



The Corporate Member Council – K-12 STEM Guidelines for All Americans

Dimension 1: Engineering Design	Declarative (Understands)	Procedural (Will be or is able to)
<p>The following topics are the initial ideas that lead to this dimension for all Americans:</p> <ul style="list-style-type: none"> • Problem-Solving National Science Standards (ITA) 9C/P. 102 and G/P. 103; Atlas of Science Literacy (Project 2061) Chapter 3; National Math Standards P. 52 • Creativity and assessment STL Chapter 5, Standard 8, P. 97, Standard 9, P. 104 • Research Abilities National Science Standards Teaching Standard C P. 37; Project 2061 P. 22; Atlas of Science Literacy P. 16-17 • Application of Engineering Design Atlas of Science Literacy P. 33-35; Engineering: An Introduction for High School, Chapter 3, P. 83-112 • Reasoning Atlas of Science Literacy P. 16-17, P. 127 	<p>All Americans will develop an understanding of engineering design.</p> <p>All Americans will understand that:</p> <ul style="list-style-type: none"> • Engineers design and conduct experiments, as well as analyze and interpret data as it relates to product design. • Applying iteration is a part of the engineering design process. • That engineers create and evaluate alternative design solutions. • That not all problems can be solved with engineering design. • Optimal solutions depend on outcomes and perspectives. For example, engineers, funding sources, project managers, and political and others are potential influences on outcomes or solutions. • Understand that engineering is the application of many fields of study to the problem solving process. “Atlas p17 9-12 SFAA 3A/H4” 	<p>All Americans will apply concepts of engineering design to solve problems.</p> <p>All Americans will:</p> <ul style="list-style-type: none"> • Apply a structured approach to solving problems including: defining a problem, brainstorming, researching and generating ideas, identifying criteria and constraints, exploring possibilities, making a model or prototype, evaluating the design using specifications, and communicating results. • Ask questions and make observations to help figure out how things work. • Learn that all products and systems are subject to failure and that many products and systems can be fixed. • Troubleshoot as a way of finding out why something does not work so that it can be fixed. • Analyze and break down complex systems into their component parts and explain the relationship and interdependency of the part and the system.



Dimension 2: Connecting Engineering to Science, Technology, and Mathematics	Declarative (Understands)	Procedural (Will be or is able to)
<p>The following topics are the initial ideas that lead to this dimension:</p> <ul style="list-style-type: none"> • Technological Literacy • How things Work 	<p>All Americans will develop an understanding of the essential concepts of and how to apply science, technology, and mathematics as they pertain to engineering.</p> <p>All Americans will develop the</p> <ul style="list-style-type: none"> • Understanding of selected concepts from established science, technology, and mathematics standards. Through multiple experiences, students will <ul style="list-style-type: none"> a. Understand properties of materials and how conditions affect those properties “Atlas p29 9-12 SFAA p21” b. Understand mathematical concepts, such as, numeration, algebraic equations, and probability and estimation. “Atlas p21 6-8 2C/2” • Understanding that engineering solutions rely upon the knowledge of science, technology, and mathematics and prior results to define and provide understanding of engineering problems. “Engineering: An Introduction for High School p124” <p>Understand how scientific and mathematical models are used to communicate and test design ideas and processes “Atlas p29 9-12 SAFF p21”</p> <p>Understand mathematical concepts are essential to modeling. “Atlas p29 2C/2”</p> <p>Understand how knowledge acquired in one context can be applied in another. “Atlas p5 6-8 1A/M2”</p>	<p>All Americans will be able to apply concepts of science, technology, and mathematics to engineering processes and problems.</p> <p>All Americans will</p> <p>Apply their knowledge of science, technology, engineering, and mathematics to define, analyze, and solve problems</p> <p>Apply contemporary engineering tools in the application of science, mathematics and technology to define analyze, model and prototype solutions to problems.</p> <p>Analyze a device and explain the principles of math and science used in the design.</p>



