# KENAI PENINSULA BOROUGH SCHOOL DISTRICT

148 North Binkley Street Soldotna, Alaska 99669-7553
Phone (907) 714-8888 Fax (907) 262-9132
www.kpbsd.k12.ak.us


## SCHOOL BOARD COMMUNICATION

| | | | |
|---|---|---|---|
| **Title:** | Curriculum Revision, Science and Social Studies | | |
| **Date:** | September 9, 2013 | **Item Number:** | Work Session |
| **Administrator:** | Melissa Linton, Curriculum and Assessment Coordinator Melissa Linton<br>Through Sean Dusek, Assistant Superintendent of Instruction Sean Dusek | | |
| **Attachments:** | Science and Social Studies Curriculum – First draft | | |

☐ **Action Needed** ☐ **For Discussion** ☒ **Information** ☐ **Other:** _____

## BACKGROUND INFORMATION

The Social Studies and Science Curriculum Committees have revised curriculum documents based on the new AK Literacy Standards, AK Mathematics Standards, and the Next Generation Science Standards. Administrators and certified staff will have the opportunity to review the revised drafts of the science and social studies curriculum. Both committees identified criteria for the material evaluation process for their in-depth review process. Vendors will not be present for either material review session in September. Once the committees make a recommendation, an email with links will be sent to teachers of social studies and science for their feedback. Questions and comments are welcomed by the Board and will be taken back to the committee for further study if required.

## ADMINISTRATIVE RECOMMENDATION

# Kenai Peninsula Borough School District

**September 9, 2013**

**Homer High School Library**

# Social Studies and Science Curriculum Worksession

**Presented by Melissa Linton**

**KPBSD Curriculum and Assessment Coordinator**

# Three Dimensions of the *Next Generation Science Standards* (NGSS)

## Scientific and Engineering Practices

### Asking Questions and Defining Problems

A practice of science is to ask and refine questions that lead to descriptions and explanations of how the natural and designed world works and which can be empirically tested.

Engineering questions clarify problems to determine criteria for successful solutions and identify constraints to solve problems about the designed world.

Both scientists and engineers also ask questions to clarify the ideas of others.

### Planning and Carrying Out Investigations

Scientists and engineers plan and carry out investigations in the field or laboratory, working collaboratively as well as individually. Their investigations are systematic and require clarifying what counts as data and identifying variables or parameters.

Engineering investigations identify the effectiveness, efficiency, and durability of designs under different conditions.

### Analyzing and Interpreting Data

Scientific investigations produce data that must be analyzed in order to derive meaning. Because data patterns and trends are not always obvious, scientists use a range of tools—including tabulation, graphical interpretation, visualization, and statistical analysis—to identify the significant features and patterns in the data. Scientists identify sources of error in the investigations and calculate the degree of certainty in the results. Modern technology makes the collection of large data sets much easier, providing secondary sources for analysis.

Engineering investigations include analysis of data collected in the tests of designs. This allows comparison of different solutions and determines how well each meets specific design criteria—that is, which design best solves the problem within given constraints. Like scientists, engineers require a range of tools to identify patterns within data and interpret the results. Advances in science make analysis of proposed solutions more efficient and effective.

### Developing and Using Models

A practice of both science and engineering is to use and construct models as helpful tools for representing ideas and explanations. These tools include diagrams, drawings, physical replicas, mathematical representations, analogies, and computer simulations.

Modeling tools are used to develop questions, predictions and explanations; analyze and identify flaws in systems; and communicate ideas. Models are used to build and revise scientific explanations and proposed engineered systems. Measurements and observations are used to revise models and designs.

### Constructing Explanations and Designing Solutions

*The products of science are explanations and the products of engineering are solutions.*

The goal of science is the construction of theories that provide explanatory accounts of the world. A theory becomes accepted when it has multiple lines of empirical evidence and greater explanatory power of phenomena than previous theories.

The goal of engineering design is to find a systematic solution to problems that is based on scientific knowledge and models of the material world. Each proposed solution results from a process of balancing competing criteria of desired functions, technical feasibility, cost, safety, aesthetics, and compliance with legal requirements. The optimal choice depends on how well the proposed solutions meet criteria and constraints.

### Engaging in Argument from Evidence

*Argumentation is the process by which explanations and solutions are reached.*

In science and engineering, reasoning and argument based on evidence are essential to identifying the best explanation for a natural phenomenon or the best solution to a design problem. Scientists and engineers use argumentation to listen to, compare, and evaluate competing ideas and methods based on merits.

Scientists and engineers engage in argumentation when investigating a phenomenon, testing a design solution, resolving questions about measurements, building data models, and using evidence to identify strengths and weaknesses of claims.

