Connections to Standards

The identification of standards to address in the PLTW Launch Pre-Kindergarten (PreK) modules comes after a careful review of standards currently addressed in PLTW Launch modules, the landscape of standards available for early childhood education at the national level, recommendations for preschool by respected organizations, and a review of state standards. Our PreK modules will address standards from the following:

- National Association for the Education of Young Children (NAEYC) Early Learning Program Standards
- Head Start Early Learning Outcomes Framework
- Next Generation Science Standards (NGSS) (provides a scaffold to kindergarten standards)
- Common Core State Standards (CCSS) in English/Language Arts (ELA) and Mathematics (provides a scaffold to kindergarten standards)
- Computer Science Teachers Association K-12 Computer Science Standards (provides a scaffold to kindergarten standards)

This document lists the standards identified from each of these sources for the Life Science: Living and Nonliving Things module.

NAEYC Early Learning Program Standards

The program standards are used for accreditation of early childhood programs, thus we call out ways in which PLTW PreK modules align to the requirements set forth by NAEYC.

1. Relationships. This program promotes positive relationships between all children and adults to encourage each child's sense of individual worth and belonging as part of a community and to foster each child's ability to contribute as a responsible community member.
2. Curriculum. The program implements a curriculum that is consistent with its goals for children and that promotes learning and development in each of the following areas: social, emotional, physical, language, and cognitive.
3. Teaching. The program uses a variety of developmentally, culturally, and linguistically appropriate and effective teaching approaches, which enhance each child's learning and development in the context of the program's curriculum goals.
4. Assessment of Child Progress. The program uses a variety of formal and informal assessment approaches to provide information on children's learning and development. These assessments occur in the context of reciprocal communications between teachers and families, and with sensitivity to cultural contexts in which children are developing.

The program uses assessment results to inform decisions about the children in their care, to improve teaching practices, and to drive program improvement.

5. Health. The program promotes the nutrition and health of children and protects children and staff from illness.*
6. Staff Competencies, Preparation, and Support. The program employs and supports a teaching and administrative staff that have the qualifications, knowledge, and professional commitment necessary to promote children's learning and development and to support families' diverse needs and interests.*
7. Families. The program establishes and maintains collaborative relationships with each child's family to foster children's development in all settings. These relationships are sensitive to family composition, language, and culture.
8. Community Relationships. The program establishes relationships with and uses the resources of the children's communities to support the achievement of program goals.
9. Physical Environment. The program has a safe and healthful environment that provides appropriate and well-maintained indoor and outdoor physical environments. The environment includes facilities, equipment, and materials to facilitate child and staff learning and development.
10. Leadership and Management. The program effectively implements policies, procedures, and systems that support stable staff and strong personnel, fiscal, and program management so all children, families, and staff have high-quality experiences.*

*Standards that are not directly addressed in the module.

Head Start Early Learning Outcomes Framework

Head Start offers well-designed curriculum standards designed specifically for early childhood learning. From our research, we believe that these standards provide a clear connection to the learning needs of pre-kindergarten students. Additionally, we noted other early childhood STEM programs that align to Head Start standards.

Approaches to Learning

Cognitive Self-Regulation (Executive Functioning)

- Goal P-ATL 6 Child maintains focus and sustains attention with minimal adult support.
- Goal P-ATL 7 Child persists in tasks.
- Goal P-ATL 8 Child holds information in mind and manipulates it to perform tasks.
- Goal P-ATL 9 Child demonstrates flexibility in thinking and behavior.

Initiative and Curiosity

- Goal P-ATL 10 Child demonstrates initiative and independence.
- Goal P-ATL 11 Child shows interest in and curiosity about the world around them.

Creativity

- Goal P-ATL 12 Child expresses creativity in thinking and communication.
- Goal P-ATL 13 Child uses imagination in play and interactions with others.

Language and Communication

Attending and Understanding

- Goal P-LC 1 Child attends to communication and language from others.
- Goal P-LC 2 Child understands and responds to increasingly complex communication and language from others.

Communicating and Speaking

- Goal P-LC 3 Child varies the amount of information provided to meet the demands of the situation.
- Goal P-LC 4 Child understands, follows, and uses appropriate social and conversational rules.
- Goal P-LC 5 Child expresses self in increasingly long, detailed, and sophisticated ways.

Vocabulary

- Goal P-LC 6 Child understands and uses a wide variety of words for a variety of purposes.
- Goal P-LC 7 Child shows understanding of word categories and relationships among words.

Literacy

Comprehension and Text Structure

- Goal P-LIT 4 Child demonstrates an understanding of narrative structure through storytelling/re-telling.
- Goal P-LIT 5 Child asks and answers questions about a book that was read aloud.

Writing

- Goal P-LIT 6 Child writes for a variety of purposes using increasingly sophisticated marks.

Mathematics Development

Measurement

- Goal P-MATH 8 Child measures objects by their various attributes using standard and non-standard measurement. Uses differences in attributes to make comparisons.

Scientific Reasoning

Scientific Inquiry

- Goal P-SCI 1 Child observes and describes observable phenomena (objects, materials, organisms, and events).
- Goal P-SCI 2 Child engages in scientific talk.
- Goal P-SCI 3 Child compares and categorizes observable phenomena.

Reasoning and Problem-Solving

- Goal P-SCI 4 Child asks a question, gathers information, and makes predictions.
- Goal P-SCI 5 Child plans and conducts investigations and experiments.
- Goal P-SCI 6 Child analyzes results, draws conclusions, and communicates.

Next Generation Science Standards

While NGSS does not include standards for early childhood learning, research led the PLTW Launch team to develop content that provides a scaffold to NGSS. Modules address Science and Engineering Practices, Crosscutting Concepts, and Disciplinary Core Ideas and also provide a learning progression toward kindergarten science standards.

- K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- K-2-ETS1-3. Analyze data from tests of two objects' design to solve the same problem to compare the strengths and weaknesses of how each performs.
- ETS1.A: Defining and Delimiting Engineering Problems
    - A situation that people want to change or create can be approached as a problem to be solved through engineering.
    - Asking questions, making observations, and gathering information are helpful in thinking about problems.
    - Before beginning to design a solution, it is important to clearly understand the problem.
- ETS1.B: Developing Possible Solutions. Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.
- ETS1.C: Optimizing the Design Solution. Because there is always more than one possible solution to a problem, it is useful to compare and test designs.
- K-ESS2-2. Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.

- K-ESS3-1. Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live.
- K-ESS3-3. Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.
- ESS2.E: Biogeology. Plants and animals can change their environment.
- ESS3.A: Natural Resources. Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do.
- ESS3.C: Human Impacts on Earth Systems. Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things.
- K-LS1-1. Use observations to describe patterns of what plants and animals (including humans) need to survive.
- Science and Engineering Practice: Asking Questions and Defining Problems. Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions that can be tested.
    - Ask questions based on observations to find more information about the natural and/or designed world(s).
    - Define a simple problem that can be solved through the development of a new or improved object or tool.
- Science and Engineering Practice: Engaging in Argument from Evidence. Engaging in argument from evidence in K–2 builds on prior experiences and progresses to comparing ideas and representation about the natural and designed world(s).
    - Construct an argument with evidence to support a claim.
- Science and Engineering Practice: Developing and Using Models. Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.
    - Use a model to represent relationships in the natural world.
    - Develop a simple model based on evidence to represent a proposed object or tool.
- Science and Engineering Practice: Obtaining, Evaluating, and Communicating Information. Obtaining, evaluating, and communicating information in K–2 builds on prior experiences and uses observations and texts to communicate new information.
    - Communicate solutions with others in oral and/or written forms using models and/or drawings that provide detail about scientific ideas.
- Science and Engineering Practice: Analyzing and Interpreting Data. Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.
    - Analyze data from tests of an object or tool to determine if it works as intended.

- Cross Cutting Concept: Structure and Function. The shape and stability of structures of natural and designed objects are related to their function(s).
- Cross Cutting Concept: Systems and System Models. Systems in the natural and designed world have parts that work together.
- Cross Cutting Concept: Cause and Effect. Events have causes that generate observable patterns.

Common Core State Standards in ELA and Mathematics

CCSS does not provide standards for early childhood learning. As with NGSS, PLTW Launch PreK modules offer a scaffold of learning that moves toward kindergarten standards in ELA and Mathematics.

English Language Arts

- CCSS.ELA-LITERACY.RL.K.1 With prompting and support, ask and answer questions about key details in a text.
- CCSS.ELA-LITERACY.RL.K.2 With prompting and support, retell familiar stories, including key details.
- CCSS.ELA-LITERACY.RL.K.3 With prompting and support, identify characters, settings, and major events in a story.
- CCSS.ELA-LITERACY.SL.K.1 Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups.
- CCSS.ELA-LITERACY.SL.K.1a Follow agreed-upon rules for discussions (e.g., listening to others and taking turns speaking about the topics and texts under discussion).
- CCSS.ELA-LITERACY.SL.K.1b Continue a conversation through multiple exchanges.

Mathematics

- CCSS.MATH.CONTENT.K.MD.A.1 Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.
- CCSS.MATH.CONTENT.K.MD.A.2 Directly compare two objects with a measurable attribute in common, to see which object has “more of”/”less of” the attribute, and describe the difference.
- CCSS.MATH.PRACTICE.MP.5 Use appropriate tools strategically.