Dimension 3: Nature of Engineering	Declarative (Understand)	Procedural (Will be or is able to)
<p>The following topics are the initial ideas that lead to this dimension:</p> <ul style="list-style-type: none"> • Engineering Careers • Engineering Practice <p>Links: Atlas of Science and Literacy (3A): The Nature of Technology- Technology and Science, pp. 55-78</p>	<p>All Americans will understand the characteristics and broad scope of engineering practice.</p> <p>All Americans will know that</p> <ul style="list-style-type: none"> • Engineering is the application of knowledge of the human made world, of physical and natural science, and of mathematics for the benefit of human kind. • An engineer is a person who is trained in and uses mathematical, scientific and technological knowledge to solve practical problems. • Engineering, society, and the natural world are in relationships that influence each other over time. • Engineering has continually improved the quality of life, added business value, and significantly influenced the global economy. 	<p>All American will be creative and innovative in their thought process and actions.</p> <p>All Americans will be able to:</p> <ul style="list-style-type: none"> • Use a logical process for inquiry, solving practical problems, critical thinking, and innovation. • Explain what engineers do • Explain how engineers solve problems • Explain the need for diversity in engineering solutions.



Dimension 4: Communication and Teamwork	Declarative (Understands)	Procedural (Will be or is able to)
<p>The following topics are the initial ideas that lead to this dimension:</p> <ul style="list-style-type: none"> • Multidisciplinary Teamwork • Communication <p>Links Technology Standards (ITEA) 17 Atlas of Science Literacy, V2, Project 2061, Communication Skills pp. 110-111</p>	<p>All Americans will understand that engineers need to communicate effectively as individuals and as members of a team.</p> <p>Americans will understand that:</p> <ul style="list-style-type: none"> • Complex problems, such as those faced by engineers, are often better solved by teams rather than by individuals. • Effective individual and group communication skills are learned attributes. • Roles of team members are an important aspect in learning to work collaboratively and cooperatively. • Communication of ideas is effective when appropriate media is used and knowledge of your audience considered. • Multidisciplinary and cross-functional teams bring a variety of skills and perspectives that enhance the engineering design and problem solving processes. 	<p>Americans will be able to use effective communication and teamwork skills to acquire information and convey outcomes to a variety of stakeholders.</p> <p>Americans will be able to</p> <ul style="list-style-type: none"> • Use appropriate communication procedures, including oral presentations and written documentation using guidelines and style standards. • Communicate effectively using multiple media. • Practice interpersonal and group dynamic skills, such as: cooperate with others, advocate, influence, resolve conflict, and negotiate. • Function on multidisciplinary and cross-functional teams.



Dimension 5: Engineering and Society	Declarative (Understand)	Procedural (Will be or is able to)
<p>The following topics are the initial ideas that lead to this dimension:</p> <ul style="list-style-type: none"> • Human Factor • Attitude <p>Links:</p> <ul style="list-style-type: none"> - Standard 4,5, 6 Technology Standards (ITEA) - Atlas of Science and Literacy (3A): The Nature of Technology- Technology and Science, pp. 55-78 Atlas of Science and Literacy (4-6): NES (std F): Science and Technology in Local Challenges, pp. 140-141 	<p>All Americans will understand that engineering is an ethical human endeavor intended to address the needs of a global society.</p> <p>Americans will understand that:</p> <ul style="list-style-type: none"> • Engineering is a human endeavor that has been practiced as long as humans have had needs. • Results and use of engineered products and systems impact global, economic, cultural, environmental, and societal contexts in both expected and unexpected ways. • Engineering itself is neither positive nor negative, but the use of engineered outcomes can have desirable and undesirable consequences. • Development and use of engineered products and systems affect the way people of different cultures live, the kind of work they do, and the decisions they have to make. 	<p>All Americans will be able to investigate and analyze the impact of engineering on a global society.</p> <p>Americans will be able to:</p> <ul style="list-style-type: none"> • Investigate and analyze the impact of engineering from multiple perspectives, such as, economic, environmental, social, political, ethical, health and safety. • Investigate and explain the positive and negative results of engineering. • Explain that ethical considerations are important in the development, selection, and use of engineered products and systems.



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