### Using Mathematics and Computational Thinking

In both science and engineering, mathematics and computation are fundamental tools for representing physical variables and their relationships. They are used for a range of tasks such as constructing simulations; statistically analyzing data; and recognizing, expressing, and applying quantitative relationships.

Mathematical and computational approaches enable scientists and engineers to predict the behavior of systems and test the validity of such predictions. Statistical methods are frequently used to identify significant patterns and establish correlational relationships.

### Obtaining, Evaluating, and Communicating Information

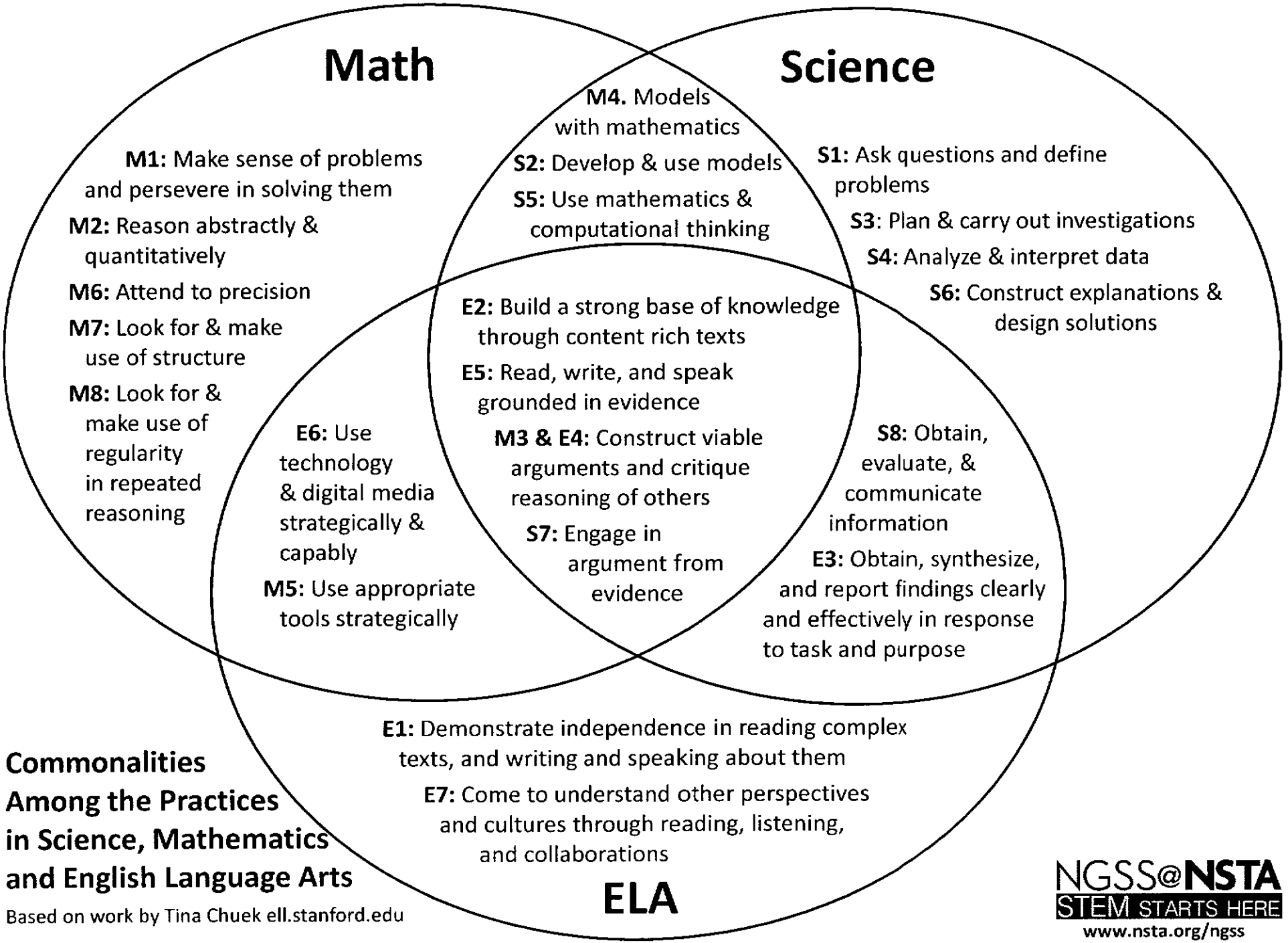
Scientists and engineers must be able to communicate clearly and persuasively the ideas and methods they generate. Critiquing and communicating ideas individually and in groups is a critical professional activity.