Sources

Early Childhood Learning & Knowledge Center (n.d.). *Head Start Early Learning Outcomes Framework: Ages Birth to Five.* Retrieved from https://eclkc.ohs.acf.hhs.gov/interactive-head-start-early-learning-outcomes-framework-ages-birth-five

National Association for the Education of Young Children (2017). *NAEYC Early Learning Program Standards*. Retrieved from https://www.naeyc.org/accreditation/early-learning/standards

National Governors Association Center for Best Practices, & Council of Chief State School Officers (2010). *Common Core State Standards.* Washington, DC: National Governors Association Center for Best Practices, Council of Chief State School Officers.

NGSS Lead States. (2013). *Next Generation Science Standards: For states by states.* Washington, DC: National Academies Press.

Connections to Standards

The identification of standards to address in the PLTW Launch Pre-Kindergarten (PreK) modules comes after a careful review of standards currently addressed in PLTW Launch modules, the landscape of standards available for early childhood education at the national level, recommendations for preschool by respected organizations, and a review of state standards. Our PreK modules will address standards from the following:

- National Association for the Education of Young Children (NAEYC) Early Learning Program Standards
- Head Start Early Learning Outcomes Framework
- Next Generation Science Standards (NGSS) (provides a scaffold to kindergarten standards)
- Common Core State Standards (CCSS) in English/Language Arts (ELA) and Mathematics (provides a scaffold to kindergarten standards)
- Computer Science Teachers Association K-12 Computer Science Standards (provides a scaffold to kindergarten standards)

This document lists the standards identified from each of these sources for the Matter: Floating and Sinking module.

NAEYC Early Learning Program Standards

The program standards are used for accreditation of early childhood programs, thus we call out ways in which PLTW PreK modules align to the requirements set forth by NAEYC.

1. Relationships. This program promotes positive relationships between all children and adults to encourage each child's sense of individual worth and belonging as part of a community and to foster each child's ability to contribute as a responsible community member.
2. Curriculum. The program implements a curriculum that is consistent with its goals for children and that promotes learning and development in each of the following areas: social, emotional, physical, language, and cognitive.
3. Teaching. The program uses a variety of developmentally, culturally, and linguistically appropriate and effective teaching approaches, which enhance each child's learning and development in the context of the program's curriculum goals.
4. Assessment of Child Progress. The program uses a variety of formal and informal assessment approaches to provide information on children's learning and development. These assessments occur in the context of reciprocal communications between teachers and families, and with sensitivity to cultural contexts in which children are developing.

The program uses assessment results to inform decisions about the children in their care, to improve teaching practices, and to drive program improvement.

5. Health. The program promotes the nutrition and health of children and protects children and staff from illness.*
6. Staff Competencies, Preparation, and Support. The program employs and supports a teaching and administrative staff that have the qualifications, knowledge, and professional commitment necessary to promote children's learning and development and to support families' diverse needs and interests.*
7. Families. The program establishes and maintains collaborative relationships with each child's family to foster children's development in all settings. These relationships are sensitive to family composition, language, and culture.
8. Community Relationships. The program establishes relationships with and uses the resources of the children's communities to support the achievement of program goals.
9. Physical Environment. The program has a safe and healthful environment that provides appropriate and well-maintained indoor and outdoor physical environments. The environment includes facilities, equipment, and materials to facilitate child and staff learning and development.
10. Leadership and Management. The program effectively implements policies, procedures, and systems that support stable staff and strong personnel, fiscal, and program management so all children, families, and staff have high-quality experiences.*

*Standards that are not directly addressed in the module.

Head Start Early Learning Outcomes Framework

Head Start offers well-designed curriculum standards designed specifically for early childhood learning. From our research, we believe that these standards provide a clear connection to the learning needs of pre-kindergarten students. Additionally, we noted other early childhood STEM programs that align to Head Start standards.

Approaches to Learning

Cognitive Self-Regulation (Executive Functioning)

- Goal P-ATL 6 Child maintains focus and sustains attention with minimal adult support.
- Goal P-ATL 7 Child persists in tasks.
- Goal P-ATL 8 Child holds information in mind and manipulates it to perform tasks.
- Goal P-ATL 9 Child demonstrates flexibility in thinking and behavior.

Initiative and Curiosity

- Goal P-ATL 10 Child demonstrates initiative and independence.
- Goal P-ATL 11 Child shows interest in and curiosity about the world around them.

Creativity

- Goal P-ATL 12 Child expresses creativity in thinking and communication.
- Goal P-ATL 13 Child uses imagination in play and interactions with others.

Language and Communication

Attending and Understanding

- Goal P-LC 1 Child attends to communication and language from others.
- Goal P-LC 2 Child understands and responds to increasingly complex communication and language from others.

Communicating and Speaking

- Goal P-LC 3 Child varies the amount of information provided to meet the demands of the situation.
- Goal P-LC 4 Child understands, follows, and uses appropriate social and conversational rules.
- Goal P-LC 5 Child expresses self in increasingly long, detailed, and sophisticated ways.

Vocabulary

- Goal P-LC 6 Child understands and uses a wide variety of words for a variety of purposes.
- Goal P-LC 7 Child shows understanding of word categories and relationships among words.

Literacy

Comprehension and Text Structure

- Goal P-LIT 4 Child demonstrates an understanding of narrative structure through storytelling/re-telling.
- Goal P-LIT 5 Child asks and answers questions about a book that was read aloud.

Writing

- Goal P-LIT 6 Child writes for a variety of purposes using increasingly sophisticated marks.

Mathematics Development

Counting and Cardinality

- Goal P-MATH 1 Child knows number names and the count sequence.

Geometry and Spatial Sense

- Goal P-MATH 9 Child identifies, describes, compares, and composes shapes.

Scientific Reasoning

Scientific Inquiry

- Goal P-SCI 1 Child observes and describes observable phenomena (objects, materials, organisms, and events).
- Goal P-SCI 2 Child engages in scientific talk.
- Goal P-SCI 3 Child compares and categorizes observable phenomena.

Reasoning and Problem-Solving

- Goal P-SCI 4 Child asks a question, gathers information, and makes predictions.
- Goal P-SCI 5 Child plans and conducts investigations and experiments.
- Goal P-SCI 6 Child analyzes results, draws conclusions, and communicates.

Next Generation Science Standards

While NGSS does not include standards for early childhood learning, research led the PLTW Launch team to develop content that provides a scaffold to NGSS. Modules address Science and Engineering Practices, Crosscutting Concepts, and Disciplinary Core Ideas and also provide a learning progression toward kindergarten science standards.

- K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- K-2-ETS1-3. Analyze data from tests of two objects' design to solve the same problem to compare the strengths and weaknesses of how each performs.
- ETS1.A: Defining and Delimiting Engineering Problems
    - A situation that people want to change or create can be approached as a problem to be solved through engineering.
    - Asking questions, making observations, and gathering information are helpful in thinking about problems.
    - Before beginning to design a solution, it is important to clearly understand the problem.
- ETS1.B: Developing Possible Solutions. Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.
- ETS1.C: Optimizing the Design Solution. Because there is always more than one possible solution to a problem, it is useful to compare and test designs.
- 2-PS1-1: Matter and Its Interactions. Plan and conduct an investigation to describe and classify different kinds of materials by their properties.

- 2-PS1-2: Matter and Its Interactions. Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.
- 2-PS1-3: Matter and Its Interactions. Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.
- 2-PS1-4: Matter and Its Interactions. Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.
- PS1.A: Structure and Properties of Matter. Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties.
    - Different properties are suited to different purposes.
    - A great variety of objects can be built up from a small set of pieces.
- PS1.B: Chemical Reactions. Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not.
- Science and Engineering Practice: Planning and Carrying Out Investigations. Planning and carrying out investigations to answer questions or test solutions to problems in K-2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.
    - Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.
- Science and Engineering Practice: Constructing Explanations and Designing Solutions. Constructing explanations and designing solutions in K-2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and in designing solutions.
    - Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena.
- Science and Engineering Practice: Asking Questions and Defining Problems. Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions that can be tested.
    - Ask questions based on observations to find more information about the natural and/or designed world(s).
    - Define a simple problem that can be solved through the development of a new or improved object or tool.
- Science and Engineering Practice: Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena. Science searches for cause and effect relationships to explain natural events.
- Science and Engineering Practice: Engaging in Argument from Evidence. Engaging in argument from evidence in K–2 builds on prior experiences and progresses to comparing ideas and representation about the natural and designed world(s).
    - Construct an argument with evidence to support a claim.

- Science and Engineering Practice: Developing and Using Models. Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.
    - Use a model to represent relationships in the natural world.
    - Develop a simple model based on evidence to represent a proposed object or tool.
- Science and Engineering Practice: Obtaining, Evaluating, and Communicating Information. Obtaining, evaluating, and communicating information in K–2 builds on prior experiences and uses observations and texts to communicate new information.
    - Communicate solutions with others in oral and/or written forms using models and/or drawings that provide detail about scientific ideas.
- Science and Engineering Practice: Analyzing and Interpreting Data. Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.
    - Analyze data from tests of an object or tool to determine if it works as intended.
- Cross Cutting Concept: Energy and Matter. Objects may break into smaller pieces and be put together into larger pieces, or change shapes.
- Cross Cutting Concept: Systems and System Models. Systems in the natural and designed world have parts that work together.
- Cross Cutting Concept: Cause and Effect. Events have causes that generate observable patterns.
- Cross Cutting Concept: Patterns. Patterns in the natural and human designed world can be observed.
- Cross Cutting Concept: Influence of Engineering, Technology, and Science on Society and the Natural World. Every human-made product is designed by applying some knowledge of the natural world and is built using materials derived from the natural world.

