance Of Frogs And Toads, 3.3.9 Toads And Insects, 3.3.10 Hatching Chicks, 3.3.11 Chick Growth, 3.3.12 Importance Of Birds, 4.3.1 Pet Care, 4.3.2 The Unincubated Egg, 4.3.3 Chick Embryology, 4.3.4 Raising Small Mammals, 4.3.5 Housing Small Mammals, 4.3.6 Weekend Care Of Pet Mammals, 4.3.7 Pairing Of Pet Mammals, 4.3.8 Reproduction Of Pet Mammals, 4.3.9 Pet Baby Care, 4.3.10 Our Early Years, 4.3.11 The First Grade Child, 4.3.12 Growth, Development, And Behavior Of Young Pets, 4.3.13 Human Growth And Development, 4.3.14 Changing Dimensions, 4.3.17 Fish Reproduction, 4.3.22 Migration And Hibernation, 4.3.23 Fall Birds, 4.3.24 Winter Birds, 4.3.25 Spring Birds; Plants 4.2.23 Seasons And The Sun, 4.4.1 Annual, Biennial, And Perennial Garden Plant.) *DASH* students study reproduction of both plants and animals including humans and identify the sperm and egg as carrying the information to insure reproductive continuity between parent and offspring. Variation in populations is investigated in several short-term and long-term studies. (Examples: K.4.4 Growing Bean Sprouts, K.4.6 Gardening, 1.3.3 Animal Survey, 1.4.2 Plant Survey, 2.4.9 Vegetable Garden In A Bucket, 2.4.10 Flower Garden In A Bucket. K.6.1 Growth Chart, K.6.2 Tooth Chart, 1.6.1 Growth Chart, 1.6.2 Tooth Chart, 2.6.1 Growth Chart, 2.6.2 Tooth Chart.) Likeness between parent organisms and offspring are studied in both animals and plants. In animals inherited behaviors are noted and distinguished from learned behaviors. These studies are extended to the students own parent-sibling group. (Examples: 3.3.3 Raising Insects, 3.3.5 Natural Habitats Of Frogs And Toads, 3.3.6 Making Habitats For Frogs And Toads, 3.3.7 Frog Metamorphosis, 3.3.10 Hatching Chicks, 3.3.11 Chick Growth, 4.3.1 Pet Care, 4.3.2 The Unincubated Egg, 4.3.3 Chick Embryology, 4.3.8 Reproduction Of Pet Mammals, 4.3.9 Pet Baby Care, 4.3.10 Our Early Years, 4.3.11 The First Grade Child, 4.3.12 Growth, Development, And Behavior Of Young Pets, 4.3.13 Human Growth And Development, 4.3.15 External Anatomy Of Fish, 4.3.16 Cleaning Fish: Internal Anatomy, 4.3.17 Fish Reproduction, 4.4.1 Annual, Biennial, And Perennial Garden Plants, 4.4.2 The Fungus Among Us, 4.4.3 Fungus Collection.)

3. Life Science (Continued)

	DASH students compare sibling and parental characteristics in grades 3 and 4. In grade K–2 they observe similarities and differences in fish and insects. (Examples: 2.3.4 Reproduction And Development Of Fish, 2.3.6 Hatching Insect Eggs). *DASH* includes studies of external anatomy and its affect on the adaptability of organisms in grades K–6. (Examples: K.3.5 Animal Environments, K.3.8 How Bugs Walk, K.3.9 Parts Of Bugs, 1.3.3 Animal Survey, 2.3.7-2.3.13). Activities in K–2 introduce the concept of once living. Extensions deal with extinct organisms. (Examples: K.3.18 Real and Imaginary).
Organisms and their environments • All animals depend on plants. Some animals eat plants for food. Other animals eat animals that eat the plants. • An organism's patterns of behavior are related to the nature of that organism's environment, including the kinds and numbers of other organisms present, the availability of food and resources, and the physical characteristics of the environment. When the environment changes, some plants and animals survive and reproduce, and others die or move to new locations. • All organisms cause changes in the environment where they live. Some of these changes are detrimental to the organism, whereas others are beneficial. • Humans depend on their natural and constructed environments. Humans change environments in ways that can be either beneficial or detrimental for themselves and other organisms.	Study of ecological interactions of plants and animals is a seven-year investigation in *DASH*. Students continually focus on interactions of plants, animals, and humans and their impact on the physical surroundings. (Examples: K.3.6 Animal Environments, K.4.2 Plant Environments, 1.3.3 Animal Survey, 1.4.2 Plant Survey, 2.4.3 Soil And Plants.) The inability of animals to manufacture their own food from the raw materials of nature is stressed from grades 1–6. Plants are observed to be producers of the food which some animals eat and those that do not eat plants are eaters of animals that do eat plants. (Examples: 3.3.1 Classroom Pets, 3.3.2 Preparing To Raise Insects, 3.3.3 Raising Insects, 3.3.4 Importance Of Insects, 3.3.5 Natural Habitats Of Frogs And Toads, 3.3.6 Making Habitats For Frogs And Toads, 3.3.7 Frog Metamorphosis, 3.3.8 Importance Of Frogs And Toads, 3.3.9 Toads And Insects, 3.5.1 Food Selection, 3.5.2 Selecting Plants For The Garden, 3.5.3 Planning The Class Feast, 3.5.4 Preparing The Class Feast, 3.5.5 The Class Feast, 3.9.2 Watching Compost, 3.9.3 Animals In Compost, 4.3.1 Pet Care, 4.3.22 Migration And Hibernation, 4.3.23 Fall Birds, 4.3.24 Winter Birds, 4.3.25 Spring Birds, 4.5.1 Nutrition Messages, 4.5.4 Food Groups, 4.5.5 Digestion Game.) Field studies throughout *DASH* show that different plants have different environmental needs. Starting in Kindergarten the students find that animals have three very different environments in which they can live—water, land, and sky; that to live in each of these environments requires special adaptations. (Examples: 3.3.2 Preparing To Raise Insects, 3.3.3 Raising Insects, 3.3.4 Importance Of Insects, 3.3.5 Natural Habitats Of Frogs And Toads, 3.3.6 Making Habitats For Frogs And Toads, 3.3.7 Frog Metamorphosis, 3.3.8 Importance Of Frogs And Toad, 3.3.9 Toads And Insects, 3.3.10 Hatching Chicks, 3.3.11 Chick Growth, 3.3.12 Importance Of Birds, 3.3.12 Importance Of Birds, 4.3.22 Migration And Hibernation, 4.3.23 Fall Birds, 4.3.24 Winter Birds, 4.3.25 Spring Birds, 4.4.1 Annual, Biennial, And Perennial Plant Project, 4.4.2 The Fungus Among Us. 4.4.3 Fungus Collection.)

3. Life Science (Continued)

	The interactions of plants and animals are investigated in the third grade biological control, pollination, and seed dispersal activities. The import of microorganisms in the digestion of animals is studied in grades 4 and 5. (Examples: 3.3.8 Importance Of Frogs And Toads, 3.3.9 Toads And Insects, 3.4.1 Garden Invaders, 3.4.11 Controlling Insects, 3.4.12 Garden Harvesting, 3.4.13 Flowers, 3.4.14 Seeds, 3.4.15 Pollination, 3.9.3 Animals In Compost, 4.3.22 Migration And Hibernation, 4.3.23 Fall Birds, 4.3.24 Winter Birds, 4.3.25 Spring Birds, 4.4.2 The Fungus Among Us, 4.5.3 Chemical Digestion.) The role of some insects as decomposers is extensively studied in the third grade composting unit and carries on through the sixth grade unit on worms. (Examples: 3.9.2 Watching Compost, 3.9.3 Animals In Compost, 3.9.4 Using Compost, 3.9.5 Fall Unearthing And Burial, 3.9.6 Spring Unearthing And Burial, 4.9.1 Unearthing.) Studies of animal hibernation and migration, and bird migrating and non-migrating populations in grades 4 and 5 lead to the same conclusion about animals' limited adaptability to changing environments—some changes enhance, some reduce viability. (Examples: 4.3.22 Migration And Hibernation, 4.3.23 Fall Birds, 4.3.24 Winter Birds, 4.3.25 Spring Birds.) The deep involvement of students with technology and the regular connecting of the work of the classroom with the technologies pursued in the world around them provide living examples of the place of technology in the culture they know. Exploration of stone cultures gives them a comparative reflection on the import and the enormity of the technology of today. (Examples: *DASH* Connections Books, 4.1.9 Survival Game, 4.5.6 Preserving Foods, 4.7.1 Boat Design, 4.7.2 Wind And Sails, 4.10.4 Collecting Rocks, 4.10.5 Hardness Of Rocks, 4.10.7 Rocks And Sharp Edges, 4.10.8 Making Tools From Rock, 4.10.9 Making Fishing Tools, 4.10.11 Clay, 4.10.12 Fire And Pottery.)