Communicating information and ideas can be done in multiple ways: using tables, diagrams, graphs, models, and equations as well as orally, in writing, and through extended discussions. Scientists and engineers employ multiple sources to acquire information that is used to evaluate the merit and validity of claims, methods, and designs.

NGSS@NSTA
STEM STARTS HERE
www.nsta.org/ngss



Developed by NSTA based on content from the *Framework for K-12 Science Education* and supporting documents for the *May 2012 Public Draft of the NGSS*




**Commonalities Among the Practices in Science, Mathematics and English Language Arts**

Based on work by Tina Chuek ell.stanford.edu

NGSS@NSTA
STEM STARTS HERE
www.nsta.org/ngss

# NGSS Matrix Organized by Topics

NGSS@NSTA
STEM STARTS HERE
ngss.org/ngss

| | | Life Science | Earth & Space Science | Physical Science | Engineering |
|---|---|---|---|---|---|
| Elementary School | K | K.Interdependent Relationships in Ecosystems: Animals, Plants, and Their Environment | K.Weather and Climate | K.Forces and Interactions: Pushes and Pulls | K-2.Engineering Design |
| | 1 | 1.Structure and Function | 1.Space Systems: Patterns and Cycles | 1.Waves: Light and Sound | |
| | 2 | 2.Interdependent Relationships in Ecosystems | 2.Earth's Systems: Processes that Shape the Earth | 2.Structure and Properties of Matter | |
| | 3 | 3.Interdependent Relationships in Ecosystems<br>3.Inheritance and Variation of Traits: Life Cycles and Traits | 3.Weather and Climate | 3.Forces and Interactions | 3-5.Engineering Design |
| | 4 | 4.Structure and Function | 4.Earth's Systems: Processes that Shape the Earth | 4.Energy<br>4.Waves: Waves and Information | |
| | 5 | 5.Matter and Energy in Organisms and Ecosystems | 5.Earth's Systems<br>5.Space Systems: Stars and the Solar System | 5.Structure and Properties of Matter | |
| Middle School | | MS.Structure and Function<br>MS.Matter and Energy in Organisms and Ecosystems<br>MS.Interdependent Relationships in Ecosystems<br>MS.Natural Selection and Adaptations<br>MS.Growth, Development, and Reproduction of Organisms | MS.Space Systems<br>MS.History of Earth<br>MS.Earth's Systems<br>MS.Weather and Climate<br>MS.Human Impacts | MS.Structure and Properties of Matter<br>MS.Chemical Reactions<br>MS.Forces and Interactions<br>MS.Energy<br>MS.Waves and Electromagnetic Radiation | MS.Engineering Design |
| High School | | HS.Structure and Function<br>HS.Inheritance and Variation of Traits<br>HS.Matter and Energy in Organisms and Ecosystems<br>HS.Interdependent Relationships in Ecosystems<br>HS.Natural Selection and Evolution | HS.Space Systems<br>HS.History of Earth<br>HS.Earth's Systems<br>HS.Weather and Climate<br>HS.Human Impacts | HS.Structure and Properties of Matter<br>HS.Chemical Reactions<br>HS.Forces and Interactions<br>HS.Energy<br>HS.Waves and Electromagnetic Radiation | HS.Engineering Design |

*This matrix was prepared by NSTA based on the release of the Next Generation Science Standards in April 2013*

# Practices in Mathematics, Science, and English Language Arts*

| Math | Science | English Language Arts |
|---|---|---|
| **M1.** Make sense of problems and persevere in solving them. | **S1.** Asking questions (for science) and defining problems (for engineering). | **E1.** They demonstrate independence. |
| **M2.** Reason abstractly and quantitatively. | **S2.** Developing and using models. | **E2.** They build strong content knowledge. |
| **M3.** Construct viable arguments and critique the reasoning of others. | **S3.** Planning and carrying out investigations. | **E3.** They respond to the varying demands of audience, task, purpose, and discipline. |
| **M4.** Model with mathematics. | **S4.** Analyzing and interpreting data. | **E4.** They comprehend as well as critique. |
| **M5.** Use appropriate tools strategically. | **S5.** Using mathematics, information and computer technology, and computational thinking. | **E5.** They value evidence. |
| **M6.** Attend to precision. | **S6.** Constructing explanations (for science) and designing solutions (for engineering). | **E6.** They use technology and digital media strategically and capably. |
| **M7.** Look for and make use of structure. | **S7.** Engaging in argument from evidence. | **E7.** They come to understanding other perspectives and cultures. |
| **M8.** Look for and express regularity in repeated reasoning. | **S8.** Obtaining, evaluating, and communicating information. | |

* The Common Core English Language Arts uses the term "student capacities" rather than the term "practices" used in Common Core Mathematics and the Next Generation Science Standards.

NGSS@NSTA STEM STARTS HERE