Common Core State Standards in ELA and Mathematics

CCSS does not provide standards for early childhood learning. As with NGSS, PLTW Launch PreK modules offer a scaffold of learning that moves toward kindergarten standards in ELA and Mathematics.

English Language Arts

- CCSS.ELA-LITERACY.RL.K.1 With prompting and support, ask and answer questions about key details in a text.
- CCSS.ELA-LITERACY.RL.K.2 With prompting and support, retell familiar stories, including key details.

- CCSS.ELA-LITERACY.RL.K.3 With prompting and support, identify characters, settings, and major events in a story.
- CCSS.ELA-LITERACY.SL.K.1 Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups.
- CCSS.ELA-LITERACY.SL.K.1a Follow agreed-upon rules for discussions (e.g., listening to others and taking turns speaking about the topics and texts under discussion).
- CCSS.ELA-LITERACY.SL.K.1b Continue a conversation through multiple exchanges.

Mathematics

- CCSS.MATH.CONTENT.K.CC.B.4 Understand the relationship between numbers and quantities; connect counting to cardinality.
- CCSS.MATH.CONTENT.K.G.B.5 Model shapes in the world by building shapes from components (e.g., sticks and clay balls) and drawing shapes.

Sources

Early Childhood Learning & Knowledge Center. (n.d.). *Head Start Early Learning Outcomes Framework: Ages Birth to Five.* Retrieved from https://eclkc.ohs.acf.hhs.gov/interactive-head-start-early-learning-outcomes-framework-ages-birth-five

National Association for the Education of Young Children. (2017). *NAEYC Early Learning Program Standards*. Retrieved from https://www.naeyc.org/accreditation/early-learning/standards

National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common Core State Standards.* Washington, DC: National Governors Association Center for Best Practices, Council of Chief State School Officers.

NGSS Lead States. (2013). *Next Generation Science Standards: For states by states.* Washington, DC: National Academies Press.

Connections to Standards

The identification of standards to address in the PLTW Launch Pre-Kindergarten (PreK) modules comes after a careful review of standards currently addressed in PLTW Launch modules, the landscape of standards available for early childhood education at the national level, recommendations for preschool by respected organizations, and a review of state standards. Our PreK modules will address standards from the following:

- National Association for the Education of Young Children (NAEYC) Early Learning Program Standards
- Head Start Early Learning Outcomes Framework
- Next Generation Science Standards (NGSS) (provides a scaffold to kindergarten standards)
- Common Core State Standards (CCSS) in English/Language Arts (ELA) and Mathematics (provides a scaffold to kindergarten standards)
- Computer Science Teachers Association K-12 Computer Science Standards (provides a scaffold to kindergarten standards)

This document lists the standards identified from each of these sources for the Healthy Habits module.

NAEYC Early Learning Program Standards

The program standards are used for accreditation of early childhood programs, thus we call out ways in which PLTW PreK modules align to the requirements set forth by NAEYC.

1. Relationships. This program promotes positive relationships between all children and adults to encourage each child's sense of individual worth and belonging as part of a community and to foster each child's ability to contribute as a responsible community member.
2. Curriculum. The program implements a curriculum that is consistent with its goals for children and that promotes learning and development in each of the following areas: social, emotional, physical, language, and cognitive.
3. Teaching. The program uses a variety of developmentally, culturally, and linguistically appropriate and effective teaching approaches, which enhance each child's learning and development in the context of the program's curriculum goals.
4. Assessment of Child Progress. The program uses a variety of formal and informal assessment approaches to provide information on children's learning and development. These assessments occur in the context of reciprocal communications between teachers and families, and with sensitivity to cultural contexts in which children are developing.

The program uses assessment results to inform decisions about the children in their care, to improve teaching practices, and to drive program improvement.

5. Health. The program promotes the nutrition and health of children and protects children and staff from illness.
6. Staff Competencies, Preparation, and Support. The program employs and supports a teaching and administrative staff that have the qualifications, knowledge, and professional commitment necessary to promote children's learning and development and to support families' diverse needs and interests.*
7. Families. The program establishes and maintains collaborative relationships with each child's family to foster children's development in all settings. These relationships are sensitive to family composition, language, and culture.
8. Community Relationships. The program establishes relationships with and uses the resources of the children's communities to support the achievement of program goals.
9. Physical Environment. The program has a safe and healthful environment that provides appropriate and well-maintained indoor and outdoor physical environments. The environment includes facilities, equipment, and materials to facilitate child and staff learning and development.
10. Leadership and Management. The program effectively implements policies, procedures, and systems that support stable staff and strong personnel, fiscal, and program management so all children, families, and staff have high-quality experiences.*

*Standards that are not directly addressed in the module.

Head Start Early Learning Outcomes Framework

Head Start offers well-designed curriculum standards designed specifically for early childhood learning. From our research, we believe that these standards provide a clear connection to the learning needs of pre-kindergarten students. Additionally, we noted other early childhood STEM programs that align to Head Start standards.

Approaches to Learning

Cognitive Self-Regulation (Executive Functioning)

- Goal P-ATL 6 Child maintains focus and sustains attention with minimal adult support.
- Goal P-ATL 7 Child persists in tasks.
- Goal P-ATL 8 Child holds information in mind and manipulates it to perform tasks.
- Goal P-ATL 9 Child demonstrates flexibility in thinking and behavior.

Initiative and Curiosity

- Goal P-ATL 10 Child demonstrates initiative and independence.
- Goal P-ATL 11 Child shows interest in and curiosity about the world around them.

Creativity

- Goal P-ATL 12 Child expresses creativity in thinking and communication.
- Goal P-ATL 13 Child uses imagination in play and interactions with others.

Language and Communication

Attending and Understanding

- Goal P-LC 1 Child attends to communication and language from others.
- Goal P-LC 2 Child understands and responds to increasingly complex communication and language from others.

Communicating and Speaking

- Goal P-LC 3 Child varies the amount of information provided to meet the demands of the situation.
- Goal P-LC 4 Child understands, follows, and uses appropriate social and conversational rules.
- Goal P-LC 5 Child expresses self in increasingly long, detailed, and sophisticated ways.

Vocabulary

- Goal P-LC 6 Child understands and uses a wide variety of words for a variety of purposes.
- Goal P-LC 7 Child shows understanding of word categories and relationships among words.

Literacy

Comprehension and Text Structure

- Goal P-LIT 4 Child demonstrates an understanding of narrative structure through storytelling/re-telling.
- Goal P-LIT 5 Child asks and answers questions about a book that was read aloud.

Writing

- Goal P-LIT 6 Child writes for a variety of purposes using increasingly sophisticated marks.

Mathematics Development

Counting and Cardinality

- Goal P-MATH 1 Child knows number names and the count sequence.
- Goal P-MATH 2 Child recognizes the number of objects in a small set.
- Goal P-MATH 4 Child compares numbers.

Measurement

- Goal P-MATH 8 Child measures objects by their various attributes using standard and non-standard measurement. Uses differences in attributes to make comparisons.

Scientific Reasoning

Scientific Inquiry

- Goal P-SCI 1 Child observes and describes observable phenomena (objects, materials, organisms, and events).
- Goal P-SCI 2 Child engages in scientific talk.
- Goal P-SCI 3 Child compares and categorizes observable phenomena.

Reasoning and Problem-Solving

- Goal P-SCI 4 Child asks a question, gathers information, and makes predictions.
- Goal P-SCI 5 Child plans and conducts investigations and experiments.
- Goal P-SCI 6 Child analyzes results, draws conclusions, and communicates.

Perceptual, Motor, and Physical Development

Health, Safety, and Nutrition

- Goal P-PMP 4 Child demonstrates personal hygiene and self-care skills.
- Goal P-PMP 5 Child develops knowledge and skills that help promote nutritious food choices and eating habits.

Next Generation Science Standards

While NGSS does not include standards for early childhood learning, research led the PLTW Launch team to develop content that provides a scaffold to NGSS. Modules address Science and Engineering Practices, Crosscutting Concepts, and Disciplinary Core Ideas and also provide a learning progression toward kindergarten science standards.

- K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- K-2-ETS1-3. Analyze data from tests of two objects' design to solve the same problem to compare the strengths and weaknesses of how each performs.
- ETS1.A: Defining and Delimiting Engineering Problems
    - A situation that people want to change or create can be approached as a problem to be solved through engineering.