4. Earth and Space Science

Properties of earth materials • Earth materials are solid rocks and soils, water, and the gases of the atmosphere. The varied materials have different physical and chemical properties, which make them useful in different ways, for example, as building materials, as sources of fuel, or for growing the plants we use as food. Earth materials provide many of the resources that humans use. • Soils have properties of color and texture, capacity to retain water, and the ability to support the growth of many kinds of plants, including those in our food supply. • Fossils provide evidence about the plants and animals that lived long ago and the nature of the environment at that time.	*DASH* introduces the study of soils in grade 2. They observe the nature of rocks and compare it with soil. They also make synthetic soil by pulverizing rock. (Examples: 2.4.1 Soil, 2.4.2 Making Soil, 2.4.3 Soil And Plants, 2.4.4 Soil Uses, 2.4.5 Finding Soil.) Rocks and their properties are characterized in grades 4–6. Study of the nature of soil and its formation begins in grade 2 and continues through grade 6. Emphasized are both the inorganic and organic components of soil. (Examples: 3.4.3 Watching Garden Soil, 3.4.4 Making Artificial Soil, 3.4.5 Testing Artificial Soil, 3.4.6 Soil And Water, 3.9.1 Making Compost, 3.9.2 Watching Compost, 3.9.3 Animals In Compost, 3.9.4 Using Compost, 4.10.4 Collecting Rocks, 4.10.5 Harness Of Rocks, 4.10.6 Specific Gravity, 4.10.7 Rocks And Sharp Edges, 4.10.11 Clay.) The study of the erosion process of nature begins in grade 2 and continues through grade 6. (Examples: 3.4.6 Soil And Water, 4.10.14 Collecting Rocks.) Air and wind are studied in grades K–6. *DASH* students keep regular records of wind speed and direction as part of their weather studies. They engage in an intensive study of air and its properties and components in grades 4 and 6. (Examples: 3.2.4 Wind, 3.8.1 Shadow, Light, And Bubbles, 3.8.2 Wind And Heat, 3.8.3 Wind Pulls And Pushes, 4.2.3 Wind Direction, 4.2.4 Wind Speed, 4.10.13 Air And Fire, 4.10.14 Fire And Oxygen, 4.10.15 Properties Of Gases.)
Objects in the sky • The sun, moon, stars, clouds, birds, and airplanes all have properties, locations, and movements that can be observed and described. • The sun provides the light and heat necessary to maintain the temperature of the earth.	Astronomy is a major area of study in *DASH*. From Kindergarten the students follow the phases of the moon and the movement of other celestial bodies across the day and night sky. In grade 3 they are introduced to a simple planetarium housing the north circumpolar stars. In grade 4 the planetarium is expanded to include the stars of the zodiac. In grade 5 declinations and right ascensions are included. Seasonal movement of the stars and sum are followed as well as the wanderings of the planets. (Examples: 3.2.9 Polar Constellations, 3.2.10 Venus, 4.2.17 Planetarium, 4.2.18 Using The Planetarium, 4.2.19 Planets) Venus is studied beginning in grade 3. Mars in added in grade 4. The other visible planets are added to their study in grade 5. (Examples: 3.2.10 Venus, 4.2.19 Planets, 5.2.10 Path Of Celestial Bodies.)

4. Earth and Space Science (Continued)

	The orbit of the moon around the earth is deduced from data on moon phases and eclipses in grade 4. The logic for a sun-centered solar system is worked out in grade 5 with the deduction that the earth and other planets are orbiting the sun contrary to common-sense observation of the apparent diurnal movements of the sun. (Examples: 4.2.17 Planetarium, 4.2.18 Using The Planetarium, 4.2.19 Planets, 4.2.24 Moon Phases And The Sun, 4.2.25 Eclipses) The logic for a spherical earth is investigated in grade 4. The 24-hour period of day and night cycle is recorded and progressively analyzed starting in grade 1. The apparent diurnal revolution of the heavens about the earth is a focus from Kindergarten through grade 5. (Examples: Earth shape 3.2.11 Eclipses, 4.2.14 Flat Or Round Earth, 4.2.25 Eclipses; Apparent Diurnal Movement 3.2.7 Moon Phases, 3.2.9 Polar Constellations, 3.2.10 Venus, 4.2.15 Length Of Day And Night, 4.2.16 The Sun's Shadow Path, 4.2.17 Planetarium, 4.2.18 Using The Planetarium, 4.2.19 Planets, 4.2.24 Moon Phases And The Sun, 4.2.25 Eclipses, 5.2.6 Gnomon, 5.2.10 Path Of Celestial Bodies)
Changes in the earth and sky • The surface of the earth changes. Some changes are due to slow processes, such as erosion and weathering, and some changes are due to rapid processes, such as landslides, volcanic eruptions, and earthquakes. • Weather changes from one day and over the seasons. Weather can be described by measurable quantities, such as temperature, wind direction and speed, and precipitation. • Objects in the sky have patterns of movement. The sun, for example, appears to move across the sky in the same way every day, but its path changes slowly over the seasons. The moon moves across the sky on a daily basis much like the sun. The observable shape of the moon changes from day to day in a cycle that lasts about a month.	Study of change is a multi-year activity in *DASH*. (Examples: K.2.6 Moon Watch, K.2.7 Moon Phases, 1.3.3 Animal Survey, 1.4.2 Plant Survey, 2.3.5–2.3.13 (A Year Long Study Of Insects And Spiders), K.2.1 Weather Watch, 1.2.1 Sky And Weather Watch, 1.2.3 Snow And Streams, 1.2.1 Sky And Weather Watch, 2.2.1 Temperature, 2.2.2 Wind, 2.2.5 Rain, 2.2.6 Snow, K.2.8 Seasons, 1.2.8 Night And Day, 1.2.10 The Seasons, 2.2.3 Sunrise, Sunset, And Seasons, K.4.4 Growing Bean Sprouts, K.4.6 Gardening, 1.4.2 Plant Survey, 2.4.9 Vegetable Garden In A Bucket, 2.4.10 Flower Garden In A Bucket, K.3.2 Classroom Animals, K.3.2 Caring For Classroom Animals, 1.3.9 Classroom Pets, 2.3.1 The Classroom Aquarium, 2.3.14 Classroom Pets, K.9.1 Decomposition, 1.9.4 Decomposition And Unearthing, 1.9.5 Decomposition And Reburial, 2.9.1 Fall Unearthing, 2.9.2 Fall Burying, 2.9.3 Spring Unearthing, 2.9.4 Spring Burying, 1.3.8 Metamorphosis, 2.3.6 Hatching Insect Eggs, 2.3.7 Early Metamorphosis, K.6.1 Growth Chart, K.6.2 Tooth Chart, 1.6.1 Growth Chart, 1.6.2 Tooth Chart, 2.6.1 Growth Chart, 2.6.2 Tooth Chart, 2.4.16 Tree Planting) The study of the erosion process of nature begins in grade 2 and continues through grade 6. (Examples: 3.4.6 Soil And Water, 4.10.14 Collecting Rocks) Gravity as a down-pulling force is introduced in grade 2. Students make force measuring instruments in grade 4 and continue the study of gravity through grades 5 and 6. (Examples: 4.8.1 Push-Pull Measuring Tool, 4.8.2 Friction, 4.8.5 Energy Of Falling Objects.)

4. Earth and Space Science (Continued)

	DASH stresses study of the sun and moon in grades K–2. Stars are the focus from grade 3 on. Students who are out viewing the early morning and evening skies are well aware of the starry background. Inquiries are recorded in the Wonder and Discover Book, a repository of questions raised and being explored by students. *DASH* encourages pursuit of individual an group interests that flow from students' curiosity. *DASH* astronomy activities focus on the movement of the sun and moon. The anomaly of the moon as a daylight companion of the sun is a point of constant surprise. (Examples: K.2.6 Moon Watch, K.2.7 Moon Phases, K.2.4 Day And Night, 1.2.1 Sky And Weather Watch, 2.2.4 Moonrise And Moonset, K.2.8 Seasons, 1.27 Sunrise And Sunset, 1.2.8 Night And Day, 1.2.9 The Sun, 1.2.10 The Seasons, 2.2.3 Sunrise, Sunset, And Seasons) The phases of the moon are a point of continuing study through grade 4. (Examples: K.2.6 Moon Watch, K.2.7 Moon Phases, 1.2.1 Sky And Weather Watch, 2.2.4 Moonrise And Moonset.) Weather is a major seven-year theme of *DASH*. Weather is directly tied into the study of seasons, climate, and gases in grades 3–6. (Examples: K.2.1 Weather Watch, 1.2.1 Sky And Weather Watch, 1.2.3 Rain And Streams, 1.2.3 Snow And Streams, 2.3 Snow And Streams, 1.2.1 Sky And Weather Watch, 2.2.1 Temperature, 2.2.2 Wind, 2.2.5 Rain, 2.2.6 Snow, K.2.8 Seasons, 1.2.8 Night And Day, 1.2.10 The Seasons, 2.2.3 Sunrise, Sunset, And Seasons.)

