

MST

Combined Standards [\[1\]](#) [\[2\]](#) [\[6\]](#) [\[7\]](#)

Math Standard 3 (Revised 2005)

Science Standard 4

Technology Standard 5

Standard 1 – Analysis, Inquiry, and Design

Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seek answers, and develop solutions.

Mathematical Analysis – Key Idea 3 - Critical thinking skills are used in the solution of mathematical problems.

- Elementary: explore and solve problems generated from school, home, and community situations, using concrete objects or manipulative materials when possible.

Scientific Inquiry – Key Idea 1 - The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing, creative process.

- Elementary: question the explanations they hear from others and read about, seeking clarification and comparing them with their own observations and understandings.
- Commencement: hone ideas through reasoning, library research, and discussion with others, including experts.

Scientific Inquiry – Key Idea 2 - Beyond the use of reasoning and consensus, scientific inquiry involves the testing of proposed explanations involving the use of conventional techniques and procedures and usually requiring considerable ingenuity.

- Intermediate: develop, present, and defend formal research proposals for testing their own explanations of common phenomena, including ways of obtaining needed observations and ways of conducting simple controlled experiments.

Scientific Inquiry – Key Idea 3 - The observations made while testing proposed explanations, when analyzed using conventional and invented methods, provide new insights into phenomena.

- Commencement: develop a written report for public scrutiny that describes their proposed explanation, including a literature review, the research they carried out, its result, and suggestions for further research.

Engineering Design – Key Idea 1 - Engineering design is an iterative process involving modeling and optimization finding the best solution within given constraints which is used to develop technological solutions to problems within given constraints.

- Elementary: generate ideas for possible solutions, individually and through group activity; apply age-appropriate mathematics and science skills; evaluate the ideas and determine the best solution; and explain reasons for the choices.
- Intermediate: identify needs and opportunities for technical solutions from an investigation of situations of general or social interest.
- Intermediate: consider constraints and generate several ideas for alternative solutions, using group and individual ideation techniques (group discussion, brainstorming, forced connections, role play); defer judgment until a number of ideas have been generated; evaluate (critique) ideas; and explain why the chosen solution is optimal.
- Commencement: generate creative solutions, break ideas into significant functional elements, and explore possible refinements; predict possible outcomes using mathematical and functional modeling techniques; choose the optimal solution to the problem, clearly documenting ideas against design criteria and constraints; and explain how human understands, economics, ergonomics, and environmental considerations have influenced the solution.

Standard 2 – Information Systems

Students will access, generate, process, and transfer information using appropriate technologies.

Information Systems – Key Idea 1 - Information technology is used to retrieve, process, and communicate information and as a tool to enhance learning.

- Elementary: access needed information from printed media, electronic data bases, and community resources.
- Intermediate: systematically obtain accurate and relevant information pertaining to a particular topic from a range of sources, including local and national media, libraries, museums, governmental agencies, industries, and individuals.
- Commencement: students receive news reports from abroad and work in groups to produce newspapers reflecting the perspectives of different countries.

Information Systems – Key Idea 2 - Knowledge of the impacts and limitations of information systems is essential to its effective and ethical use.

- Elementary: describe the uses of information systems in homes, schools, and businesses.
- Elementary: demonstrate ability to evaluate information.
- Intermediate: understand why electronically stored personal information has greater potential for misuse than records kept in conventional form.
- Commencement: discuss the ethical and social issues raised by the use and abuse of information systems.

Information Systems – Key Idea 3 - Information technology can have positive and negative impacts on society, depending on how it is used.

- Intermediate: use graphical, statistical, and presentation software to present projects to fellow classmates.
- Intermediate: describe applications of information technology in mathematics, science, and other technologies that address needs and solve problems in the community.
- Commencement: discuss how applications of information technology can address some major global problems and issues.
- Commencement: discuss the environmental, ethical, moral, and social issues raised by the use and abuse of information technology.

Standard 3 – Mathematics (Revised 2005)

Students will understand the concepts of and become proficient with the skills of mathematics; communicate and reason mathematically; become problem solvers by using appropriate tools and strategies; through the integrated study of number sense and operations, algebra, geometry, measurement, and statistics and probability.

Students will gain a better understanding of mathematics and have longer retention of mathematical knowledge as they solve problems, reason mathematically, prove mathematical relationships, participate in mathematical discourse, make mathematical connections, and model and represent mathematical ideas in a variety of ways. A broad range of content, taught in an integrated fashion, allows students to see how various mathematics knowledge is related, not only within mathematics, but also to other disciplines and the real world as well.

Performance Indicators from the elementary, middle and commencement levels:

Communications Strand

- Share organized mathematical ideas through the manipulation of objects, numerical tables, drawings, pictures, charts, graphs, tables, diagrams, models and symbols in written and verbal form
- Share organized mathematical ideas through the manipulation of objects, numerical tables, drawings, pictures, charts, graphs, tables, diagrams, models and symbols in written and verbal form
- Draw conclusions about mathematical ideas through decoding, comprehension, and interpretation of mathematical visuals, symbols, and technical writing

Connections Strand

- Recognize and provide examples of the presence of mathematics in their daily lives
- Apply mathematical ideas to problem situations that develop outside of mathematics
- Investigate the presence of mathematics in careers and areas of interest
- Recognize and apply mathematics to other disciplines, areas of interest, and societal issues

Representation Strand

- Use mathematics to show and understand social phenomena (e.g. determine profit from sale of yearbooks)

Standard 4 – Science

Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science.