    - Asking questions, making observations, and gathering information are helpful in thinking about problems.
    - Before beginning to design a solution, it is important to clearly understand the problem.
- ETS1.B: Developing Possible Solutions. Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.
- ETS1.C: Optimizing the Design Solution. Because there is always more than one possible solution to a problem, it is useful to compare and test designs.
- Science and Engineering Practice: Asking Questions and Defining Problems. Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions that can be tested.
    - Ask questions based on observations to find more information about the natural and/or designed world(s).
    - Define a simple problem that can be solved through the development of a new or improved object or tool.
- Science and Engineering Practice: Engaging in Argument from Evidence. Engaging in argument from evidence in K–2 builds on prior experiences and progresses to comparing ideas and representation about the natural and designed world(s).
    - Construct an argument with evidence to support a claim.
- Science and Engineering Practice: Developing and Using Models. Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.
    - Use a model to represent relationships in the natural world.
    - Develop a simple model based on evidence to represent a proposed object or tool.
- Science and Engineering Practice: Obtaining, Evaluating, and Communicating Information. Obtaining, evaluating, and communicating information in K–2 builds on prior experiences and uses observations and texts to communicate new information.
    - Communicate solutions with others in oral and/or written forms using models and/or drawings that provide detail about scientific ideas.
- Science and Engineering Practice: Analyzing and Interpreting Data. Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.
    - Analyze data from tests of an object or tool to determine if it works as intended.
- Cross Cutting Concept: Structure and Function. The shape and stability of structures of natural and designed objects are related to their function(s).
- Cross Cutting Concept: Systems and System Models. Systems in the natural and designed world have parts that work together.

- Cross Cutting Concept: Cause and Effect. Events have causes that generate observable patterns.

Common Core State Standards in ELA and Mathematics

CCSS does not provide standards for early childhood learning. As with NGSS, PLTW Launch PreK modules offer a scaffold of learning that moves toward kindergarten standards in ELA and Mathematics.

English Language Arts

- CCSS.ELA-LITERACY.RL.K.1 With prompting and support, ask and answer questions about key details in a text.
- CCSS.ELA-LITERACY.RL.K.2 With prompting and support, retell familiar stories, including key details.
- CCSS.ELA-LITERACY.RL.K.3 With prompting and support, identify characters, settings, and major events in a story.
- CCSS.ELA-LITERACY.SL.K.1 Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups.
- CCSS.ELA-LITERACY.SL.K.1a Follow agreed-upon rules for discussions (e.g., listening to others and taking turns speaking about the topics and texts under discussion).
- CCSS.ELA-LITERACY.SL.K.1b Continue a conversation through multiple exchanges.

Mathematics

- CCSS.MATH.CONTENT.K.MD.A.1 Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.
- CCSS.MATH.CONTENT.K.MD.A.2 Directly compare two objects with a measurable attribute in common, to see which object has “more of”/”less of” the attribute, and describe the difference.
- CCSS.MATH.PRACTICE.MP.5 Use appropriate tools strategically.

Sources

Early Childhood Learning & Knowledge Center (n.d.). *Head Start Early Learning Outcomes Framework: Ages Birth to Five.* Retrieved from https://eclkc.ohs.acf.hhs.gov/interactive-head-start-early-learning-outcomes-framework-ages-birth-five

National Association for the Education of Young Children (2017). *NAEYC Early Learning Program Standards*. Retrieved from https://www.naeyc.org/accreditation/early-learning/standards

National Governors Association Center for Best Practices, & Council of Chief State School Officers (2010). *Common Core State Standards.* Washington, DC: National Governors Association Center for Best Practices, Council of Chief State School Officers.

NGSS Lead States. (2013). *Next Generation Science Standards: For states by states.* Washington, DC: National Academies Press.

Connections to Standards

The identification of standards to address in the PLTW Launch Pre-Kindergarten (PreK) modules comes after a careful review of standards currently addressed in PLTW Launch modules, the landscape of standards available for early childhood education at the national level, recommendations for preschool by respected organizations, and a review of state standards. Our PreK modules will address standards from the following:

- National Association for the Education of Young Children (NAEYC) Early Learning Program Standards
- Head Start Early Learning Outcomes Framework
- Next Generation Science Standards (NGSS) (provides a scaffold to kindergarten standards)
- Common Core State Standards (CCSS) in English/Language Arts (ELA) and Mathematics (provides a scaffold to kindergarten standards)
- Computer Science Teachers Association K-12 Computer Science Standards (provides a scaffold to kindergarten standards)

This document lists the standards identified from each of these sources for the Spatial Sense and Coding module.

NAEYC Early Learning Program Standards

The program standards are used for accreditation of early childhood programs, thus we call out ways in which PLTW PreK modules align to the requirements set forth by NAEYC.

1. Relationships. This program promotes positive relationships between all children and adults to encourage each child's sense of individual worth and belonging as part of a community and to foster each child's ability to contribute as a responsible community member.
2. Curriculum. The program implements a curriculum that is consistent with its goals for children and that promotes learning and development in each of the following areas: social, emotional, physical, language, and cognitive.
3. Teaching. The program uses a variety of developmentally, culturally, and linguistically appropriate and effective teaching approaches, which enhance each child's learning and development in the context of the program's curriculum goals.
4. Assessment of Child Progress. The program uses a variety of formal and informal assessment approaches to provide information on children's learning and development. These assessments occur in the context of reciprocal communications between teachers and families, and with sensitivity to cultural contexts in which children are developing.

The program uses assessment results to inform decisions about the children in their care, to improve teaching practices, and to drive program improvement.

5. Health. The program promotes the nutrition and health of children and protects children and staff from illness.*
6. Staff Competencies, Preparation, and Support. The program employs and supports a teaching and administrative staff that have the qualifications, knowledge, and professional commitment necessary to promote children's learning and development and to support families' diverse needs and interests.*
7. Families. The program establishes and maintains collaborative relationships with each child's family to foster children's development in all settings. These relationships are sensitive to family composition, language, and culture.
8. Community Relationships. The program establishes relationships with and uses the resources of the children's communities to support the achievement of program goals.
9. Physical Environment. The program has a safe and healthful environment that provides appropriate and well-maintained indoor and outdoor physical environments. The environment includes facilities, equipment, and materials to facilitate child and staff learning and development.
10. Leadership and Management. The program effectively implements policies, procedures, and systems that support stable staff and strong personnel, fiscal, and program management so all children, families, and staff have high-quality experiences.*

*Standards that are not directly addressed in the module.

Head Start Early Learning Outcomes Framework

Head Start offers well-designed curriculum standards designed specifically for early childhood learning. From our research, we believe that these standards provide a clear connection to the learning needs of pre-kindergarten students. Additionally, we noted other early childhood STEM programs that align to Head Start standards.

Approaches to Learning

Cognitive Self-Regulation (Executive Functioning)

- Goal P-ATL 6 Child maintains focus and sustains attention with minimal adult support.
- Goal P-ATL 7 Child persists in tasks.
- Goal P-ATL 8 Child holds information in mind and manipulates it to perform tasks.
- Goal P-ATL 9 Child demonstrates flexibility in thinking and behavior.

Initiative and Curiosity

- Goal P-ATL 10 Child demonstrates initiative and independence.
- Goal P-ATL 11 Child shows interest in and curiosity about the world around them.

Creativity

- Goal P-ATL 12 Child expresses creativity in thinking and communication.
- Goal P-ATL 13 Child uses imagination in play and interactions with others.

Language and Communication

Attending and Understanding

- Goal P-LC 1 Child attends to communication and language from others.
- Goal P-LC 2 Child understands and responds to increasingly complex communication and language from others.

Communicating and Speaking

- Goal P-LC 3 Child varies the amount of information provided to meet the demands of the situation.
- Goal P-LC 4 Child understands, follows, and uses appropriate social and conversational rules.
- Goal P-LC 5 Child expresses self in increasingly long, detailed, and sophisticated ways.

Vocabulary

- Goal P-LC 6 Child understands and uses a wide variety of words for a variety of purposes.
- Goal P-LC 7 Child shows understanding of word categories and relationships among words.

Literacy

Comprehension and Text Structure

- Goal P-LIT 4 Child demonstrates an understanding of narrative structure through storytelling/re-telling.
- Goal P-LIT 5 Child asks and answers questions about a book that was read aloud.

Writing

- Goal P-LIT 6 Child writes for a variety of purposes using increasingly sophisticated marks.

Mathematics Development

Counting and Cardinality

- Goal P-MATH 2 Child recognizes the number of objects in a small set.

Operations and Algebraic Thinking

- Goal P-MATH 7 Child understands simple patterns.

Geometry and Spatial Sense

- Goal P-MATH 9 Child identifies, describes, compares, and composes shapes.
- Goal P-MATH 10 Child explores the positions of objects in space.

Scientific Reasoning

Scientific Inquiry

- Goal P-SCI 1 Child observes and describes observable phenomena (objects, materials, organisms, and events).
- Goal P-SCI 2 Child engages in scientific talk.
- Goal P-SCI 3 Child compares and categorizes observable phenomena.

Reasoning and Problem-Solving

- Goal P-SCI 4 Child asks a question, gathers information, and makes predictions.
- Goal P-SCI 5 Child plans and conducts investigations and experiments.
- Goal P-SCI 6 Child analyzes results, draws conclusions, and communicates.

Next Generation Science Standards

While NGSS does not include standards for early childhood learning, research led the PLTW Launch team to develop content that provides a scaffold to NGSS. Modules address Science and Engineering Practices, Crosscutting Concepts, and Disciplinary Core Ideas and also provide a learning progression toward kindergarten science standards.