5. Science and Technology

Abilities of technological design (identifying a simple problem; propose a solution; implementing proposed solutions; evaluate a product or design; communicate a problem, design, and solution)	*DASH* presents students with an array of problems to be solved. K–2 problems are practical ones, often involving technology and rooted in the local environment. Techniques emphasized include: Thinking. All activities help develop thinking skills from cataloging and generalizing to conceptualizing a final product. Organizing work teams. Cooperative group organization of the class is the normal pattern of operation and students are giving growing responsibility for class organization. Allocating time. Projects have a time allocation component which the students participate in. Establishing rules and procedures. As part of the cooperative enterprise students are regularly called upon to establish procedures and rules for the care of organism, discharging jobs, behavior in groups, etc. Presenting ideas and other products. In each activity attention is given to the representation of ideas and products in oral, pictorial, demonstration to other form. Special attention is given to the need for refinement and modification of ideas and continual repair and maintenance of equipment and the classroom environments. In their construction and other technology activities students are asked to consider how they are going to organize for harmonious use of space, maintain their projects, and clean up. They also consider how they are going to work harmoniously with others. Biological projects involve planning for the care and ultimate disposition of animals and agricultural products and growing sites. (Examples: K.3.3 Caring For Classroom Animals, K.4.6 Gardening, 1.3.6 Planning To Raise Small Animals, 2.3.14 Classroom Pets, 2.4.16 Tree Planting; K.7.10 Traffic Simulation, K.9.2 Waste Disposal, 1.7.7 The Great Regatta, 1.10.12 Cardboard House Plan, 2.7.5 Building A Village.)

5. Science and Technology (Continued)

Understanding about science and technology • People have always had questions about their world. Science is one way of answering questions and explaining the natural world. • People have always had problems and invented tools and techniques (ways of doing something) to solve problems. Trying to determine the effects of solutions helps people avoid some new problems. • Scientists and engineers often work in teams with different individuals doing different things that contribute to the results. This understanding focuses primarily on teams working together and secondarily, on the combination of scientist and engineer teams. • Women and men of all ages, backgrounds, and groups engage in a variety of scientific and technological work. • Tools help scientist make better observations, measurements, and equipment for investigations. They help scientists see, measure, and do things that they could not otherwise see, measure, and do.	Basic biological needs and the technologies developed to satisfy them are major organizing ideas throughout *DASH* K–6. In these studies the students are "changers" of the world. In each activity they are given a role of a technologist, scientist, health provider or other who professionally works at the same tasks. They are inventors and work at the tasks of modern farmers, food processors, distributors, and cooks; they are carpenters, plumbers, electricians, and instrument makers: they are makers of sleds, wheeled carriers, rockets, and airplanes; they are communicators with speaking tubes, light, telephone, radio and codes; they are sanitary engineers, health service providers, builders of shelters, and safety experts. In all these experiences they get a deep insight into how we humans have put together the things of nature through manufacturing to enhance our capacity to survive as organisms. During their activities, students readily become aware of physical limitations in making their own devices. They are allowed to encounter the limitations of skill, materials, time, knowledge, the designs themselves, and the community including peers, teacher, administrators, and parents. The *DASH* Connections Book is used to relate what students are doing in the classroom with the wider world outside of school. As tools and techniques are used in class, students are asked to report on similar usage elsewhere. What they do in the microcosm of the school is seen on a continuum with the wider world of humans in general. (Examples: Ancient Technologists 4.1.9 Survival Game, 4.5.6 Preserving Foods, 4.7.1 Boat Design, 4.7.2 Wind And Sails, 4.10.4 Collecting Rocks, 4.10.5 Hardness Of Rocks, 4.10.7 Rocks And Sharp Edges, 4.10.8 Making Tools From Rock, 4.10.9 Making Fishing Tools, 4.10.11 Clay, 4.10.12 Fire And Pottery.) (Examples: Food Technologists 3.4.1 Garden Planning, 3.4.2 Garden Preparation, 3.4.3 Watching Garden Soil, 3.4.4 Making Artificial Soil, 3.4.5 Testing Artificial Soil, 3.4.6 Soil And Water, 3.4.7 Garden Planting, 3.4.8 Garden Care, 3.4.9 Garden Watering Systems, 3.4.1 Garden Invaders, 3.4.11 Controlling Insects, 3.4.12 Garden Harvesting, 3.4.13 Flowers, 3.4.14 Seeds, 3.4.15 Pollination, 3.5.1 Food Selection, 3.5.2 Selecting Plants For The Garden, 3.5.3 Planning The Class Feast, 3.5.4 Preparing The Class Feast, 3.5.5 The Class Feast, 3.5.6 Drying Foods, 3.5.7 Pickling Foods, 3.5.8 Preserving And Rotting, 3.5.9 Supermarket Game Preparation, 3.5.10 Pricing, 3.5.11 Newspaper Ads And Banking, 3.5.12 Farmers And Processors, 3.5.13 Supermarket Game, 4.5.6 Preserving Foods.) (Examples: Health and Sanitation 3.6.10 Disease Transmission, 3.6.11 Trash And Sanitation, 3.6.12 Helpful Drugs, 3.6.13 Proper Drug Use, 4.6.7 Smoking And The Lungs, 4.6.8 Alcohol, Tobacco, And Drugs.)

5. Science and Technology (Continued)

	(Examples: Builders and Communicators 3.3.6 Making Habitats For Frogs And Toads, 3.7.1 Garden Mover, 3.7.2 Propeller-Driven Message Center, 3.7.3 Propeller-Driven Boat, 3.7.4 Delivery Systems, 3.8.4 Propellers Driving Propellers, 3.8.5 Waterwheels, 3.8.6 Propellers In Water, 3.8.7 Heliograph, 3.8.8 Speaking Tube, 3.8.9 String Telephone, 3.10.10 Supermarket Planning, 3.10.11 Supermarket Construction, 4.7.1 Boat Design, 4.7.2 Wind And Sail,.) (Examples: Instrument Makers 3.2.1 Weather, 3.2.2 Temperature, 3.2.4 Wind, 3.10.12 Measuring Devices, 4.2.1 Rainfall, 4.2.2 Snowfall, 4.2.3 Wind Direction, 4.2.4 Wind Speed, 4.2.21 Making A Sundial, 4.2.17 Planetarium, 4.2.19 Planets, 4.10.1 Linear Measurement, 4.10.2 Volume Measurement, 4.10.3 Mass Measurement.) (Examples: Project Developers 3.3.6 Making Habitats For Frogs And Toads, 3.7.1 Garden Mover, 3.7.2 Propeller-Driven Message Center, 3.7.3 Propeller-Driven Boat, 3.7.4 Delivery Systems, 3.8.4 Propellers Driving Propellers, 3.8.5 Waterwheels, 3.8.6 Propellers In Water, 3.8.7 Heliograph, 3.8.8 Speaking Tube, 3.8.9 String Telephone, 3.10.10 Supermarket Planning, 3.10.11 Supermarket Construction, 4.7.1 Boat Design, 4.7.2 Wind And Sail.)
Abilities to distinguish between natural objects and objects made by humans • Some objects occur in nature; others have been designed and made by people to solve human problems and enhance the quality of life. • Objects can be categorized into two groups, natural and designed.	*DASH* students extensively study the properties of naturally occurring materials starting in kindergarten where wood and cloth are introduced as common building materials. In grade 4 stone, clay, natural fibers, wood, and leather are used to construct products using ancient technological processes. (Examples: 4.10.4 Collecting Rocks, 4.10.5 Hardness Of Rocks, 4.10.6 Specific Gravity, 4.10.7 Rocks And Sharp Edges, 4.10.8 Making Tools From Rock, 4.10.9 Making Fishing Tools, 4.10.10 Clowns, 4.10.11 Clay, 4.10.12 Fire And Pottery.) Judging the appropriate qualities of building materials is a necessary part of *DASH* construction and fabrication projects. *DASH* uses the Inventors Box to hold a range of materials from which students can select those most appropriate to their needs. (Examples: K.6.15 Raincoats, K.6.16 Testing Raincoats, K.7.10 Traffic Simulation, K.8.3 Making Things Stop, K.8.6 Repairing Thing, K.10.8 Linear Measurement, 1.3.7 Building Cages, 1.7.5 Making A Boat, 1.10.1 Meter String Can, 1.10.5 Water Systems, 1.10.9 Building With Air, 1.10.13 Making A Cardboard House, 1.10.15-19 (Furnishing The House), 2.4.6 Pipes And Water, 2.4.7 Moving Water With Gravity, 2.4.8 Moving Water With Pumps, 2.7.2 Making Race Cars, 2.7.5-2.7.8 (Building A Traffic Simulation Village), 2.8.1 Camera Obscura, 2.10.1 Desk Organizer, 2.10.3 The Balance, 2.10.4 Meter-String Can, 2.10.5 Measuring Volume.)

