STANDARDS SAIL CAR

Grades 4 to 12+ K-3 version available at teachergeek.com/sailcar

Contents

Reading the Standards

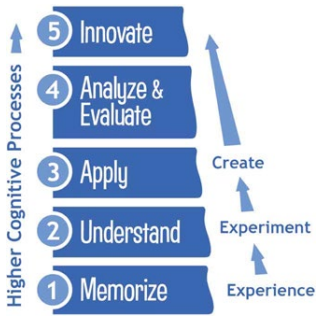
The parts of the standard we address are bold, the rest isn't.

Example:

CCSS.Math.Content.7.RP.A.2
Recognize and represent **proportional relationships between quantities.**

Our Taxonomy

TeacherGeek activities take students through a process which grows their understanding and abilities to the levels at which they can apply, analyze, evaluate, and innovate new solutions.



Grade 6-8 Standards

MS-ETSI-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETSI-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETSI-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETSI-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Science and Engineering Practices

Asking Questions and Defining Problems

Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.

Developing and Using Models

Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs.

Analyzing and Interpreting Data

Analyze and interpret data to determine similarities and differences in findings.

Engaging in Argument from Evidence

Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.

Disciplinary Core Ideas

ETS1.A: Defining and Delimiting Engineering Problems

The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions.

ETS1.B: Developing Possible Solutions

A solution needs to be tested, and then modified on the basis of the test results, in order to improve it.

There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.

Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors.

Models of all kinds are important for testing solutions.

ETS1.C: Optimizing the Design Solution

Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design.

The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution.

Crosscutting Concepts

Influence of Science, Engineering, and Technology on Society and the Natural World

All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment.

The uses of technologies and limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions.

GO GUIDE: NGSS (Continued)

Grade 9-12 Standards

HS-ETSI-1. **Analyze** a major global **challenge to specify qualitative and quantitative criteria and constraints for solutions** that account for societal needs and wants.

HS-ETSI-2. **Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.**

HS-ETSI-3. **Evaluate a solution to a complex real-world problem based on** prioritized **criteria and trade-offs that account for a range of constraints,** including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

Science and Engineering Practices

Asking Questions and Defining Problems

Analyze complex real-world **problems by specifying criteria and constraints for successful solutions.**

Using Mathematics and Computational Thinking

Use mathematical **models** and/or computer simulations **to predict the effects of a design solution on systems and/or the interactions between systems.**

Constructing Explanations and Designing Solutions

Design a solution to a complex real-world **problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.**

Evaluate a solution to a complex real-world **problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.**

Disciplinary Core Ideas

ETS1.B: Developing Possible Solutions

When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts.

Both **physical models** and computers **can be used in various ways to aid in the engineering design process.** Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs.

ETS1.C: Optimizing the Design Solution

Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed.

Crosscutting Concepts

Systems and System Models

Models (e.g., physical, mathematical, computer models) **can be used to simulate systems and interactions—including energy,** matter, and information **flows— within and between systems at different scales.**

Grade 6-8 ELA Standards

Craft and Structure:

CCSS.ELA-Literacy.RST.6-8.4
Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6-8* texts and *topics*.

Key Ideas and Details:

CCSS.ELA-Literacy.RST.6-8.3
Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

CCSS.ELA-Literacy.RST.6-8.7
Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, **or table).**

Grade 9-10 ELA Standards

Craft and Structure:

CCSS.ELA-Literacy.RST.9-10.4
Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9-10* texts and *topics*.

CCSS.ELA-Literacy.RST.9-10.5
Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force, friction,* reaction force, energy).

Key Ideas and Details:

CCSS.ELA-Literacy.RST.9-10.3
Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

CCSS.ELA-Literacy.RST.9-10.7
Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) **and translate information expressed visually or mathematically (e.g., in an equation) into words.**

Grade 10-12 ELA Standards

CCSS.ELA-Literacy.RST.11-12.3
Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

CCSS.ELA-Literacy.RST.11-12.7
Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) **in order to address a question or solve a problem.**

CCSS.ELA-Literacy.RST.11-12.8
Evaluate the hypotheses, data, analysis, and conclusions in a science or **technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.**

CCSS.ELA-Literacy.RST.11-12.9
Synthesize information from a range of sources (e.g., texts, **experiments**, simulations) **into a coherent understanding of a process, phenomenon, or concept,** resolving conflicting information when possible.