- K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- K-2-ETS1-3. Analyze data from tests of two objects' design to solve the same problem to compare the strengths and weaknesses of how each performs.
- ETS1.A: Defining and Delimiting Engineering Problems
    - A situation that people want to change or create can be approached as a problem to be solved through engineering.
    - Asking questions, making observations, and gathering information are helpful in thinking about problems.
    - Before beginning to design a solution, it is important to clearly understand the problem.
- ETS1.B: Developing Possible Solutions. Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.

- ETS1.C: Optimizing the Design Solution. Because there is always more than one possible solution to a problem, it is useful to compare and test designs.
- Science and Engineering Practice: Asking Questions and Defining Problems. Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions that can be tested.
    - Ask questions based on observations to find more information about the natural and/or designed world(s).
    - Define a simple problem that can be solved through the development of a new or improved object or tool.
- Science and Engineering Practice: Engaging in Argument from Evidence. Engaging in argument from evidence in K–2 builds on prior experiences and progresses to comparing ideas and representation about the natural and designed world(s).
    - Construct an argument with evidence to support a claim.
- Science and Engineering Practice: Developing and Using Models. Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.
    - Use a model to represent relationships in the natural world.
    - Develop a simple model based on evidence to represent a proposed object or tool.
- Science and Engineering Practice: Obtaining, Evaluating, and Communicating Information. Obtaining, evaluating, and communicating information in K–2 builds on prior experiences and uses observations and texts to communicate new information.
    - Communicate solutions with others in oral and/or written forms using models and/or drawings that provide detail about scientific ideas.
- Science and Engineering Practice: Analyzing and Interpreting Data. Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.
    - Analyze data from tests of an object or tool to determine if it works as intended.
- Cross Cutting Concept: Structure and Function. The shape and stability of structures of natural and designed objects are related to their function(s).
- Cross Cutting Concept: Systems and System Models. Systems in the natural and designed world have parts that work together.
- Cross Cutting Concept: Cause and Effect. Events have causes that generate observable patterns.

Common Core State Standards in ELA and Mathematics

CCSS does not provide standards for early childhood learning. As with NGSS, PLTW Launch PreK modules offer a scaffold of learning that moves toward kindergarten standards in ELA and Mathematics.

English Language Arts

- CCSS.ELA-LITERACY.RL.K.1 With prompting and support, ask and answer questions about key details in a text.
- CCSS.ELA-LITERACY.RL.K.2 With prompting and support, retell familiar stories, including key details.
- CCSS.ELA-LITERACY.RL.K.3 With prompting and support, identify characters, settings, and major events in a story.
- CCSS.ELA-LITERACY.SL.K.1 Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups.
- CCSS.ELA-LITERACY.SL.K.1a Follow agreed-upon rules for discussions (e.g., listening to others and taking turns speaking about the topics and texts under discussion).
- CCSS.ELA-LITERACY.SL.K.1b Continue a conversation through multiple exchanges.

Mathematics

- CCSS.MATH.PRACTICE.MP.2 Reason abstractly and quantitatively.
- CCSS.MATH.PRACTICE.MP.4 Model with mathematics.
- CCSS.MATH.PRACTICE.MP.5 Use appropriate tools strategically.

CSTA K-12 Computer Science Standards

Since PreK standards are not included in CSTA K-12 Computer Science Standards, PLTW Launch PreK modules address skills that easily scaffold to expectations for learning in the K–2 grade bands.

- 1A-CS-01 Select and operate appropriate software to perform a variety of tasks, and recognize that users have different needs and preferences for the technology they use.
- 1A-AP-09 Model the way programs store and manipulate data by using numbers or other symbols to represent information.
- 1A-AP-10 Develop programs with sequences and simple loops, to express ideas or address a problem.

- 1A-AP-11 Decompose (break down) the steps needed to solve a problem into a precise sequence of instructions.
- 1A-AP-12 Develop plans that describe a program's sequence of events, goals, and expected outcomes.
- 1A-AP-13 Give attribution when using the ideas and creations of others while developing programs.
- 1A-AP-14 Debug (identify and fix) errors in an algorithm or program that includes sequences and simple loops.
- 1A-AP-15 Using correct terminology, describe steps taken and choices made during the iterative process of program development.

Sources

Computer Science Teacher Association. (2017). *CSTA K-12 Computer Science Standards, Revised 2017.* Retrieved from https://www.csteachers.org/page/standards

Early Childhood Learning & Knowledge Center. (n.d.). *Head Start Early Learning Outcomes Framework: Ages Birth to Five.* Retrieved from https://eclkc.ohs.acf.hhs.gov/interactive-head-start-early-learning-outcomes-framework-ages-birth-five

National Association for the Education of Young Children. (2017). *NAEYC Early Learning Program Standards*. Retrieved from https://www.naeyc.org/accreditation/early-learning/standards

National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common Core State Standards.* Washington, DC: National Governors Association Center for Best Practices, Council of Chief State School Officers.

NGSS Lead States. (2013). *Next Generation Science Standards: For states by states.* Washington, DC: National Academies Press.

Connections to Standards

PLTW programs are designed to empower students to thrive in an evolving world. As a part of this process, we take connections to standards into account when developing and updating our curriculum. The PLTW Launch modules address standards from the following:

- Next Generation Science Standards (NGSS)
- Common Core State Standards (CCSS) in English/Language Arts (ELA) and Mathematics

This document lists the standards identified from each of these sources for the Structure and Function: Exploring Design module.

Next Generation Science Standards

- K-2-ETS1-1 Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2-ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- K-2-ETS1-3 Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.
- ETS1.A: Defining and Delimiting an Engineering Problem. Asking questions, making observations, and gathering information are helpful in thinking about problems.
- ETS1.B: Developing Possible Solutions. Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.
- ETS1.C: Optimizing the Design Solution. Because there is always more than one possible solution to a problem, it is useful to compare and test designs.
- Science and Engineering Practice: Asking Questions and Defining Problems. Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions.
    - Ask questions based on observations to find more information about the natural and/or designed world(s).
    - Define a simple problem that can be solved through the development of a new or improved object or tool.
- Science and Engineering Practice: Developing and Using Models. Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e.,

diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.
    - Develop a simple model based on evidence to represent a proposed object or tool.
- Science and Engineering Practice: Analyzing and Interpreting Data. Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.
    - Analyze data from tests of an object or tool to determine if it works as intended.
- Crosscutting Concept: Structure and Function. The shape and stability of structures of natural and designed objects are related to their function(s).

Common Core State Standards ELA and Mathematics

English Language Arts

- CCSS.ELA-LITERACY.RL.K.1 With prompting and support, ask and answer questions about key details in a text.
- CCSS.ELA-LITERACY.RL.K.2 With prompting and support, retell familiar stories, including key details.
- CCSS.ELA-LITERACY.RL.K.3 With prompting and support, identify characters, settings, and major events in a story.
- CCSS.ELA-LITERACY.SL.K.1 Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups.
- CCSS.ELA-LITERACY.SL.K.1a Follow agreed-upon rules for discussions (e.g., listening to others and taking turns speaking about the topics and texts under discussion).
- CCSS.ELA-LITERACY.SL.K.1b Continue a conversation through multiple exchanges.

Mathematics

- CCSS.MATH.CONTENT.K.MD.A.1 Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.
- CCSS.MATH.CONTENT.K.MD.A.2 Directly compare two objects with a measurable attribute in common, to see which object has “more of”/“less of” the attribute, and describe the difference.
- CCSS.MATH.PRACTICE.MP.2 Reason abstractly and quantitatively.
- CCSS.MATH.PRACTICE.MP.4 Model with mathematics.
- CCSS.MATH.PRACTICE.MP.5 Use appropriate tools strategically.

Sources

National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common core state standards.* Washington, DC: National Governors Association Center for Best Practices, Council of Chief State School Officers.

NGSS Lead States. (2013). *Next generation science standards: For states by states.* Washington, DC: The National Academies Press.

Connections to Standards

PLTW programs are designed to empower students to thrive in an evolving world. As a part of this process, we take connections to standards into account when developing and updating our curriculum. The PLTW Launch modules will address standards from the following:

- Next Generation Science Standards (NGSS)
- Common Core State Standards (CCSS) in English/Language Arts (ELA) and Mathematics

This document lists the standards identified from each of these sources for the Pushes and Pulls module.

Next Generation Science Standards

- K-PS2-1 Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.
- K-PS2-2 Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.
- PS2.A Forces and Motion: Pushes and pulls can have different strengths and directions.
- PS2.A Forces and Motion: Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it.
- PS2.B Types of Interactions: When objects touch or collide, they push on one another and can change motion.
- PS3.C Relationship Between Energy and Forces: A bigger push or pull makes things speed up or slow down more quickly.
- K-2-ETS1-1 Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2-ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- K-2-ETS1-3 Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.
- ETS1.A Defining and Delimiting an Engineering Problem: Asking questions, making observations, and gathering information are helpful in thinking about problems.
- ETS1.B Developing Possible Solutions: Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.