5. Science and Technology (Continued)

	DASH students work with and are involved in the production of fabricated materials from kindergarten where they make paper. Probably the most spectacular fabrication occurs in the production of new foods. The students constantly use plastics, metals, and synthetic fibers in their crafting of tools. As part of their search for making connections, production processes are an ongoing point of inquiry. (Examples: Activity Materials Lists, 3.5.3 Planning The Class Feast, 3.5.4 Preparing The Class Feast, 3.5.5 The Class Feast, 3.5.6 Drying Foods, 3.5.7 Pickling Foods, 4.5.6 Preserving Foods, 4.10.11 Clay, 4.10.12 Fire And Pottery.) Recycling is an ongoing project in *DASH* schools. Organic material is composted. Paper, aluminum, plastic, and glass are collected for normal recycling. Other materials are disposed of recognizing that at some future point these to may be recycled. All student projects are produced from recycled materials. (Examples: 3.9.1 Making Compost, 3.9.2 Watching Compost, 3.9.3 Animals In Compost, 3.9.4 Using Compost, 4.9.2 Recycling Project.)

6. Science in Personal and Social Perspectives

Personal health • Safety and security are basic needs of humans. Safety involves freedom from danger, risk, or injury. Security involves feelings of confidence and lack of anxiety and fear. Student understandings include following safety rules for home and school, preventing abuse and neglect, avoiding injury, knowing whom to ask for help, and when and how to say no. • Individuals have some responsibility for their own health. Students should engage in personal care—dental hygiene, cleanliness, and exercise—that will maintain and improve health. Understandings include how communicable diseases, such as colds, are transmitted and some of the body's defense mechanisms that prevent or overcome illness. • Nutrition is essential to health. Students should understand how the body uses food and how various foods contribute to health. Recommendations for good nutrition include eating a variety of foods, eating less sugar, and eating less fat. • Different substances can damage the body and how it functions. Such substances include tobacco, alcohol, over-the-counter medicines, and illicit drugs. Students should understand that some substances, such as prescription drugs can be beneficial, but that any substance can be harmful if used inappropriately.	Two major *DASH* themes are food and nutrition. Understanding the body's nutrient requirements is introduced in Kindergarten and is progressively studied through grade 6. *DASH* students first classify foods as they are used for activation, regulation, or fabrication. In grade 4 they use the US Department of Agriculture's Nutritional Pyramid. (Examples: K.5.4 Familiar Foods, Favorite Foods, New Foods, 1.5.1 Basic Three Food Groups, 1.5.2 Cooking, 2.5.2 Food Preferences, 2.5.3 Basic Food Groups, K.6.4 Exercise, 1.6.7 Staying Healthy, 2.6.6 Staying Well; 3.5.1 Food Selection, 3.5.2 Selecting Plants For The Garden, 3.5.3 Planning The Class Feast, 3.5.5 The Class Feast, 4.5.1 Nutrition Messages, 4.5.4 Food Groups, 4.5.5 Digestion Game, 4.5.6 Preserving Foods.) Hygiene and the dangers of ingesting, inhaling, entry through wounds and injection of foreign organisms and detrimental chemicals are pursued with increasing sophistication in grades K–6. In grades K–2 emphasis is on hygiene. (Examples: K.6.5 Germs, K.6.6 Washing Hands, K.6.7 Bathrooms And Basins, K.6.10 Getting Sick, K.6.11 Feeling Sick, K.6.12 Going To The Doctor, K.6.13 What Doctors Do, K.6.14 Going To The Hospital, 1.6.7 Staying Healthy, 2.1.3 Aphorisms, 2.6.5 Getting Sick, 2.6.5 Staying Well.) Study of germ transmission, disease, and the need for sanitation is stressed from K–6. Each year some aspect of the problem of disease transmission is studied. Virus, bacteria, protozoa, and disease producing microscopic insects are studied in grade 5 and 6 when sexually transmitted diseases become a focal point of investigation. Throughout there is an emphasis on the body's natural defenses and ways of enhancing those defenses. (Examples: K.6.5. Germs, K.6.6. Washing Hands. K.6.7. Bathrooms and Basins, K.6.10. Getting Sick, K.6.11. Feeling Sick, 1.6.7. Staying Healthy. 2.6.5. Getting Sick.)3.6.10 Disease Transmission, 4.4.2 The Fungus Among Us.) *DASH* students make measurements of all the body indicators that are within the practical instrument capability of the classroom including temperature, heart rate, and breathing rate. From this they find that there are normal ranges of data for these functions that apply to most people. They are made aware of more complex tests using X-ray machines, otoscopes, ophthalmoscopes, sphygmomanometers, and body fluid chemical tests. Most important they are made aware of what specific kind of information each kind of body probe produces and what constitutes a normal response. (Examples: Focus Books: Going To The Doctor; What Doctors Do; Going To The Hospital , 3.6.1 Growth Chart, 3.6.2 Tooth Chart, 3.6.3 Breathing Air, 3.6.4 Anatomy Of Breathing, 3.6.5 Lung Model, 3.6.7 Breathing And Pulse Rate, 3.6.8 Heart, Veins, And Arteries, 3.6.9 Heart, Lungs, And Exercise, 4.3.18 Modeling Our Digestive System.)

6. Science in Personal and Social Perspectives (Continued)

	Physical and mental health are seen as intertwined in *DASH* lessons on human behavior. People's feelings are affected by their health and health is affected by feelings. Human emotions are studied through several vehicles. These include role playing, vignette analysis, and interpreting the content of a *DASH* story series. In role playing the students are involved in the creation and analysis of the problems. Multiple perceptions of feelings are evident and become the basis for insight in this emotional variable in their relationships with peers and family. Vignettes and novels create much the same experience through vicarious involvement. (Examples: 3.1.6 Friends, 3.1.7 Giving And Receiving, 3.1.8 Working Together, 4.1.5 Working Together, 4.1.9 Survival Game.) Emotions of joy, anger, and fear are dealt with through commentary to the teacher in the *DASH* Teacher Guide and through a series of activities on group dynamics and friendship. (Examples: K.1.13 Families, K.1.14 Families And Helping, K.1.15 Making Friends, K.1.16 Being Friends, K.1.17 School And Home, 1.1.5 Helping, 1.1.6 Working Together, 1.1.7 Taking Turns And Sharing, 2.1.5 Getting Help, 2.1.6 Making And Keeping Friends, 2.1.7 Turns, 2.1.8 School, Teacher, Friends, And Family) *DASH* uses simulations, puppets, problems in drama as techniques for conflict resolution. These give outlet to ways of solving problems and allow group assessment of effectiveness. (Examples: K.1.16 Being Friends, 1.1.6 Working Together, 1.1.7 Taking Turns And Sharing, 2.1.6 Making And Keeping Friends, 2.1.7 Turns.) The friendship, school, parent series of activities open up opportunities to carry the notions of caring, helping, and talking out problems. (Examples: K.1.13 Families, K.1.14 Families And Helping, K.1.17 School And Home, 1.1.5 Helping, 2.1.5 Getting Help, 2.1.6 Making And Keeping Friends, 2.1.8 School, Teacher, Friends, And Family.) Medicine and various treatment modes are a K–6 theme. In K–2, the idea of medicines is introduced. (Examples: K.6.10 Getting Sick, K.6.11 Feeling Sick, K.6.12 Going To The Doctor, K.6.13 What Do Doctors Do, K.6.14 Going To The Hospital, 1.6.6 Getting Hurt, 1.6.7 Staying Healthy, 2.6.4 Getting Hurt, 2.6.5 Getting Sick, 2.6.6 Staying Well.) Environmental poisons, alcohol, tobacco and recreationally used drugs are topics of extensive study beginning in grade 2. Both the physiological and social implications of their use are studied. Students keep separate class room Scrap Books of newspaper accounts of drugs, tobacco, and alcohol use and treatment. (Examples: 3.4.1 Garden Invaders, 3.4.11 Controlling Insects, 3.6.5 Lung Model, 3.6.6 Lungs And Smoking, 3.6.12 Helpful Drugs, 3.6.13 Proper Drug Use, 4.6.7 Smoking And The Lungs, 4.6.8 Alcohol, Tobacco, And Drug.)