BALANCED FORCES LAB: NGSS

Grade 3-5 Standards

3-PS2-1. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

3-PS2-2. Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.

Science and Engineering Practices

Asking Questions and Defining Problems

Ask questions that can be investigated based on patterns such as cause and effect relationships.

Define a simple problem that can be solved through the development of a new or improved object or tool.

Planning and Carrying Out Investigations

Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.

Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.

Disciplinary Core Ideas

PS2.A: Forces and Motion

Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion.

The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it.

PS2.B: Types of Interactions

Objects in contact exert forces on each other.

Crosscutting Concepts

Patterns

Patterns of change can be used to make predictions.

Cause and Effect

Cause and effect relationships are routinely identified.

Cause and effect relationships are routinely identified, tested, and used to explain change.

BALANCED FORCES LAB: NGSS (Continued)

Grade 6-8 Standards

MS-PS2-2. Plan an investigation to **provide evidence that the change in an object's motion depends on the sum of the forces on the object** and the mass of the object.

MS-ETSI-I. **Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.**

MS-ETSI-2. **Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**

MS-ETSI-3. **Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.**

MS-ETSI-4. **Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.**

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Disciplinary Core Ideas

PS2.A: Forces and Motion

The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion.

ETS1.A: Defining and Delimiting Engineering Problems

The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions.

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The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution.

Crosscutting Concepts

Stability and Change

Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales.

BALANCED FORCES LAB: CCSS

Grade 4 ELA Standards

Craft and Structure:

CCSS.ELA-Literacy.RI.4.4
Determine the meaning of general academic and domain-specific words or phrases in a text relevant to a *grade 4 topic or subject area*.

Integration of Knowledge and Ideas:

CCSS.ELA-Literacy.RI.4.7
Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, **diagrams,** time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.

Grade 5 ELA Standards

Craft and Structure:

CCSS.ELA-Literacy.RI.5.4
Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a *grade 5 topic or subject area*.

Grade 6-8 ELA Standards

Craft and Structure:

CCSS.ELA-Literacy.RST.6-8.4
Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6-8* texts and *topics.*

Key Ideas and Details:

CCSS.ELA-Literacy.RST.6-8.3
Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

CCSS.ELA-Literacy.RST.6-8.7
Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, **or table).**

FORCES & MOTION LAB: NGSS

Grade 6-8 Standards

MS-PS2-2. **Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object** and the mass of the object.

Science and Engineering Practices

Planning and Carrying Out Investigations

Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.

Disciplinary Core Ideas

PS2.A: Forces and Motion

The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion.

Crosscutting Concepts

Cause and Effect

Cause and effect relationships may be used to predict phenomena in natural or designed systems.

Stability and Change

Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales.

FORCES & MOTION LAB: CCSS

Grade 6-8 ELA Standards

Craft and Structure:

CCSS.ELA-Literacy.RST.6-8.4
Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6-8* *texts and* *topics*.

Key Ideas and Details:

CCSS.ELA-Literacy.RST.6-8.3
Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

CCSS.ELA-Literacy.RST.6-8.7
Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, **or table).**

Grade 7 Math Standards

Analyze proportional relationships and use them to solve real-world and mathematical problems.

CCSS.Math.Content.7.RP.A.2
Recognize and represent **proportional relationships between quantities.**

CCSS.Math.Content.7.RP.A.2.a
Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or **graphing on a coordinate plane and observing whether the graph is a straight line through the origin.**

Grade 8 Math Standards

Understand the connections between proportional relationships, lines, and linear equations.

CCSS.Math.Content.8.EE.B.5
Graph proportional relationships, interpreting the unit rate as the slope of the graph. **Compare two different proportional relationships** represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.

INERTIA LAB: NGSS

Grades 6-8 Standards

MS-PS2-2. Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

Science and Engineering Practices

Planning and Carrying Out Investigations

Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.

Disciplinary Core Ideas

PS2.A: Forces and Motion

The motion of an object is determined by the sum of the forces acting on it; **if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion.**

Crosscutting Concepts

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Cause and effect relationships may be used to predict phenomena in natural or designed systems.

Stability and Change

Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales.

INERTIA LAB: CCSS

Grade 6-8 ELA Standards

Craft and Structure:

CCSS.ELA-Literacy.RST.6-8.4
Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6-8* *texts and* *topics*.