- ETS1.C Optimizing the Design Solution: Because there is always more than one possible solution to a problem, it is useful to compare and test designs.
- Science and Engineering Practice: Asking Questions and Defining Problems. Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions.
    - Ask questions based on observations to find more information about the natural and/or designed world(s).
    - Define a simple problem that can be solved through the development of a new or improved object or tool.
- Science and Engineering Practice: Developing and Using Models. Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.
    - Develop a simple model based on evidence to represent a proposed object or tool.
- Science and Engineering Practice: Analyzing and Interpreting Data. Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.
    - Analyze data from tests of an object or tool to determine if it works as intended.
- Crosscutting Concept: Structure and Function. The shape and stability of structures of natural and designed objects are related to their function(s).
- Crosscutting Concept: Cause and Effect. Simple tests can be designed to gather evidence to support or refute student ideas about causes.

Common Core State Standards ELA and Mathematics

English Language Arts

- CCSS.ELA-LITERACY.W.K.2 Use a combination of drawing, dictating, and writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic.
- CCSS.ELA-LITERACY.SL.K.1 Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups.
    - CCSS.ELA-LITERACY.SL.K.1.A Follow agreed-upon rules for discussions (e.g., listening to others and taking turns speaking about the topics and texts under discussion).
    - CCSS.ELA-LITERACY.SL.K.1.B Continue a conversation through multiple exchanges.

- CCSS.ELA-LITERACY.SL.K.2 Confirm understanding of a text read aloud or information presented orally or through other media by asking and answering questions about key details and requesting clarification if something is not understood.
- CCSS.ELA-LITERACY.SL.K.3 Ask and answer questions in order to seek help, get information, or clarify something that is not understood.
- CCSS.ELA-LITERACY.SL.K.4 Describe familiar people, places, things, and events and, with prompting and support, provide additional detail.
- CCSS.ELA-LITERACY.SL.K.5 Add drawings or other visual displays to descriptions as desired to provide additional detail.

Mathematics

- CCSS.MATH.CONTENT.K.MD.A.1 Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.
- CCSS.MATH.CONTENT.K.MD.A.2 Directly compare two objects with a measurable attribute in common, to see which object has “more of”/”less of” the attribute, and describe the difference. For example, directly compare the heights of two children and describe one child as taller/shorter.
- CCSS.MATH.CONTENT.K.MD.B.3 Classify objects into given categories; count the numbers of objects in each category and sort the categories by count.

Sources

National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common core state standards.* Washington, DC: National Governors Association Center for Best Practices, Council of Chief State School Officers.

NGSS Lead States. (2013). *Next generation science standards: For states by states.* Washington, DC: The National Academies Press.

Connections to Standards

PLTW programs are designed to empower students to thrive in an evolving world. As a part of this process, we take connections to standards into account when developing and updating our curriculum. The PLTW Launch modules will address standards from the following:

- Next Generation Science Standards (NGSS)
- Common Core State Standards (CCSS) in English/Language Arts (ELA) and Mathematics

This document lists the standards identified from each of these sources for the Structure and Function: Human Body module.

Next Generation Science Standards

- K-2-ETS1-1 Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2-ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- K-2-ETS1-3 Analyze data from tests of two objects design to solve the same problem to compare the strengths and weaknesses of how each performs.
- ETS1.A Defining and Delimiting an Engineering Problem: Asking questions, making observations, and gathering information are helpful in thinking about problems.
- ETS1.B Developing Possible Solutions: Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.
- ETS1.C Optimizing the Design Solution: Because there is always more than one possible solution to a problem, it is useful to compare and test designs.
- Cross Cutting Concept: Structure and Function. The shape and stability of structures of natural and designed objects are related to their function(s).
- Cross Cutting Concept: Systems and System Models. Systems in the natural and designed world have parts that work together.
- Science and Engineering Practice: Asking Questions and Defining Problems. Asking questions and defining problems in K-2 builds on prior experiences and progresses to simple descriptive questions that can be tested.
- Science and Engineering Practice: Developing and Using Models. Modeling in K-2 builds on prior experiences and progresses to include using and developing models (i.e.,

diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.

- Science and Engineering Practice: Planning and Carrying Out Investigations. Planning and carrying out investigations to answer questions or test solutions to problems in K-2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.
- Science and Engineering Practice: Analyzing and Interpreting Data. Analyzing data in K-2 builds on prior experiences and progresses to collecting, recording, and sharing observations.
- Science and Engineering Practice: Using Mathematics and Computational Thinking. Mathematical and computational thinking in K-2 builds on prior experience and progresses to recognizing that mathematics can be used to describe the natural and designed world(s).
- Science and Engineering Practice: Constructing Explanations and Designing Solutions. Constructing explanations and designing solutions in K-2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.
- Science and Engineering Practice: Engaging in Argument from Evidence. Engaging in argument from evidence in K-2 builds on prior experiences and progresses to comparing ideas and representation about the natural and designed world(s).
- Science and Engineering Practice: Obtaining, Evaluating, and Communicating Information. Obtaining, evaluating, and communicating information in K-2 builds on prior experiences and uses observations and texts to communicate new information.

Common Core State Standards ELA and Mathematics

English Language Arts

- CCSS.ELA-LITERACY.RL.K.1 With prompting and support, ask and answer questions about key details in a text.
- CCSS.ELA-LITERACY.RL.K.2 With prompting and support, retell familiar stories, including key details.
- CCSS.ELA-LITERACY.RL.K.3 With prompting and support, identify characters, settings, and major events in a story.
- CCSS.ELA-LITERACY.RL.K.10 Actively engage in group reading activities with purpose and understanding.
- CCSS.ELA-LITERACY.SL.K.1 Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups.
- CCSS.ELA-LITERACY.SL.K.1a Follow agreed-upon rules for discussions (e.g., listening to others and taking turns speaking about the topics and texts under discussion).

- CCSS.ELA-LITERACY.SL.K.1b Continue a conversation through multiple exchanges.

Mathematics

- CCSS.MATH.CONTENT.K.CC.A.1 Count to 100 by ones and by tens.
- CCSS.MATH.CONTENT.K.CC.A.3 Write numbers from 0 to 20. Represent a number of objects with a written numeral 0–20 (with 0 representing a count of no objects).
- CCSS.MATH.CONTENT.K.CC.B.5 Count to answer “how many?” questions about as many as 20 things arranged in a line, a rectangular array, or a circle, or as many as 10 things in a scattered configuration; given a number from 1–20, count out that many objects.
- CCSS.MATH.PRACTICE.MP.2 Reason abstractly and quantitatively.
- CCSS.MATH.PRACTICE.MP.4 Model with mathematics.
- CCSS.MATH.PRACTICE.MP.5 Use appropriate tools strategically.

Sources

National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common core state standards.* Washington, DC: National Governors Association Center for Best Practices, Council of Chief State School Officers.

NGSS Lead States. (2013). *Next generation science standards: For states by states.* Washington, DC: The National Academies Press.

Connections to Standards

PLTW programs are designed to empower students to thrive in an evolving world. As a part of this process, we take connections to standards into account when developing and updating our curriculum. The PLTW Launch modules will address standards from the following:

- Computer Science Teachers Association K-12 Computer Science Standards
- Next Generation Science Standards (NGSS)
- Common Core State Standards (CCSS) in English/Language Arts (ELA) and Mathematics

This document lists the standards identified from each of these sources for the Animals and Algorithms module.

Computer Science Teachers Association K-12 CS Standards

- 1A-CS-01 Select and operate appropriate software to perform a variety of tasks, and recognize that users have different needs and preferences for the technology they use.
- 1A-AP-09 Model the way programs store and manipulate data by using numbers or other symbols to represent information.
- 1A-AP-10 Develop programs with sequences and simple loops, to express ideas or address a problem.
- 1A-AP-11 Decompose (break down) the steps needed to solve a problem into a precise sequence of instructions.
- 1A-AP-12 Develop plans that describe a program's sequence of events, goals, and expected outcomes.
- 1A-AP-14 Debug (identify and fix) errors in an algorithm or program than includes sequences and simple loops.
- 1A-AP-15 Using correct terminology, describe steps taken and choices made during the iterative process of program development.

Next Generation Science Standards

- K-ESS3-1 Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live.

- K-2-ETS1-1 Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2-ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- K-2-ETS1-3 Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.
- ETS1.A Defining and Delimiting Engineering Problems
    - Asking questions, making observations, and gathering information are helpful in thinking about problems.
    - Before beginning to design a solution, it is important to clearly understand the problem.
- ETS1.B Developing Possible Solutions: Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas from a problem's solutions to other people.
- ETS1.C Optimizing the Design Solution: Because there is always more than one possible solution to a problem, it is useful to compare and test designs.
- Science and Engineering Practice: Asking Questions and Defining Problems. Asking questions and defining problems in K-2 builds on prior experiences and progresses to simple descriptive questions that can be tested.
- Science and Engineering Practice: Use tools and/or materials to design and/or build a device that solves a specific problem or a solution to a specific problem.
- Science and Engineering Practice: Generate and/or compare multiple solutions to a problem.
- Science and Engineering Practice: With guidance, plan and conduct an investigation in collaboration with peers (for K).

