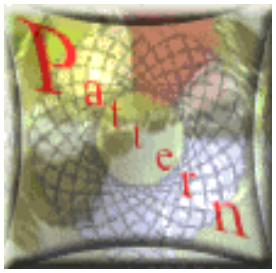
Interconnectedness: Common Themes

STANDARD 6

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.

MST Standards



Alternate Assessment Standards for Students with Severe Disabilities

Standard 6: Models

Standard 6: Magnitude and Scale

Standard 6: Equilibrium and Stability

Standard 6
Interconnectedness: Common Themes

Systems Thinking

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.

Key Idea: 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.

Performance Indicators--Students will:

Elementary	Intermediate	Commencement
• observe and describe interactions among components of simple systems	• describe the differences between dynamic systems and organizational systems	• explain how positive feedback and negative feedback have opposite effects on system outputs
• identify common things that can be considered to be systems (e.g., a plant population, a subway system, human beings)	• describe the differences and similarities between engineering systems, natural systems, and social systems	• use an input-process output-feedback diagram to model and compare the behavior of natural and engineered systems
	• describe the differences between open- and closed loop systems	• define boundary conditionswhen doing systems analysis to determine what influences a system and how it behaves
	• describe how the output from one part of a system (which can include material, energy, or information) can become the input to other parts	

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Models

Key Idea: Models are simplified representations of objects, structures, or systems used in analysis, explanation, interpretation, or design.

Performance Indicators--Students will:

Elementary	Intermediate	Commencement
• analyze, construct, and operate models in order to discover attributes of the real thing	• select an appropriate model to begin the search for answers or solutions to a question or problem	• revise a model to create a more complete or improved representation of the system
• discover that a model of something is different from the real thing but can be used to study the real thing	• use models to study processes that cannot be studied directly (e.g., when the real process is too slow, too fast, or too dangerous for direct observation)	• collect information about the behavior of a system and use modeling tools to represent the operation of the system
• use different types of models, such as graphs, sketches, diagrams, and maps, to represent various aspects of the real world	• demonstrate the effectiveness of different models to represent the same thing and the same model to represent different things	• find and use mathematical models that behave in the same manner as the processes under investigation
		• compare predictions to actual observations using test models

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Magnitude and Scale

Key Idea: 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.

Performance Indicators--Students will:

Elementary	Intermediate	Commencement
• provide examples of natural and manufactured things that belong to the same category yet have very different sizes, weights, ages, speeds, and other measurements	• cite examples of how different aspects of natural and designed systems change at different rates with changes in scale	• describe the effects of changes in scale on the functioning of physical, biological, or designed systems
• identify the biggest and the smallest values as well as the average value of a system when given information about its characteristics and behavior	• use powers of ten notation to represent very small and very large numbers	• extend their use of powers of ten notation to understanding the exponential function and performing operations with exponential factors

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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.

Equilibrium and Stability

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

Performance Indicators--Students will:

Elementary	Intermediate	Commencement
• cite examples of systems in which some features stay the same while other features change	• describe how feedback mechanisms are used in both designed and natural systems to keep changes within desired limits	• describe specific instances of how disturbances might affect a system's equilibrium, from small disturbances that do not upset the equilibrium to larger disturbances (threshold level) that cause the system to become unstable
• distinguish between reasons for stability–from lack of changes to changes that counterbalance one another to changes within cycles	• describe changes within equilibrium cycles in terms of frequency or cycle length and determine the highest and lowest values and when they occur	• cite specific examples of how dynamic equilibrium is achieved by equality of change in opposing directions

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Patterns of Change

Key Idea: Identifying patterns of change is necessary for making predictions about future behavior and conditions.

Performance Indicators--Students will:

Elementary	Intermediate	Commencement
• use simple instruments to measure such quantities as distance, size, and weight and look for patterns in the data	• use simple linear equations to represent how a parameter changes with time	• use sophisticated mathematical models, such as graphs and equations of various algebraic or trigonometric functions
• analyze data by making tables and graphs and looking for patterns of change	• observe patterns of change in trends or cycles and make predictions on what might happen in the future	• search for multiple trends when analyzing data for patterns, and identify data that do not fit the trends

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Optimization

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.

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

Performance Indicators--Students will:

Elementary	Intermediate	Commencement
• determine the criteria and constraints of a simple decision making problem	• determine the criteria and constraints and make tradeoffs to determine the best decision	• use optimization techniques, such as linear programming, to determine optimum solutions to problems that can be solved using quantitative methods
• use simple quantitative methods, such as ratios, to compare costs to benefits of a decision problem	• use graphs of information for a decision making problem to determine the optimum solution	• analyze subjective decision making problems to explain the trade-offs that can be made to arrive at the best solution

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Models

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.

Key Idea: Models are simplified representations of objects, structures or systems used in analysis, explanation, interpretation or design.

ALTERNATE ASSESSMENT

Performance Indicators--Students:

• reconstruct and operate models in order to discover attributes of the real thing

• discover that a model of something is different from the real thing but can be used to study the real thing

• use different types of models, such as graphs, sketches, diagrams, dioramas and maps, to represent various aspects of the real world

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Magnitude and Scale

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.

Key Idea: 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.

ALTERNATE ASSESSMENT

Performance Indicators--Students:

• rprovide examples of natural and manufactured things that belong to the same category yet have very different sizes, weights, ages, speeds and other measurements

• identify the biggest and the smallest values of a system when given information about its characteristics and behavior

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Equilibrium and Stability

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.

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

ALTERNATE ASSESSMENT

Performance Indicators--Students:

• observe a balance and notice what happens when objects are placed on the balance

• record body temperature, etc.