Key Ideas and Details:

CCSS.ELA-Literacy.RST.6-8.3
Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

CCSS.ELA-Literacy.RST.6-8.7
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Grade 7 Math Standards

Analyze proportional relationships and use them to solve real-world and mathematical problems.

CCSS.Math.Content.7.RP.A.2
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CCSS.Math.Content.7.RP.A.2.a
Decide whether two quantities are in a proportional relationship, **e.g., by** testing for equivalent ratios in a table or **graphing on a coordinate plane and observing whether the graph is a straight line through the origin.**

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Understand the connections between proportional relationships, lines, and linear equations.

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Graph proportional relationships, interpreting the unit rate as the slope of the graph. **Compare two different proportional relationships** represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.

ATWOOD'S MACHINE LAB: NGSS

Grades 9-12 Standards

HS-PS2-1. Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Analyzing and Interpreting Data Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.	**PS2.A: Forces and Motion** Newton's second law accurately predicts changes in the motion of macroscopic objects.	**Cause and Effect** Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

ATWOOD'S MACHINE LAB: CCSS

Grade 10-12 ELA Standards

CCSS.ELA-Literacy.RST.11-12.3
Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

CCSS.ELA-Literacy.RST.11-12.7
Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

CCSS.ELA-Literacy.RST.11-12.8
Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

CCSS.ELA-Literacy.RST.11-12.9
Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

Grades 9-12 Math Standards

Reason quantitatively and use units to solve problems.

CCSS.Math.Content.HSN.Q.A.1
Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

CCSS.Math.Content.HSN.Q.A.2
Define appropriate quantities for the purpose of descriptive modeling.

CCSS.Math.Content.HSN.Q.A.3
Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Interpret the structure of expressions.

CCSS.Math.Content.HSA.SSE.A.1
Interpret expressions that represent a quantity in terms of its context.

CCSS.Math.Content.HSA.SSE.A.1.a
Interpret parts of an expression, such as terms, factors, and coefficients.

Create equations that describe numbers or relationships.

CCSS.Math.Content.HSA.CED.A.2
Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

Construct and compare linear, quadratic, and exponential models and solve problems.

CCSS.Math.Content.HSF.LE.A.1
Distinguish between situations that can be modeled with linear functions and with exponential functions.

CCSS.Math.Content.HSF.LE.A.1.b
Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

MOMENTUM LAB: NGSS

Grades 9-12 Standards

HS-PS2-2. Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.

Science and Engineering Practices

Analyzing and Interpreting Data

Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.

Disciplinary Core Ideas

PS2.A: Forces and Motion

Newton's second law accurately predicts changes in the motion of macroscopic objects.

Momentum is defined for a particular frame of reference; it is the mass times the velocity of the object.

If a system interacts with objects outside itself, the total momentum of the system can change; however, any such change is balanced by changes in the momentum of objects outside the system.

Crosscutting Concepts

Systems and System Models

When investigating or describing a system, the boundaries and initial conditions of the system need to be defined.

Cause and Effect

Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

Grade 10-12 ELA Standards

CCSS.ELA-Literacy.RST.11-12.3
Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

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ENGINEERING CHALLENGES: NGSS

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MS-ETSI-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

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All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment.

The uses of technologies and limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions.

ENGINEERING CHALLENGES: NGSS (Continued)

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HS-ETSI-2. **Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.**

HS-ETSI-3. **Evaluate a solution to a complex real-world problem based on** prioritized **criteria and trade-offs that account for a range of constraints,** including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

Science and Engineering Practices

Asking Questions and Defining Problems

Analyze complex real-world **problems by specifying criteria and constraints for successful solutions.**

Using Mathematics and Computational Thinking

Use mathematical **models** and/or computer simulations **to predict the effects of a design solution on systems and/or the interactions between systems.**

Constructing Explanations and Designing Solutions

Design a solution to a complex real-world **problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.**

Evaluate a solution to a complex real-world **problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.**

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ETS1.B: Developing Possible Solutions

When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts.

Both **physical models** and computers **can be used in various ways to aid in the engineering design process.** Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs.

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Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed.

