

Selected Grade K-8 MA Curriculum Frameworks Science and Technology/Engineering

Grades PreK - 2

1. Materials and Tools

Materials both natural and human-made have specific characteristics that determine how they will be used.

2. Engineering Design

Engineering design requires creative thinking and consideration of a variety of ideas to solve practical problems.

Grades 3 - 5

1. Materials & Tools

Appropriate materials, tools, machines extend our ability to solve problems, invent.

1.1 Identify materials used to accomplish a design task based on a specific property, i.e., weight, strength, hardness, and flexibility.

2. Engineering Design

Engineering design requires creative thinking and strategies to solve practical problems generated by needs & wants.

2.1 Identify a problem that reflects the need for shelter, storage or convenience.

2.2 Describe different ways in which a problem can be represented (sketches, diagrams, graphic organizers, lists).

2.3 Identify relevant design features (size, shape, weight) for building a prototype of a solution to a given problem

2.4 Compare natural systems with mechanical systems that are designed to serve similar purposes, e.g., a bird's wings as compared to an airplane's wings.

Grades 6 - 8

2. Engineering Design

Engineering design is an iterative process involving modeling and optimizing for developing technological solutions to problems within given constraints.

2.1 Identify and explain the steps of the engineering design process, i.e., identify the need or problem, research the problem, develop possible solutions, select the best possible solution(s), construct a prototype, test and evaluate, communicate the solution(s), and redesign.

2.2 Demonstrate methods of representing solutions to a design e.g. sketches, orthographic projections, multiview drawings.

2.5 Explain how such design features as size, shape, weight, function, and cost limitations would affect the construction of a given prototype.

3. Communication Technologies

Ideas can be communicated through engineering drawings, written reports, and pictures.

3.2 Identify and explain the appropriate tools, machines, electronic devices (drawing tools, computer-aided design, cameras) used to produce/reproduce design solutions (engineering drawings, prototypes, reports).

5. Construction Technologies

Construction technology involves building structures in order to contain, shelter, manufacture, transport, communicate, and provide recreation.

5.1 Describe and explain parts of a structure, e.g., foundation, flooring, decking, wall, roofing systems.

5.2 Identify and describe three major types of bridges (e.g., arch, beam, and suspension) and their appropriate uses (e.g., site, span, resources, and load).

5.3 Explain how forces of tension, compression, torsion, bending, shear affect performance of bridges.

5.4 Describe and explain the effects of loads and structural shapes on bridges.



Mathematics

Grades K - 4

- K.G.1** Name, describe, sort, and draw simple two-dimensional shapes.
- K.G.3** Name and compare three-dimensional shapes.
- 2.G.2** Identify, describe, draw and compare 2-d shapes, including polygonal and curved figures.
- 4.G.1** Compare and analyze attributes and other features (e.g. number of sides, faces, corners, right
- 4.G.2** Describe, model, draw, compare, and classify two- and three-dimensional shapes, e.g., circles,
- 4.G.5** Describe and draw intersecting, parallel, and perpendicular lines.
- 4.G.8** Identify and describe line symmetry in two-dimensional shapes.
- 4.M.1** Demonstrate an understanding of such attributes as length, area, weight, and volume, and select the appropriate type of unit for measuring each attribute.

Grades 5 - 6

- 6.G.1** Identify polygons based on properties: types of interior angles, perpendicular or parallel sides, congruence of sides, [squares, rectangles, rhombuses, parallelograms, trapezoids, isosceles, equilateral, right triangles.
- 6.G.2** Identify 3-d shapes(cubes, prisms, spheres, cones, pyramids) based on properties (edges, faces).
- 6.G.3** Identify relationships among points, lines, and planes, e.g., intersecting, parallel, perpendicular.
- 6.G.7** Identify types of symmetry, including line and rotational.
- 6.G.9** Match 3-d objects and their 2-d representations, e.g., nets, projections, and perspective drawings.
- 6.M.2** Identify, measure, describe, classify, and construct various angles, triangles, and quadrilaterals.

Grades 7 - 8

- 8.G.7** Identify three-dimensional figures (e.g., prisms, pyramids) by their physical appearance, distinguishing attributes, and spatial relationships such as parallel faces.
- 8.G.8** Recognize and draw two-dimensional representations of three-dimensional objects, e.g., nets, projections, and perspective drawings.

Visual Arts

An effective arts curriculum provides opportunities for students to make connections among the arts, with other disciplines within the core curriculum, and with arts resources in the community

STANDARD 2 Elements and Principles of Design

Students will demonstrate knowledge of the elements and principles of design.

Grades K-4

- 2.1** For **color**, explore and experiment with the use of color in dry and wet media
- 2.2** For **line**, explore the use of line in 2D and 3D works; Identify a wide variety of types of lines in the environment and in artwork
- 2.3** For **texture**, explore the use of textures in 2D and 3D works. Identify a wide variety of types of textures, *smooth, rough, and bumpy*, in the environment and in artwork Create representations of textures in drawings, paintings, rubbings, or relief
- 2.4** For **shape and form**, explore the use of shapes and forms in 2D and 3D works Identify simple shapes of different sizes, *for example, circles, squares, triangles*, and forms, *for example, spheres, cones, cubes*, in the environment and in artwork
- 2.5** For **pattern and symmetry**, explore the use of patterns and symmetrical shapes in 2D and 3D works. Identify patterns and symmetrical forms and shapes in the environment and artwork. Explain and demonstrate ways in which patterns and symmetrical shapes may be made
- 2.6** For **space and composition**, explore composition by creating artwork with a center of interest, repetition, and/or balance; Define and identify occurrences of balance, rhythm, repetition, variety, and emphasis



Grades 5-8

2.8 For **line**, use and be able to identify various types of line, *for example in **contour drawings, calligraphy, freehand studies from observation, memory, and imagination, and schematic studies***

2.9 For **texture**, use and be able to differentiate between surface texture and the illusion of texture (visual texture)

2.10 For **shape, form, and pattern**, use and be able to identify an expanding and increasingly sophisticated array of shapes and forms, such as organic, geometric, positive and negative, or varieties of symmetry

2.11 For **space and composition**, create unified 2D and 3D compositions that demonstrate an understanding of balance, repetition, rhythm, scale, proportion, unity, harmony, and emphasis.