Common Core State Standards ELA and Mathematics

English Language Arts

- CCSS.ELA-LITERACY.RL.K.3 With prompting and support, identify characters, settings, and major events in a story.
- CCSS.ELA-LITERACY.W.K.3 Use a combination of drawing, dictating, and writing to narrate a single event or several loosely linked events, tell about the events in the order in which they occurred, and provide a reaction to what happened.
- CCSS.ELA-LITERACY.W.K.6 With guidance and support from adults, explore a variety of digital tools to produce and publish writing, including in collaboration with peers.

- CCSS.ELA-LITERACY.SL.K.1 Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups.
    - CCSS.ELA-LITERACY.SL.K.1.A Follow agreed-upon rules for discussions (e.g., listening to others and taking turns speaking about the topics and texts under discussion).
    - CCSS.ELA-LITERACY.SL.K.1.B Continue a conversation through multiple exchanges.
- CCSS.ELA-LITERACY.SL.K.5 Add drawings or other visual displays to descriptions as desired to provide additional detail.

Mathematics

- CCSS.MATH.CONTENT.K.CC.A.2 Count forward beginning from a given number within the known sequence (instead of having to begin at 1).
- CCSS.MATH.CONTENT.K.G.A.1 Describe objects in the environment using names of shapes, and describe the relative positions of these objects using terms such as above, below, beside, in front of, behind, and next to**.**

Sources

Computer Science Teachers Association. (2017). *CSTA K-12 computer science standards, revised 2017*. Retrieved from http://www.csteachers.org/standards.

National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common core state standards.* Washington, DC: National Governors Association Center for Best Practices, Council of Chief State School Officers.

NGSS Lead States. (2013). *Next generation science standards: For states by states.* Washington, DC: The National Academies Press.

Connections to Standards

PLTW programs are designed to empower students to thrive in an evolving world. As a part of this process, we take connections to standards into account when developing and updating our curriculum. The PLTW Launch modules will address standards from the following:

- Next Generation Science Standards (NGSS)
- Common Core State Standards (CCSS) in English/Language Arts (ELA) and Mathematics

This document lists the standards identified from each of these sources for the Light and Sound module.

Next Generation Science Standards

- 1-PS4-1 Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.
- 1-PS4-2 Make observations to construct an evidence-based account that objects in darkness can be seen only when illuminated.
- 1-PS4-3 Plan and conduct an investigation to determine the effect of placing objects made with different materials in the path of a beam of light.
- 1-PS4-4 Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.
- PS4.A Wave Properties: Sound can make matter vibrate, and vibrating matter can make sound.
- PS4.B Electromagnetic Radiation: Objects can be seen if light is available to illuminate them or if they give off their own light.
- PS4.B Electromagnetic Radiation: Some materials allow light to pass through them, others allow only some light through and others block all the light and create a dark shadow on any surface beyond them, where the light cannot reach. Mirrors can be used to redirect a light beam.
- PS4.C Information Technologies and Instrumentation: People also use a variety of devices to communicate (send and receive information) over long distances.
- K-2-ETS1-1 Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2-ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

- K-2-ETS1-3 Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.
- ETS1.A Defining and Delimiting an Engineering Problem: Asking questions, making observations, and gathering information are helpful in thinking about problems.
- ETS1.B Developing Possible Solutions: Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.
- ETS1.C Optimizing the Design Solution: Because there is always more than one possible solution to a problem, it is useful to compare and test designs.
- Science and Engineering Practice: Asking Questions and Defining Problems. Asking questions and defining problems in K-2 builds on prior experiences and progresses to simple descriptive questions that can be tested.
- Science and Engineering Practice: Developing and Using Models. Modeling in K-2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.
- Science and Engineering Practice: Planning and Carrying Out Investigations. Planning and carrying out investigations to answer questions or test solutions to problems in K-2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.
- Science and Engineering Practice: Analyzing and Interpreting Data. Analyzing data in K-2 builds on prior experiences and progresses to collecting, recording, and sharing observations.
- Science and Engineering Practice: Using Mathematics and Computational Thinking. Mathematical and computational thinking in K-2 builds on prior experience and progresses to recognizing that mathematics can be used to describe the natural and designed world(s).
- Science and Engineering Practice: Constructing Explanations and Designing Solutions. Constructing explanations and designing solutions in K-2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.
- Science and Engineering Practice: Engaging in Argument from Evidence. Engaging in argument from evidence in K-2 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s).
- Science and Engineering Practice: Obtaining, Evaluating, and Communicating Information. Obtaining, evaluating, and communicating information in K-2 builds on prior experiences and uses observations and texts to communicate new information.
- Crosscutting Concept: Cause and Effect. Simple tests can be designed to gather evidence to support or refute student ideas about causes.

Common Core State Standards ELA and Mathematics

English Language Arts

- CCSS.ELA-LITERACY.W.1.2 Write informative/explanatory texts in which they name a topic, supply some facts about the topic, and provide some sense of closure.
- CCSS.ELA-LITERACY.SL.1.1 Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups.
    - CCSS.ELA-LITERACY.SL.1.1a Follow agreed-upon rules for discussions (e.g., listening to others with care, speaking one at a time about the topics and texts under discussion).
    - CCSS.ELA-LITERACY.SL.1.1b Build on others' talk in conversations by responding to the comments of others through multiple exchanges.
    - CCSS.ELA-LITERACY.SL.1.1c Ask questions to clear up any confusion about the topics and texts under discussion.
- CCSS.ELA-LITERACY.SL.1.5 Add drawings or other visual displays to descriptions when appropriate to clarify ideas, thoughts, and feelings.
- CCSS.ELA-LITERACY.SL.1.6 Produce complete sentences when appropriate to task and situation.

Mathematics

- CCSS.MATH.CONTENT.1.MD.A.1 Order three objects by length; compare the lengths of two objects indirectly by using a third object.
- CCSS.MATH.CONTENT.1.MD.A.2 Express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps.
- CCSS.MATH.CONTENT.1.MD.C.4 Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.

Sources

National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common core state standards.* Washington, DC: National Governors Association Center for Best Practices, Council of Chief State School Officers.

NGSS Lead States. (2013). *Next generation science standards: For states by states.* Washington, DC: The National Academies Press.

Connections to Standards

PLTW programs are designed to empower students to thrive in an evolving world. As a part of this process, we take connections to standards into account when developing and updating our curriculum. The PLTW Launch modules will address standards from the following:

- Next Generation Science Standards (NGSS)
- Common Core State Standards (CCSS) in English/Language Arts (ELA) and Mathematics

This document lists the standards identified from each of these sources for the Light: Observing the Sun, Moon, and Stars module.

Next Generation Science Standards

- 1-PS4-2 Make observations to construct an evidence-based account that objects in darkness can be seen only when illuminated.
- PS4.B Electromagnetic Radiation: Objects can be seen if light is available to illuminate them or if they give off their own light.
- PS4.B Electromagnetic Radiation: Some materials allow light to pass through them, others allow only some light through and others block all the light and create a dark shadow on any surface beyond them, where the light cannot reach. Mirrors can be used to redirect a light beam.
- 1-ESS1-1 Use observations of the sun, moon, and stars to describe patterns that can be predicted.
- 1-ESS1-2 Make observations at different times of year to relate the amount of daylight to the time of year.
- ESS1.A The Universe and its Stars: Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted.
- ESS1.B Earth and the Solar System: Seasonal patterns of sunrise and sunset can be observed, described, and predicted.
- K-2-ETS1-1 Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2-ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- K-2-ETS1-3 Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

- ETS1.A Defining and Delimiting an Engineering Problem: Asking questions, making observations, and gathering information are helpful in thinking about problems.
- ETS1.B Developing Possible Solutions: Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.
- ETS1.C Optimizing the Design Solution: Because there is always more than one possible solution to a problem, it is useful to compare and test designs.
- Science and Engineering Practice: Asking Questions and Defining Problems. Asking questions and defining problems in K-2 builds on prior experiences and progresses to simple descriptive questions that can be tested.
- Science and Engineering Practice: Developing and Using Models. Modeling in K-2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.
- Science and Engineering Practice: Planning and Carrying Out Investigations. Planning and carrying out investigations to answer questions or test solutions to problems in K-2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.
- Science and Engineering Practice: Analyzing and Interpreting Data. Analyzing data in K-2 builds on prior experiences and progresses to collecting, recording, and sharing observations.
- Science and Engineering Practice: Using Mathematics and Computational Thinking. Mathematical and computational thinking in K-2 builds on prior experience and progresses to recognizing that mathematics can be used to describe the natural and designed world(s).
- Science and Engineering Practice: Constructing Explanations and Designing Solutions. Constructing explanations and designing solutions in K-2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.
- Science and Engineering Practice: Engaging in Argument from Evidence. Engaging in argument from evidence in K-2 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s).
- Science and Engineering Practice: Obtaining, Evaluating, and Communicating Information. Obtaining, evaluating, and communicating information in K-2 builds on prior experiences and uses observations and texts to communicate new information.
- Crosscutting Concept: Cause and Effect. Simple tests can be designed to gather evidence to support or refute student ideas about causes.
- Crosscutting Concept: Patterns. Patterns in the natural world can be observed, used to describe phenomena, and used as evidence.