Physical Setting – Key Idea 2 - Many of the phenomena that we observe on Earth involve interactions among components of air, water, and land.

- Elementary: describe the relationships among air, water, and land on Earth.

Physical Setting – Key Idea 4 - Energy exists in many forms, and when these forms change energy is conserved.

- Intermediate: describe the sources and identify the transformations of energy observed in everyday life.
- Commencement: observe and describe transmission of various forms of energy.

The Living Environment – Key Idea 5 - Organisms maintain a dynamic equilibrium that sustains life.

- Intermediate: describe the importance of major nutrients, vitamins, and minerals in maintaining health and promoting growth and explain the need for a constant input of energy for living organisms.

The Living Environment – Key Idea 6 - Plants and animals depend on each other and their physical environment.

- Elementary: describe how plants and animals, including humans, depend upon each other and the nonliving environment.

The Living Environment – Key Idea 7 - Human decisions and activities have had a profound impact on the physical and living environment.

- Commencement: explain how individual choices and societal actions can contribute to improving the environment.

Standard 5 – Technology

Students will apply technological knowledge and skills to design, construct, use, and evaluate products and systems to satisfy human and environmental needs.

Key Idea 3 – Computer Technology - Computers, as tools for design, modeling, information processing, communication, and system control, have greatly increased human productivity and knowledge.

- Intermediate: use a computer system to connect to and access needed information from various Internet sites.

Key Idea 4 – Technological Systems - Technological systems are designed to achieve specific results and produce outputs, such as products, structures, services, energy, or other systems.

- Intermediate: describe how subsystems and system elements (inputs, processes, and outputs) interact within systems. (compare government structure to a factory/company structure)

Key Idea 5 – History and Evolution of Technology - Technology has been the driving force in the evolution of society from an agricultural to an industrial to an information base.

- Intermediate: describe how the evolution of technology led to the shift in society from an agricultural base to an industrial base to an information base.
- Intermediate: understand the contributions of people of different genders, races, and ethnic groups to technological development.
- Intermediate: understand the contributions of people of different genders, races, and ethnic groups to technological development.
- Commencement: explain how technological inventions and innovations have caused global growth and interdependence, stimulated economic competitiveness, created new jobs, and made other jobs obsolete.

Key Idea 6 – Impacts of Technology - Technology can have positive and negative impacts on individuals, society, and the environment and humans have the capability and responsibility to constrain or promote technological development.

- Elementary: describe how technology can have positive and negative effects on the environment and on the way people live and work.
- Commencement: explain how computers and automation have changed the nature of work.
- Commencement: explain how national security is dependent upon both military and nonmilitary applications of technology.

Key Idea 7 – Management of Technology: Project management is essential to ensuring that technological endeavors are profitable and that products and systems are of high quality and built safely, on schedule, and within budget.

- Elementary: speculate on and model possible technological solutions that can improve the safety and quality of the school or community environment.
- Intermediate: assume leadership responsibilities within a structured group activity.

- Commencement: explain how statistical process control helps to assure high quality output.
- Commencement: discuss the role technology has played in the operation of successful U.S. businesses and under what circumstances they are competitive with other countries.

Standard 6 – Interconnectedness: Common Themes

Students will understand the relationships and common themes that connect mathematics, science, and technology and apply the themes to these and other areas of learning.

Systems Thinking – Key Idea 1 - Through systems thinking, people can recognize the commonalities that exist among all systems and how parts of a system interrelate and combine to perform specific functions.

- Elementary: identify common things that can be considered to be systems (e.g., a plant population, a subway system, human beings).
- Commencement: define boundary conditions when doing systems analysis to determine what influences a system and how it behaves.

Magnitude and Scale – Key Idea 3 - The grouping of magnitudes of size, time, frequency, and pressures or other units of measurement into a series of relative order provides a useful way to deal with the immense range and the changes in scale that affect the behavior and design of systems.

- Commencement: describe the effects of changes in scale on the functioning of physical, biological, or designed systems.

Equilibrium and Stability – Key Idea 4 - Equilibrium is a state of stability due either to a lack of changes (static equilibrium) or a balance between opposing forces (dynamic equilibrium).

- Elementary: cite examples of systems in which some features stay the same while other features change.

Patterns of Change – Key Idea 5 - Identifying patterns of change is necessary for making predictions about future behavior and conditions.

- Intermediate: observe patterns of change in trends or cycles and make predictions on what might happen in the future.

Optimization – Key Idea 6 - In order to arrive at the best solution that meets criteria within constraints, it is often necessary to make trade-offs.

- Intermediate: determine the criteria and constraints and make tradeoffs to determine the best decision.

Standard 7 – Interdisciplinary Problem Solving

Students will apply the knowledge and thinking skills of mathematics, science, and technology to address real-life problems and make informed decisions.

Note: All of the Key Ideas and Performance Indicators included in MST Standard 7 accentuate interdisciplinary learning.

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