6. Science in Personal and Social Perspectives (Continued)

Characteristics and changes in populations • Human populations include groups of individuals living in a particular location. One important characteristic of human population is the population density—the number of individuals of a particular population that lives in a give amount of space. • The size of a human population can increase or decrease. Populations will increase unless other factors such as disease or famine decrease the population.	Animals, particularly birds in the wild are studied through a two-year period. Individuals are identified. Their ability to survive over the winter is observed and the characteristics of temperament, eating habits, plumage, and other features that more or less enhance their survival are noted. *DASH* includes studies of external anatomy and its affect on the adaptability of organisms in grades K–6. (Examples: K.3.5 Animal Environments, K.3.8 How Bugs Walk, K.3.9 Parts Of Bugs, 1.3.3 Animal Survey, 2.3.7-2.3.13.) Activities in K–2 introduce the concept of once living. Extensions deal with extinct organisms. (Examples: K.3.18 Real and Imaginary.) The idea of differences among people is carried out in the study of difference in general. (Example: K.6.1 Growth Chart, K.6.2 Tooth Chart, 1.6.1 Growth Chart, 1.6.2 Tooth Chart, 2.6.1 Growth Chart, 2.6.2 Tooth Chart)
Types of resources • Resources are things that we get from the living and non living environment to meet the needs and wants of a population. • Some resources are basic materials, such as air, water, and soil; some are produced from basic resources, such as food, fuel, and building materials; and some resources are non material, such as quiet places, beauty, security, and safety. • The supply of many resources is limited. If used, resources can be extended through recycling and decreased use.	Throughout *DASH* a growing list of energy sources are identified and associated with household uses including cooling and house warming. (Examples: K.8.1 Energy, 1.8.4 Sources Of Energy, 1.10.18 Warming And Cooling The House, 1.10.19 Lighting The House, 2.5.10 Energy From Food.) Moving air and water are extensively studied in grade 3. Here students make wind mills, water wheels, paddle wheels, and propellers. This equipment is used to propel boats. The study of wind and water driven machines is returned to in grade 5. (Examples: 3.7.2 Propeller-Driven Message Center, 3.7.3 Propeller-Driven Boat, 3.8.1 Shadow, Light, And Bubbles, 3.8.3 Wind Pulls And Pushes, 3.8.4 Propellers Driving Propellers, 3.8.5 Waterwheels, 3.8.6 Propellers In Water.) Conservation of energy is another theme of *DASH*. Beginning in Kindergarten, students are aware of the need to conserve energy as well as other resources. (Examples: K.8.4 Turning Things Off, K.8.5 Turning Things On, 1.9.2 Conservation Of Energy.) Agriculture is an ongoing study in *DASH* involving both plants and animals. Students are engaged in small-scale farming, including gardening, horticulture, and aquaculture in grades K–6. They deal with cost considerations in deciding what to grow, soil conditions, fertilization, and ways of irrigating their gardens. Simultaneously, they are alert to the practices of large scale farms visited or seen around them and reports on farms in the media as collected on the *DASH* Learning Calendar in conjunction with studies of seasons.

6. Science in Personal and Social Perspectives (Continued)

	(Examples: 3.3.8 Importance Of Frogs And Toads, 3.3.12 Importance Of Birds, 3.4.1 Garden Planning, 3.4.2 Garden Preparation, 3.4.3 Watching Garden Soil, 3.4.4 Making Artificial Soil, 3.4.6 Soil And Water, 3.4.7 Garden Planting, 3.4.8 Garden Care, 3.4.9 Garden Watering Systems, 3.4.10 Garden Invaders, 3.4.11 Controlling Insects, 3.4.12 Garden Harvesting, 3.4.13 Flowers, 3.4.14 Seeds, 3.4.15 Pollination, 3.5.1. Food Selection, 3.5.2 Selecting Plants For The Garden, 3.5.3 Planning The Class Feast, 3.9.1 Making Compost, 3.9.2 Watching Compost, 3.9.3 Animals In Compost, 3.9.4 Using Compost, 3.10.1 Acidic And Basic Soil, 4.1.4 The Learning Calendar, 4.2.23 Seasons And The Sun, 4.4.1 Annual, Biennial, And Perennial Garden Plants, 4.4.2 The Fungus Among Us.) Food preservation is studied from grade 3 on. Students use smoking, drying, freezing, canning, and other techniques for long term preservation of foods. (Examples: 3.5.6 Drying Foods, 3.5.7 Pickling Foods, 3.5.8 Preserving And Rotting, 4.5.6 Preserving Foods.) *DASH* students extensively study the properties of naturally occurring materials starting in kindergarten where wood and cloth are introduced as common building materials. In grade 4 stone, clay, natural fibers, wood, and leather are used to construct products using ancient technological processes. (Examples: 4.10.4 Collecting Rocks, 4.10.5 Hardness Of Rocks, 4.10.6 Specific Gravity, 4.10.7 Rocks And Sharp Edges, 4.10.8 Making Tools From Rock, 4.10.9 Making Fishing Tools, 4.10.10 Clowns, 4.10.11 Clay, 4.10.12 Fire And Pottery.) Recycling is an ongoing project in *DASH* schools. Organic material is composted. Paper, aluminum, plastic, and glass are collected for normal recycling. Other materials are disposed of recognizing that at some future point these to may be recycled. All student projects are produced from recycled materials. (Examples: 3.9.1 Making Compost, 3.9.2 Watching Compost, 3.9.3 Animals In Compost, 3.9.4 Using Compost, 4.9.2 Recycling Project.) Energy depletion, its costs, and means of conservation are studied in grades 2–6. Global interdependence is extensively studied in grades 3–6 including analysis of where foods are produced, how they are transported and stored.

6. Science in Personal and Social Perspectives (Continued)

Changes in environments • Environments are the space, conditions, and factors that affect an individual's and a population's ability to survive and their quality of life. • Changes in environments can be natural or influenced by humans. Some changes are good, some are bad, and some are neither good nor bad. Pollution is a change in the environment that can influence the health, survival, or activities of organisms, including humans. • Some environmental changes occur slowly, and other occur rapidly. Students should understand the different consequences of changing environments in small increments over long periods as compared with changing environments in large increments over short periods.	Study of change is a multi-year activity in *DASH*. (Examples: K.2.6 Moon Watch, K.2.7 Moon Phases, 1.3.3 Animal Survey, 1.4.2 Plant Survey, 2.3.5–2.3.13 (A Year Long Study Of Insects And Spiders), K.2.1 Weather Watch, 1.2.1 Sky And Weather Watch, 1.2.3 Snow And Streams, 1.2.1 Sky And Weather Watch, 2.2.1 Temperature, 2.2.2 Wind, 2.2.5 Rain, 2.2.6 Snow, K.2.8 Seasons, 1.2.8 Night And Day, 1.2.10 The Seasons, 2.2.3 Sunrise, Sunset, And Seasons, K.4.4 Growing Bean Sprouts, K.4.6 Gardening, 1.4.2 Plant Survey, 2.4.9 Vegetable Garden In A Bucket, 2.4.10 Flower Garden In A Bucket, K.3.2 Classroom Animals, K.3.2 Caring For Classroom Animals, 1.3.9 Classroom Pets, 2.3.1 The Classroom Aquarium, 2.3.14 Classroom Pets, K.9.1 Decomposition, 1.9.4 Decomposition And Unearthing, 1.9.5 Decomposition And Reburial, 2.9.1 Fall Unearthing, 2.9.2 Fall Burying, 2.9.3 Spring Unearthing, 2.9.4 Spring Burying, 1.3.8 Metamorphosis, 2.3.6 Hatching Insect Eggs, 2.3.7 Early Metamorphosis, K.6.1 Growth Chart, K.6.2 Tooth Chart, 1.6.1 Growth Chart, 1.6.2 Tooth Chart, 2.6.1 Growth Chart, 2.6.2 Tooth Chart, 2.4.16 Tree Planting.) Study of ecological interactions of plants and animals is a seven-year investigation in *DASH*. Students continually focus on interactions of plants, animals, and humans and their impact on the physical surroundings. (Examples: K.3.6 Animal Environments, K.4.2 Plant Environments, 1.3.3 Animal Survey, 1.4.2 Plant Survey, 2.4.3 Soil And Plants.) Change in environment is seen dramatically in studies of decomposition, human growth, and environmental surveys. (Examples: K.9.1 Decomposition, 1.9.4 Decomposition And Unearthing, 1.9.5 Decomposition And Reburial, 2.9.1 Fall Unearthing, 2.9.2 Fall Burying, 2.9.3 Spring Unearthing, 2.9.4 Spring Burying, K.6.1 Growth Chart, K.6.2 Tooth Chart, 1.6.1 Growth Chart, 1.6.2 Tooth Chart, 2.6.1 Growth Chart, 26.2 Tooth Chart, 1.3.3 Animal Survey, 1.3.4 Animal Key, 1.4.2 Plant Survey, 1.4.4 Plant Key.) Slow change is readily seen in human growth and plant studies. (Examples: 1.4.2 Plant Survey, K.6.1 Growth Chart, 1.6.1 Growth Chart, 2.6.1 Growth Chart, 2.4.1 Soil.) Rapid change is seen in the movement of animals and objects. (Examples: K 3.8 How Bugs Walk, K.8.2 Making Things Move, K.8.3 Making Things Stop, 1.3.9 Classroom Pets, 1.7.7 The Great Regatta, 2.7.3 Racing Cars.)