Crosscutting Concepts

Systems and System Models

Models (e.g., physical, mathematical, computer models) **can be used to simulate systems and interactions—including energy,** matter, and information **flows— within and between systems at different scales.**

Grade 3-5 STL Standards

Standard 1. Students will develop an understanding of the characteristics and scope of technology.

D. Tools, materials, and skills are used to make things and carry out tasks.
E. Creative thinking and economic and cultural influences shape technological development.

Standard 2. Students will develop an understanding of the core concepts of technology.

G. When parts of a system are missing, it may not work as planned.
I. Tools are used to design, make, use, and assess technology.
J. Materials have many different properties.
K. Tools and machines extend human capabilities, such as holding, lifting, carrying, fastening, separating, and computing.
L. Requirements are the limits to designing or making a product or system.

Standard 8. Students will develop an understanding of the attributes of design.

C. The design process is a purposeful method of planning practical solutions to problems.
D. Requirements for a design include such factors as the desired elements and features of a product or system or the limits that are placed on the design.

Standard 9. Students will develop an understanding of engineering design.

C. The engineering design process involves defining a problem, generating ideas, selecting a solution, testing the solution(s), making the item, evaluating it, and presenting the results.
D. When designing an object, it is important to be creative and consider all ideas.
E. Models are used to communicate and test design ideas and processes.

Standard 10. Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

C. Troubleshooting is a way of finding out why something does not work so that it can be fixed.
E. The process of experimentation, which is common in science, can also be used to solve technological problems.

Standard 11. Students will develop abilities to apply the design process.

E. The process of designing involves presenting some possible solutions in visual form and then selecting the best solution(s) from many.
F. Test and evaluate the solutions for the design problem.
G. Improve the design solutions.

Standard 12. Students will develop the abilities to use and maintain technological products and systems.

D. Follow step-by-step directions to assemble a product.
E. Select and safely use tools, products, and systems for specific tasks.
G. Use common symbols, such as numbers and words, to communicate key ideas.

Standard 13. Students will develop the abilities to assess the impact of products and systems.

C. Compare, contrast, and classify collected information in order to identify patterns.
E. Examine the trade-offs of using a product or system and decide when it could be used.

ENGINEERING CHALLENGES: ITEEA (Continued)

Grade 6-8 STL Standards

Standard 1. Students will develop an understanding of the characteristics and scope of technology.

F. New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology.
G. The development of technology is a human activity and is the result of individual and collective needs and the ability to be creative.
H. Technology is closely linked to creativity, which has resulted in innovation.

Standard 2. Students will develop an understanding of the core concepts of technology.

N. Systems thinking involves considering how every part relates to others.
P. Technological systems can be connected to one another.
Q. Malfunctions of any part of a system may affect the function and quality of the system.
R. Requirements are the parameters placed on the development of a product or system.
S. Trade-off is a decision process recognizing the need for careful compromises among competing factors.

Standard 3. Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.

E. A product, system, or environment developed for one setting may be applied to another setting.
F. Knowledge gained from other fields of study has a direct effect on the development of technological products and systems.

Standard 7. Students will develop an understanding of the influence of technology on history.

C. Many inventions and innovations have evolved by using slow and methodical processes of tests and refinements.

Standard 8. Students will develop an understanding of the attributes of design.

E. Design is a creative planning process that leads to useful products and systems.
F. There is no perfect design.
G. Requirements for a design are made up of criteria and constraints.

Standard 9. Students will develop an understanding of engineering design.

F. Design involves a set of steps, which can be performed in different sequences and repeated as needed.
G. Brainstorming is a group problem-solving design process in which each person in the group presents his or her ideas in an open forum.
H. Modeling, testing, evaluating, and modifying are used to transform ideas into practical solutions.

Standard 10. Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

F. Troubleshooting is a problem-solving method used to identify the cause of a malfunction in a technological system.
H. Some technological problems are best solved through experimentation.

Standard 11. Students will develop abilities to apply the design process.

H. Apply a design process to solve problems in and beyond the laboratory-classroom.
I. Specify criteria and constraints for the design.
J. Make two-dimensional and three-dimensional representations of the designed solution.
K. Test and evaluate the design in relation to preestablished requirements, such as criteria and constraints, and refine as needed.
L. Make a product or system and document the solution.

Standard 12. Students will develop the abilities to use and maintain technological products and systems.