STANDARD 3 Observation, Abstraction, Invention, and Expression

Students will demonstrate their powers of observation, abstraction, invention, and expression...

Grades K-4

3.1 Create 2D and 3D artwork from direct observation

3.3 Create 2D and 3D artwork from memory or imagination to tell a story or embody an idea or fantasy.

Grades 5-8

3.4 Create 2D and 3D representational artwork from direct observation in order to develop skills of perception, discrimination, physical coordination, and memory of detail.

3.6 Create artwork that shows knowledge of the ways in which architects, craftsmen, and designers develop abstract symbols by simplifying elements of the environment

STANDARD 5 Critical Response

Students will describe and analyze their own work and the work of others using appropriate visual arts vocabulary.

Grades K-4

5.3 Describe similarities and differences in works, and present personal responses to the subject matter, materials, techniques, and use of design elements in artworks

5.4 Explain strengths, weaknesses in their work; share comments constructively, supportively within group

Grades 5-8

5.5 Demonstrate the ability to recognize and describe the visual, spatial, and tactile characteristics of their own work and that of others

5.7 Demonstrate a fundamental awareness of architectural styles and their influence on painting and sculpture

STANDARD 6 Purposes and Meanings in the Arts

Students will describe the purposes for which works of dance, music, theatre, visual arts, and architecture were and are created, and, when appropriate, interpret their meanings.

Grades K-4

6.1 When viewing or listening to examples of visual arts, architecture, music, dance, storytelling, and theatre, ask and answer questions such as, *“What is the artist trying to say?” “Who made this, and why?” “How does this work make me feel?”*

6.2 Investigate uses and meanings of examples of the arts in children’s daily lives, homes, and communities

Grades 5-8

6.3 Interpret the meanings of artistic works by explaining how the subject matter and/or form reflect the events, ideas, religions, and customs of people living at a particular time in history

6.4 Describe how artistic production can shape and be influenced by the aesthetic preferences of a society



STANDARD 7 Roles of Artists in Communities

Students will describe the roles of artists, patrons, cultural and arts institutions in societies past and present.

Grades K-4

7.1 Investigate how artists create their work; read about, view films about, or interview artists.

Grades 5-8

7.2 Describe the roles of artists in specific cultures and periods; compare similarities and differences in these roles.

7.3 Identify and describe careers in at least one art form

7.4 Describe the function of cultural organizations and arts institutions such as museums... and historical preservation organizations

STANDARD 8 Concepts of Style, Stylistic Influence, and Stylistic Change

Students will demonstrate understanding of styles, stylistic influence, and stylistic change; identifying when and where art works were created; analyzing characteristic features of art works from various historical periods, cultures, and genres.

Grades K-4

8.1 Identify characteristic features of the... visual arts of native populations and immigrant groups to America

8.3 Perform or create works inspired by historical or cultural styles

Grades 5-8

8.4 Identify American styles and genres of...architecture, describe their sources, trace their evolution, and cite well-known artists associated with these styles

STANDARD 9 Inventions, Technologies, and the Arts

Students will describe and analyze how visual artists use and have used materials, inventions, and technologies.

Grades K-4

9.1 When using art materials or handling and viewing artifacts... ask and answer questions such as “What is this made of?” “Would I design this differently?” “Who first thought of making something like this?”

Grades 5-8

9.2 Identify and describe examples of how the discovery of new inventions and technologies, or the availability of new materials brought about changes in the arts in various time periods and cultures

9.3 Identify and describe examples of how artists make innovative uses of technologies and inventions

STANDARD 10 Interdisciplinary Connections

Students will apply their knowledge of the arts to the study of English language arts, foreign languages, health, history and social science, mathematics, and science and technology/engineering.

Grades K-4

10.1 Integrate knowledge of... visual arts and apply the arts to learning other disciplines

Grades 5-8

10.2 Continue the above and apply knowledge of other disciplines in learning in and about the arts
[using design skills and knowledge of physical science from science and technology/engineering...]

History and Social Science

K.3 Identify student’s street address, city or town; Massachusetts as state and United States as country in which he or she lives. Identify name of the student’s school and the city or town in which it is located.

K.4 Describe location and features of places in immediate neighborhood of the student’s home or school.



- 1.4 Describe a map as a representation of a space, such as the classroom, the school, the neighborhood, town, city, state, country, or world.
- 2.10 After reading or listening to a variety of true stories about individuals recognized for their achievements, describe and compare different ways people have achieved great distinction. (H)
- 3.3 Observe and describe local or regional historic artifacts and sites and generate questions about their function, construction, and significance.
- 3.4 Use cardinal directions, map scales, legends, and titles to locate places on contemporary maps of New England, Massachusetts, and the local community.
- 3.9 Identify historic buildings, monuments, sites in the area; and explain their purpose and significance.
- 3.12 Explain how objects or artifacts of everyday life in the past tell us how ordinary people lived and how everyday life has changed. Draw on local historical society and local museums as needed.