6. Science in Personal and Social Perspectives (Continued)

Science and technology in local challenges • People continue inventing new ways of doing things, solving problems, and getting work done. New ideas and inventions often affect other people; sometimes the effects are good and sometimes they are bad. It is helpful to try to determine in advance how ideas and inventions will affect other people. • Science and technology have greatly improved food quality and quantity, transportation, health, sanitation, and communication. These benefits of science and technology are not available to all of the people in the world.	The *DASH* Connections Book is used to relate what students are doing in the classroom with the wider world outside of school. As tools and techniques are used in class, students are asked to report on similar usage elsewhere. What they do in the microcosm of the school is seen on a continuum with the wider world of humans in general. In their construction and other technology activities students are asked to consider how they are going to organize for harmonious use of space, maintain their projects, and clean up. They also consider how they are going to work harmoniously with others. Biological projects involve planning for the care and ultimate disposition of animals and agricultural products and growing sites. (Examples: K.3.3 Caring For Classroom Animals, K.4.6 Gardening, 1.3.6 Planning To Raise Small Animals, 2.3.14 Classroom Pets, 2.4.16 Tree Planting; K.7.10 Traffic Simulation, K.9.2 Waste Disposal, 1.7.7 The Great Regatta, 1.10.12 Cardboard House Plan, 2.7.5 Building A Village) Each *DASH* activity identifies the professionals who would do or are involved in the kinds of things students are doing. Teachers invite professionals to class to tell what they do, what their training is, what they receive in salary, and to answer other student questions. As keepers of class pets, tenders of gardens, researchers into the impact of technological practices on forests, shrub, and grasslands *DASH* students are deeply aware of the effects of our technology on other organisms. (Examples: 3.3.1 Classroom Pets, 3.3.2 Preparing To Raise Insects, 3.3.3 Raising Insects, 3.3.6 Making Habitats For Frogs And Toads, 3.3.7 Frog Metamorphosis, 3.3.10 Hatching Checks, 3.3.11 Chick Growth, 3.4.1 Garden Invaders, 3.4.7 Garden Planting, 3.4.8 Garden Care, 3.4.11 Controlling Insects, 4.3.1 Pet Care, 4.3.4 Raising Small Mammals, 4.3.5 Housing Pet Mammals, 4.3.6 Weekend Care Of Pet Mammals, 4.3.7 Pairing Pet Mammals, 4.3.8 Reproduction Of Pet Mammals, 4.3.9 Pet Baby Care.) The deep involvement of students with technology and the regular connecting of the work of the classroom with the technologies pursued in the world around them provide living examples of the place of technology in the culture they know. Exploration of stone cultures gives them a comparative reflection on the import and the enormity of the technology of today. (Examples: *DASH* Connections Books, 4.1.9 Survival Game, 4.5.6 Preserving Foods, 4.7.1 Boat Design, 4.7.2 Wind And Sails, 4.10.4 Collecting Rocks, 4.10.5 Hardness Of Rocks, 4.10.7 Rocks And Sharp Edges, 4.10.8 Making Tools From Rock, 4.10.9 Making Fishing Tools, 4.10.11 Clay, 4.10.12 Fire And Pottery.)

6. Science in Personal and Social Perspectives (Continued)

	By looking at the history of technology *DASH* students gain a sense of the immense difference between our modern technological wealth and the paucity of the available technological products of the past. Through science and technology news articles recorded on the *DASH* Learning Calendar and accounts in the Connections Book they see that much of the world does not yet have access to many of the material products of our culture. (Examples: 3.1.1 The Learning Calendar, 3,1,2 Last Year, 4.1.1 The Learning Calendar, 4.1.3 Last Year, 4.1.4 The Library.) In *DASH*, technology is a vehicle to learning concepts that undergrid science. *DASH* students simultaneously confront engineering principles, scientific laws, and properties of materials. Safety, appearance, space occupied, time necessary for construction, cost, and the impact of failure are all considered in the design phase of projects. Similar concerns in the working world of technology and science are found in interviews with professionals as guest presenters at numerous points in the program. (Examples: 3.10.12 Measuring Devices, 3.10.13 Safety Equipment, 4.10.1 Linear Measurement, 4.10.2 Volume Measurement, 4.10.3 Mass Measurement, 4.10.4 Collecting Rocks, 4.10.5 Hardness Of Rocks, 4.10.7 Rocks And Sharp Edges, 4.10.11 Clay, 4.10.12 Fire And Pottery.) Advantages and disadvantages are a common topic of newspaper articles posted on the Learning Calendar and observations made in the Connections Book. The relative environmental costs and benefits of chemical pesticides and biological controls are studied in agricultural activities. Other costs and benefits such as diseases associated with trash and pollution and the values of clean up; the waste of energy and material resources and their conservation or recycling are ongoing studies. (Examples: 3.4.1 Garden Invaders, 3.4.11 Controlling Insects, 3.6.10 Disease Transmission, 3.6.11 Trash And Sanitation, 3.6.12 Helpful Drugs, 3.6.13 Proper Drug Use, 4.1.1 The Learning Calendar, 4.6.7 Smoking And The Lungs, 4.6.8 Alcohol, Tobacco, And Drugs, 4.9.2 Recycling Project, 5.1.1 The Learning Calendar.)

7. History and Nature of Science

Science as a human endeavor

- Science and technology have been practiced by people for a long time.
- Men and women have made a variety of contributions throughout the history of science and technology.
- Although men and women using scientific inquiry have learned much about the objects, event, and phenomena in nature, much more remains to be understood. Science will never be finished.
- Many people choose science as a career and devote their entire lives to studying it. Many people choose science as a career and devote their entire lives to studying it. Many people derive great pleasure from doing science.

DASH involves all students in doing science. Investigations call for different roles, skills, and knowledge. Each *DASH* activity identifies the kinds of professionals who would engage in such work. Teachers are encouraged to have guest speakers talk with students about their jobs, training, salary, and professional obligations.

In keeping with the goal of science for all students, *DASH* activities are designed for full class participation. To achieve this, activities are designed to address differences in learning styles and modalities. They include opportunities to engage students with strengths in kinesthetic, spatial, logical-mathematical, linguistic, interpersonal, and intrapersonal modes of learning.

Cooperative learning and grouping techniques allow teachers to organize the classroom for maximum use of peer teaching. These techniques cause greater focus on the work under study by all students.

One of the *DASH* goals is to get students to be self-actuated learners willing to pursue their natural curiosity to answer their own questions. Throughout they are asked to frame their own questions and seek answers. To aid in the process techniques such as the Wonder and Discover Book are used.

DASH assumes every child is a teacher. In the Concept and Skill Inventory "can teach" is the highest level of achievement. Throughout students are given the opportunity and encouraged to share their knowledge and skills with others. (Examples: K.1.1 The Learning Calendar, K.1.4 Responsibility, K.1.18 Concept And Skill Inventory, 1.1.1 The Learning Calendar, 1.1.2 The Responsibility Chart, 1.1.5 Helping, 1.1.8 Concept And Skill Inventory, 2.1.1 The Learning Calendar, 2.1.4 Helping Myself And Others, 2.1.5 Getting Help, 2.1.13 Concept And Skill Inventory.)

The *DASH* classroom is designed to model the larger communities of the biological, earth, physical and social sciences; technologies; and health care services. Communication is essential since investigations are interconnected, often long term, and often the product of small groups of students. Records kept in the Science Record Book, on the *DASH* Learning Calendar, in the Working Dictionary, in the Wonder and Discover Book, and in the Connections Book, all have functional import in ongoing work. *DASH* strongly recommends that classrooms supplement the research with trade books, reference works particularly almanacs and newspapers, and science and natural history magazines so the students can get a sense of the vital character of today's science and technology that is being pursued by professionals.

7. History and Nature of Science (Continued)

	Intellectual honesty is held as a high virtue in the communities of technologists and science researchers in which *DASH* students participate. Error is expected, accepted, and overcome by alternative contributions by the community or redoing an investigation or remaking a product. Records are kept as they are generated and changes are recorded as additional data with corresponding explanation. The *DASH* community of technologists and scientists is a community of reason. Ideas are presented based on interpreted experience and data and they are judged on the same basis.