H. Use information provided in manuals, protocols, or by experienced people to see and understand how things work.

I. Use tools, materials, and machines safely to diagnose, adjust, and repair systems.

K. Operate and maintain systems in order to achieve a given purpose.

Standard 13. Students will develop the abilities to assess the impact of products and systems.

G. Use data collected to analyze and interpret trends in order to identify the positive and negative effects of a technology.

I. Interpret and evaluate the accuracy of the information obtained and determine if it is useful.

Grade 9-12 STL Standards

Standard 1. Students will develop an understanding of the characteristics and scope of technology.

J. The nature and development of technological knowledge and processes are functions of the setting.
L. Inventions and innovations are the results of specific, goal-directed research.

Standard 2. Students will develop an understanding of the core concepts of technology.

W. Systems thinking applies logic and creativity with appropriate compromises in complex real-life problems.
X. Systems, which are the building blocks of technology, are embedded within larger technological, social, and environmental systems.
Z. Selecting resources involves trade-offs between competing values, such as availability, cost, desirability, and waste.
AA. Requirements involve the identification of the criteria and constraints of a product or system and the determination of how they affect the final design and development.
BB. Optimization is an ongoing process or methodology of designing or making a product and is dependent on criteria and constraints.
CC. New technologies create new processes.

Standard 3. Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.

J. Technological progress promotes the advancement of science and mathematics.

Standard 7. Students will develop an understanding of the influence of technology on history.

G. Most technological development has been evolutionary, the result of a series of refinements to a basic invention.

Standard 8. Students will develop an understanding of the attributes of design.

H. The design process includes defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating the design using specifications, refining the design, creating or making it, and communicating processes and results.
J. The design needs to be continually checked and critiqued, and the ideas of the design must be redefined and improved.
K. Requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other.

Standard 9. Students will develop an understanding of engineering design.

I. Established design principles are used to evaluate existing designs, to collect data, and to guide the design process.
J. Engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
K. A prototype is a working model used to test a design concept by making actual observations and necessary adjustments.

Standard 10. Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

L. Many technological problems require a multidisciplinary approach.

Standard 11. Students will develop abilities to apply the design process.

M. Identify the design problem to solve and decide whether or not to address it.
N. Identify criteria and constraints and determine how these will affect the design process.
O. Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product.
P. Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for proper design and to note areas where improvements are needed.
Q. Develop and produce a product or system using a design process.

Standard 12. Students will develop the abilities to use and maintain technological products and systems.

M. Diagnose a system that is malfunctioning and use tools, materials, machines, and knowledge to repair it.

N. Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision.

O. Operate systems so that they function in the way they were designed.

Standard 13. Students will develop the abilities to assess the impact of products and systems.

J. Collect information and evaluate its quality.

L. Use assessment techniques, such as trend analysis and experimentation, to make decisions about the future development of technology.

Grade 6-8 ELA Standards

Craft and Structure:

CCSS.ELA-Literacy.RST.6-8.4
Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6-8* texts and *topics*.

Key Ideas and Details:

CCSS.ELA-Literacy.RST.6-8.3
Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

CCSS.ELA-Literacy.RST.6-8.7
Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, **or table).**

Grade 9-10 ELA Standards

Craft and Structure:

CCSS.ELA-Literacy.RST.9-10.4
Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9-10* texts and *topics*.

CCSS.ELA-Literacy.RST.9-10.5
Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force*, *friction*, *reaction force, energy*).

Key Ideas and Details:

CCSS.ELA-Literacy.RST.9-10.3
Follow precisely a complex multistep procedure when carrying out experiments, **taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.**

CCSS.ELA-Literacy.RST.9-10.7
Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) **and translate information expressed visually or mathematically (e.g., in an equation) into words.**

Grade 10-12 ELA Standards

CCSS.ELA-Literacy.RST.11-12.3
Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

CCSS.ELA-Literacy.RST.11-12.7
Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) **in order to address a question or solve a problem.**

CCSS.ELA-Literacy.RST.11-12.8
Evaluate the hypotheses, data, analysis, and conclusions in a science or **technical text**, **verifying the data when possible and corroborating or challenging conclusions with other sources of information.**

CCSS.ELA-Literacy.RST.11-12.9
Synthesize information from a range of sources (e.g., texts, **experiments**, simulations) **into a coherent understanding of a process, phenomenon, or concept,** resolving conflicting information when possible.