8. Unifying Concepts and Processes

Systems, order, and organization	*DASH* students have wide-ranging experiences with systems and the interaction of parts. They deal with the human body as a system composed of organs, machines as systems composed of parts, the solar system composed of the sun, moon, planets, asteroids, ecosystems composed of living and non-living things, and classrooms as a social system composed of teachers and students. (Examples: Biological Systems. K.3.9 Parts Of Animals, K.3.10 Parts Of Mammals, K.3.12 People, K.4.1 Plant Parts, K.4.4 Bean Sprouts, 1.3.8 Metamorphosis, 1.4.1 Plant Identification, 1.4.2 Plant Pressing, 2.3.2 External Anatomy Of Fish, 2.4.12 Root And Stems; 3.6.5 Lung Model, 3.6.7 Breathing And Pulse Rates, 3.6.8 Heart, Veins, And Arteries, 4.3.15 External Anatomy Of Fish, 4.3.16 Cleaning Fish: Internal Anatomy, 4.3.17 Fish Reproduction, 4.3.18 Modeling Our Digestive System, 4.3.19 Our Digestive System, In Two Dimensions, 4.3.20 Digestive, Circulatory, And Respiratory Systems (Examples: Machines As Systems 3.7.1 Garden Mover, 3.7.2 Propeller-Driven Message Center, 3.7.3 Propeller-Driven Boat, 3.7.4 Delivery Systems, 3.8.4 Propellers Driving Propellers, 3.8.5 Waterwheels, 3.8.6 Propellers In Water, 3.8.9 String Telephone, 3.10.12 Measuring Devices, 4.2.1 Rainfall, 4.2.2 Snowfall, 4.2.21 Making A Sundial, 4.7.1 Boat Design, 4.7..2 Wind And Sail, 4.10.1 Linear Measurement, 4.10.2 Volume Measurement, 4.10.3 Mass Measurement.) (Examples: Solar System 3.2.7 Moon Phases, 3.2.8 Polar Sky Model, 3.2.9 Polar Constellation, 3.2.10 Venus, 3.2.11 Eclipses, 4.2.15 Length Of Day And Night, 4.2.16 The Sun's Shadow Path, 4.2.17 Planetarium, 4.2.18 Using The Planetarium, 4.2.19 Planets, 4.2.20 When Is It Noon?, 4.2.21 Making A Sundial, 4.2.24 Moon Phases And The Sun, 4.2.25 Eclipses.)

8. Unifying Concepts and Processes (Continued)

	(Examples: Ecosystems 3.3.4 Importance Of Insects, 3.3.5 Natural Habitats Of Frogs And Toads, 3.3.6 Making Habitats For Frogs And Toads, 3.3.7 Frog Metamorphosis, 3.3.8 Importance Of Frogs And Toads, 3.3.9 Toads And Insects, 3.3.12 Importance Of Birds, 3.4.10 Garden Invaders, 4.3.22 Migration And Hibernation, 4.3.23 Fall Birds, 4.3.24 Winter Birds, 4.3.25 Spring Birds, 4.4.1 Annual, Biennial, And Perennial Garden Plants, 4.4.2 The Fungus Among Us.) (Examples: Social Systems 3.1.3 Responsibility, 3.1.4 Planning, 3.1.5 Organizing Our Environment, 3.1.6 Friends, 3.1.7 Giving And Receiving, 3.1.8 Working Together, 3.1.9 Helping Myself And Others, 3.1.10 Aphorisms, 3.1.12 Carey's Garden, 4.1.2 Responsibility, 4.1.3 Last Year; 4.1.4 The Library, 4.1.5 Working Together, 4.1.6 Things I Can Do For Myself And Others, 4.1.7 Aphorisms, 4.1.8 Planning, 4.1.9 Survival Game) Environmental parts are developed as the surrounding world is described. (Examples: K.2.1 Weather Watch, K.3.6 Animal Environments, K.4.2 Plant Environments, 1.2.1 Sky And Weather Watch, 1.2.2 Rain And Streams, 1.2.3 Snow And Streams, 2.2.2 Wind, 2.2.5 Rain, 2.2.6 Snow, 2.4.1 Soil, 2.4.4 Uses Of Soil, 2.4.5 Finding Soil) Astronomical parts are progressively identified through the seven years of *DASH*. (Examples: K.2.7 Moon Phases, K.7.2 Sunrise, K.7.3 Sunset, K.7.5 Rising Moon, K.7.6 Setting Moon, 1.2.7 Sunrise And Sun Set, 1.2.9 Sun, 2.2.3 Sunrise , Sunset, And Seasons, 2.2.4 Moonrise And Moonset) Identification of the parts of technological devices is ongoing in all technology activities. (Examples: K.6.15 Rain Coats, K.6.16 Testing Raincoats, K.6.20 Hand And Foot Protection, K.7.10 Traffic Simulation, K.8.3 Making Things Stop, 1.7.5 Making A Boat, 1.7.7 The Great Regatta, 1.10.1 Meter String Can, 1.10.5 Water Systems, 1.10.9 Building With Air, 1.10.13 Making A Cardboard House, 1.10.15-19 (Furnishing The House), 2.4.6 Pipes And Water, 2.4.7 Moving Water With Gravity, 2.4.8 Moving Water With Pumps, 2.7.2 Making Race Cars, 2.7.5 Building A Village) Because of the intensive work with systems, *DASH* students learn early that social and mechanical systems have problems as their parts become dysfunctional (mismatched, tired, missing, worn out, etc.) Likewise, the body and ecosystems can be less effective or productive as changes occur in their parts. (Examples: Body Systems—3.6.5 Lung Model, 3.6.7 Breathing And Pulse Rates, 3.6.8 Heart, Veins, And Arteries, 4.3.20 Digestive, Circulatory, And Respiratory Systems.)

8. Unifying Concepts and Processes (Continued)

	Order and organization—Tendencies to bring order and organization to their work are personal qualities nurtured throughout *DASH*. Students are caused to confront the need for order and organization in their conceptual and skill development, in the ways materials are used and stored, and the way their work environment operates. Ongoing conceptual organization of work is daily arrayed in the use of the Learning Calendar. Data on weather and astronomy are recorded and the day's instructional experience is systematic debriefing to list concepts and skills studied and practiced. Concept mapping and entries in the Working Dictionary regularly cause consideration of connectivity as an organizer of ideas. Throughout *DASH*, organization of work space, personal storage areas such as cubbies and desk compartments is the subject of invention. Notebooks and classroom records are intentionally organized for immediate and long-term retrieval. Safety and need for storage and work space motivate organization and storage of classroom materials. Students are made aware of the need for organization of time, space, and energy to carry out projects and the detailed organization necessary to consider in the technological environments of the school, home, and society. Order and organization are found in studies of natural environments and events. Order as sequence is found in meteorological, astronomical, and cycles of life. Structural organization in nature becomes most evident as the parts and systems of organisms are studied.
Evidence, models, and explanation	Constructing devices and other products is common throughout *DASH*. In major projects, models are made of final products on the assumption that experimentation on a miniature version or a graphic representation is far more efficient than rebuilding the final product after deficiency is found. Students also make models of body parts, the solar system, and the universal sky. (Examples: Mechanical Models—3.7.3 Propeller-Driven Boat, 3.7.4 Delivery Systems, 3.8.5 Water Wheels, 3.10.10 Supermarket Planning, 3.10.11 Supermarket Construction, 4.7.1 Boat Design, 5.8.9 Forces Projects.) (Examples: Body Models—3.6.5 Lung Model, 4.3.18 Modeling Our Digestive System, 4.3.19 Our Digestive System In Two Dimensions, 4.3.20 Digestive, Circulatory, And Respiratory Systems.) (Examples: Astronomical Models—3.2.8 Polar Sky Model, 4.2.17 Planetarium, 4.2.18 Using The Planetarium 4.2.24 Moon Phases And The Sun, 4.2.25 Eclipses.)

8. Unifying Concepts and Processes (Continued)

	DASH students are constantly communicating with each other, their teacher, and a wider audience of parents and interested outsiders. To do this they use a full range of modes of communication including geometric figures in geometric explanations of problems, number sequences in deciphering codes, graphs analysis and presentation of data, diagrams and sketches of things to be made and things observed, number lines in timelines and instrument scales, maps in planning projects, and projectional stories about what could have and might yet happen. (Examples: Graphs/Number Lines—3.2.2 Temperature, 3.2.5 Rain And Snow, 3.2.6 Humidity, 3.6.1 Growth Chart, 3.6.2 Tooth Chart, 4.2.1 Rainfall, 4.2.2 Snowfall, 4.2.15 Length Of Day And Night, 4.2.23 Seasons And The Sun, 4.2.24 Moon Phases And The Sun, 4.6.1 Growth Chart And Area Measurement, 4.6.2 Tooth Chart.) (Examples: Geometry—4.2.5 Height Of Clouds, 4.2.16 The Sun's Shadow Path, 4.2.20 When Is It Noon?, 4.2.21 Making A Sundial, 4.2.22 Using A Sundial, 4.8.5 Energy Of Falling Objects, 4.8.6 Circles And Speed.) (Examples: Scale Drawings—3.2.8 Polar Sky Model, 3.3.6 Making Habitats For Frogs And Toads, 3.4.1 Garden Planning, 3.7.1 Garden Mover, 3.7.2 Propeller-Driven Message Center, 3.7.3 Propeller-Driven Boat, 3.7.4 Delivery Systems, 3.10.10 Supermarket Planning, 4.3.5 Housing Pet Mammals, 4.7.1 Boat Design.) (Examples: Diagrams And Models—3.7.3 Propeller-Driven Boat, 3.7.4 Delivery Systems, 3.8.5 Water Wheels, 3.10.10 Supermarket Planning, 3.10.11 Supermarket Construction, 4.7.1 Boat Design.) (Examples: Projects—3.2.8 Polar Sky Model, 3.6.5 Lung Model, 4.2.17 Planetarium, 4.2.18 Using The Planetarium, 4.2.24 Moon Phases And The Sun, 4.2.25 Eclipses, 4.3.18 Modeling Our Digestive System, 4.3.19 Our Digestive System In Two Dimensions, 4.3.20 Digestive, Circulatory, And Respiratory Systems.) (Examples: Prediction—3.2.7 Moon Phases, 3.6.1 Growth Chart, 3.6.2 Tooth Chart, 3.9.5 Fall Unearthing And Burial, 3.9.6 Spring Unearthing And Burial, 4.2.1 Rainfall, 4.2.2 Snowfall, 4.2.3 Wind Direction, 4.2.4 Wind Speed, 4.2.5 Height Of Clouds, 4.2.6 Humidity, 4.2.12 Predicting Weather, 4.2.23 Seasons And The Sun, 4.2.24 Moon Phases And The Sun, 4.2.25 Eclipses, 4.6.1 Growth Chart And Area Measurement, 4.6.2 Tooth Chart, 4.9.1 Unearthing, 4.9.2 Recycling Project.)

8. Unifying Concepts and Processes (Continued)

	Evidence and explanation—From the beginning of kindergarten students are involved in observing, describing, classifying, and generalizing about phenomena in the artificial and natural worlds around them. This evidentiary base becomes the grist for explanation of how things work. In the beginning, explanation is tested in the light of reasonableness—Does the explanation being made fit with the evidence we know? Over time the evidentiary process is a product of intentional experimental probing to test explanation. Almost all *DASH* activities provide the stuff of evidence. Many evoke generalization and explanation.
Change, constancy, and measurement	*DASH* students are daily observers of change. They see change and constancy in common features of the events around them—in the growth of plants and animals and their own growth, in the decomposition and materials, in their constructing with materials, in their interpersonal relationships. They also see, handle, make, and use numerous things that have shapes that when viewed from different angles appear to be the same-spheres and circles, cubes and squares, and other geometric figures and organisms that mimic these geometries. Constancy and change are seen in studies of decomposition, human growth, and environmental surveys. (Examples: K.9.1 Decomposition, 1.9.4 Decomposition And Unearthing, 1.9.5 Decomposition And Reburial, 2.9.1 Fall Unearthing, 2.9.2 Fall Burying, 2.9.3 Spring Unearthing, 2.9.4 Spring Burying, K.6.1 Growth Chart, K.6.2 Tooth Chart, 1.6.1 Growth Chart, 1.6.2 Tooth Chart, 2.6.1 Growth Chart, 26.2 Tooth Chart, 1.3.3 Animal Survey, 1.3.4 Animal Key, 1.4.2 Plant Survey, 1.4.4 Plant Key.) Changes in color, size, weight, and movement are found in many activities. (Examples: 1.4.2 Plant Survey, 1.4.3 Plant Press, 3.4.10 Plants And Sunlight, K.6.1 Growth Chart, K.6.2 Tooth Chart, 1.6.1 Growth Chart, 1.6.2 Tooth Chart, 2.6.1 Growth Chart, 2.6.2 Tooth Chart.) Slow change is readily seen in human growth and plant studies. (Examples: 1.4.2 Plant Survey, K.6.1 Growth Chart, 1.6.1 Growth Chart, 2.6.1 Growth Chart, 2.4.1 Soil.) Rapid change is seen in the movement of animals and objects. (Examples: K 3.8 How Bugs Walk, K.8.2 Making Things Move, K.8.3 Making Things Stop, 1.3.9 Classroom Pets, 1.7.7 The Great Regatta, 2.7.3 Racing Cars.)

8. Unifying Concepts and Processes (Continued)

	(Examples: Change—3.2.1 Weather, 3.2.2 Temperature, 3.2.4 Wind, 3.2.5 Rain And Snow, 3.2.6 Humidity, 3.2.7 Moon Phases, 3.2.8 Polar Sky Model, 3.2.9 Polar Constellations, 3.2.10 Venus, 3.2.11 Eclipses, 3.3.3 Raising Insects, 3.3.5 Natural Habitats Of Frogs And Toads, 3.3.7 Frog Metamorphosis, 3.3.9 Toads And Insects, 3.3.10 Hatching Chicks, 3.3.11 Chick Growth, 3.4.3 Watching Garden Soil, 3.4.5 Testing Artificial Soil, 3.4.6 Soil And Water, 3.4.7 Garden Planting, 3.4.8 Garden Care, 3.4.9 Garden Watering Systems, 3.4.10 Garden Invaders, 3.4.11 Controlling Insects, 3.4.12 Garden Harvesting, 3.4.13 Flower, 3.4.14 Seeds, 3.4.15 Pollination, 3.9.1 Making Compost, 3.9.2 Watching Compost, 3.9.3 Animals In Compost, 3.9.4 Using Compost, 3.9.5 Fall Unearthing And Burial, 3.9.6 Spring Unearthing, 4.2.1 Rainfall, 4.2.2 Snowfall, 4.2.3 Wind Direction, 4.2.4 Wind Speed, 4.2.5 Height Of Clouds, 4.2.6 Humidity, 4.2.7 Clouds And Weather, 4.2.8 Storm Clouds, 4.2.10 Weather Maps, 4.2.12 Predicting Weather, 4.2.13 Wind Chill, 4.2.14 Flat Or Round Earth. 4.2.15 Length Of Day And Night, 4.2.16 The Sun's Shadow Path, 4.2.17 Planetarium, 4.2.18 Using The Planetarium, 4.2.19 Planets, 4.2.20 When Is It Noon?, 4.2.22 Using A Sundial, 4.2.23 Seasons, 4.3.9 Pet Baby Care, 4.3.10 Our Early Years, 4.3.11 The First Grade Child, 4.3.12 Growth, Development, And Behavior Of Young Pets, 4.3.13 Human Growth And Development, 4.3.14 Changing Dimensions, 4.3.17 Fish Reproduction, 4.3.18 Modeling Our Digestive System, 4.3.22 Migration And Hibernation, 4.3.23 Fall Birds, 4.3.24 Winter Birds, 4.3.25 Spring Birds, 4.4.1 Annual, Biennial, And Perennial Garden Plants, 4.6.1 Growth Chart And Area Measurement, 4.6.2 Tooth Chart, 4.9.1 Unearthing.) Rhythm of change and rate of change are both inherent in many *DASH* studies. To give analyzable accounts of these kinds of change, measurements are constantly made. Investigations involving measurements of rhythm are found in studies of the phase of the moon, the movement of the sun along the ecliptic, the growth, maturity, and death of plants and animals. Rate studies include growth rates, speeds of vehicle, decomposition rates, and rates of heating. (Examples: Regular And Irregular Rates Of Change, 3.2.1 Weather, 3.2.6 Humidity, 3.2.7 Moon Phases, 3.2.8 Polar Sky Model, 3.2.9 Polar Constellation, 3.2.10 Venus, 3.2.11 Eclipses, 3.3.3 Raising Insects.) Measurement Counting is basic to all *DASH* activities. Measuring with metric and other tools is found throughout *DASH*. Measuring tools include are clocks, watches, calendars, thermometers, rulers, metric marked strings, area grid paper, volumetric measuring cups, graduated cylinders, scales, balances and compasses. *DASH* students make almost all of the measuring equipment they use in the classroom. Instrument making has two functions. First, it provides measurements of data for science inquiries and technological construction and services activities. Second, it causes the student to think about the nature of measurement, its functions, limitations, and advantages.

8. Unifying Concepts and Processes (Continued)

	Human error, instrument, and observational error are considered in all measurement problems. *DASH* students quickly find that actual measurements are quite often slightly different, and the same measurement is seen slightly differently by different observers. (Examples: 3.10.12 Measuring Devices, 4.10.1 Linear Measurement, 4.10.2 Volume Measurement, 4.10.3 Mass Measurement.)
Evolution and equilibrium	Evolution in the sense of evolving ordered and predictable change over time is a common experience in *DASH*. This is found in studies of seasonal change, life cycle changes including their own physiology, and astronomical and meteorological change. Evolution in the Darwinian sense is saved for the experience of grades 5–8. Equilibrium in the sense of balance is brought out in the making of metric balances. Balance within ecological systems is found in observation of classroom aquariums.
Form and function	Form and function are called on in organizing categories of objects such as organisms and in the creation of definition. Kindergartners are introduced to the roles of form and function in definition in the *DASH* Focus Book, The Friendly Shape. Question about form and function are asked throughout *DASH*.

CURRICULUM RESEARCH & DEVELOPMENT GROUP

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