Common Core State Standards ELA and Mathematics

English Language Arts

- CCSS.ELA-LITERACY.W.1.2 Write informative/explanatory texts in which they name a topic, supply some facts about the topic, and provide some sense of closure.
- CCSS.ELA-LITERACY.SL.1.1 Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups.
    - CCSS.ELA-LITERACY.SL.1.1a Follow agreed-upon rules for discussions (e.g., listening to others with care, speaking one at a time about the topics and texts under discussion).
    - CCSS.ELA-LITERACY.SL.1.1b Build on others' talk in conversations by responding to the comments of others through multiple exchanges.
    - CCSS.ELA-LITERACY.SL.1.1c Ask questions to clear up any confusion about the topics and texts under discussion.
- CCSS.ELA-LITERACY.SL.1.5 Add drawings or other visual displays to descriptions when appropriate to clarify ideas, thoughts, and feelings.
- CCSS.ELA-LITERACY.SL.1.6 Produce complete sentences when appropriate to task and situation.

Mathematics

- CCSS.MATH.CONTENT.1.MD.A.1 Order three objects by length; compare the lengths of two objects indirectly by using a third object.
- CCSS.MATH.CONTENT.1.MD.A.2 Express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps.
- CCSS.MATH.CONTENT.1.MD.C.4 Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.
- CCSS.MATH.CONTENT.1.MD.B.3 Tell and write time in hours and half-hours using analog and digital clocks.

Sources

National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common core state standards.* Washington, DC: National Governors Association Center for Best Practices, Council of Chief State School Officers.

NGSS Lead States. (2013). *Next generation science standards: For states by states.* Washington, DC: The National Academies Press.

Connections to Standards

PLTW programs are designed to empower students to thrive in an evolving world. As a part of this process, we take connections to standards into account when developing and updating our curriculum. The PLTW Launch modules will address standards from the following:

- Next Generation Science Standards (NGSS)
- Common Core State Standards (CCSS) in English/Language Arts (ELA) and Mathematics

This document lists the standards identified from each of these sources for the Animal Adaptations module.

Next Generation Science Standards

- 1-LS1-1 Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.
- LS1.A Structure and Function: All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water, and air. Plants also have different parts that help them survive and grow.
- LS1.D Information Processing: Animals have body parts that capture and convey different kinds of information needed for growth and survival. Animals respond to these inputs with behaviors that help them survive. Plants also respond to some external inputs.
- K-2-ETS1-1 Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2-ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- ETS1.A Defining and Delimiting Engineering Problems
    - Asking questions, making observations, and gathering information are helpful in thinking about problems.
    - Before beginning to design a solution, it is important to clearly understand the problem.
- ETS1.B Developing Possible Solutions: Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas from a problem's solutions to other people.

- ETS1.C Optimizing the Design Solution: Because there is always more than one possible solution to a problem, it is useful to compare and test designs.
- Cross Cutting Concept: Systems and System Models. A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.
    - Objects and organisms can be described in terms of their parts.
    - Systems in the natural and designed world have parts that work together.
- Cross Cutting Concept: Structure and Function. The way an object is shaped or structured determines many of its properties and functions.
    - The shape and stability of structures of natural and designed objects are related to their function(s).
- Science and Engineering Practice: Asking Questions and Defining Problems. Asking questions and defining problems in K-2 builds on prior experiences and progresses to simple descriptive questions that can be tested.
- Science and Engineering Practice: Developing and Using Models. Modeling in K-2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.
- Science and Engineering Practice: Planning and Carrying Out Investigations. Planning and carrying out investigations to answer questions or test solutions to problems in K-2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.
- Science and Engineering Practice: Analyzing and Interpreting Data. Analyzing data in K-2 builds on prior experiences and progresses to collecting, recording, and sharing observations.
- Science and Engineering Practice: Using Mathematics and Computational Thinking. Mathematical and computational thinking in K-2 builds on prior experience and progresses to recognizing that mathematics can be used to describe the natural and designed world(s).
- Science and Engineering Practice: Constructing Explanations and Designing Solutions. Constructing explanations and designing solutions in K-2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.
- Science and Engineering Practice: Engaging in Argument from Evidence. Engaging in argument from evidence in K-2 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s).
- Science and Engineering Practice: Obtaining, Evaluating, and Communicating Information. Obtaining, evaluating, and communicating information in K-2 builds on prior experiences and uses observations and texts to communicate new information.

Common Core State Standards ELA and Mathematics

English Language Arts

- CCSS.ELA-LITERACY.RL.1.1 Ask and answer questions about key details in a text.
- CCSS.ELA-LITERACY.RL.1.2 Retell stories, including key details, and demonstrate understanding of their central message or lesson.
- CCSS.ELA-LITERACY.RL.1.3 Describe characters, settings, and major events in a story, using key details.
- CCSS.ELA-LITERACY.RI.1.1 Ask and answer questions about key details in a text.
- CCSS.ELA-LITERACY.RI.1.2 Identify the main topic and retell key details of a text.
- CCSS.ELA-LITERACY.RI.1.10 With prompting and support, read informational texts appropriately complex for grade 1.
- CCSS.ELA-LITERACY.RF.1.4 Read with sufficient accuracy and fluency to support comprehension.
- CCSS.ELA-LITERACY.W.1.8 With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.
- CCSS.ELA-LITERACY.SL.1.1 Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups.
- CCSS.ELA-LITERACY.SL.1.1.A Follow agreed-upon rules for discussions (e.g., listening to others with care, speaking one at a time about the topics and texts under discussion).
- CCSS.ELA-LITERACY.SL.1.1.B Build on others' talk in conversations by responding to the comments of others through multiple exchanges.
- CCSS.ELA-LITERACY.SL.1.1.C Ask questions to clear up any confusion about the topics and texts under discussion.
- CCSS.ELA-LITERACY.SL.1.2 Ask and answer questions about key details in a text read aloud or information presented orally or through other media.
- CCSS.ELA-LITERACY.SL.1.5 Add drawings or other visual displays to descriptions when appropriate to clarify ideas, thoughts, and feelings.
- CCSS.ELA-LITERACY.SL.1.6 Produce complete sentences when appropriate to task and situation.
- CCSS.ELA-LITERACY.L.1.4 Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 1 reading and content, choosing flexibly from an array of strategies.
- CCSS.ELA-LITERACY.L.1.5 With guidance and support from adults, demonstrate understanding of word relationships and nuances in word meanings.
- CCSS.ELA-LITERACY.L.1.6 Use words and phrases acquired through conversations, reading and being read to, and responding to texts, including using frequently occurring conjunctions to signal simple relationships (e.g., because).

Mathematics

- CCSS.MATH.CONTENT.1.NBT.A.1 Count to 120, starting at any number less than 120. In this range, read and write numerals and represent a number of objects with a written numeral.
- CCSS.MATH.CONTENT.1.NBT.B.2 Understand that the two digits of a two-digit number represent amounts of tens and ones. Understand the following as special cases:
    - CCSS.MATH.CONTENT.1.NBT.B.2.A 10 can be thought of as a bundle of ten ones — called a "ten."
    - CCSS.MATH.CONTENT.1.NBT.B.2.B The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones.
    - CCSS.MATH.CONTENT.1.NBT.B.2.C The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens (and 0 ones).
- CCSS.MATH.CONTENT.1.NBT.B.3 Compare two two-digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols >, =, and <.
- CCSS.MATH.CONTENT.1.MD.C.4 Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.

Sources

National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common core state standards.* Washington, DC: National Governors Association Center for Best Practices, Council of Chief State School Officers.

NGSS Lead States. (2013). *Next generation science standards: For states by states.* Washington, DC: The National Academies Press.

Connections to Standards

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- Computer Science Teachers Association K-12 Computer Science Standards
- Next Generation Science Standards (NGSS)
- Common Core State Standards (CCSS) in English/Language Arts (ELA) and Mathematics

This document lists the standards identified from each of these sources for PLTW Launch.

Computer Science Teachers Association K-12 CS Standards

- 1A-CS-01 Select and operate appropriate software to perform a variety of tasks, and recognize that users have different needs and preferences for the technology they use.
- 1A-AP-09 Model the way programs store and manipulate data by using numbers or other symbols to represent information.
- 1A-AP-10 Develop programs with sequences and simple loops, to express ideas or address a problem.
- 1A-AP-11 Decompose (break down) the steps needed to solve a problem into a precise sequence of instructions.
- 1A-AP-12 Develop plans that describe a program's sequence of events, goals, and expected outcomes.
- 1A-AP-14 Debug (identify and fix) errors in an algorithm or program than includes sequences and simple loops.
- 1A-AP-15 Using correct terminology, describe steps taken and choices made during the iterative process of program development.

Next Generation Science Standards

- K-2-ETS1-1 Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

- K-2-ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- K-2-ETS1-3 Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.
- ETS1.A Defining and Delimiting Engineering Problems
    - Asking questions, making observations, and gathering information are helpful in thinking about problems.
    - Before beginning to design a solution, it is important to clearly understand the problem.
- ETS1.B Developing Possible Solutions: Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas from a problem's solutions to other people.
- ETS1.C Optimizing the Design Solution: Because there is always more than one possible solution to a problem, it is useful to compare and test designs.
- Science and Engineering Practice: Asking Questions and Defining Problems. Asking questions and defining problems in K-2 builds on prior experiences and progresses to simple descriptive questions that can be tested.
- Science and Engineering Practice: Developing and Using Models. Modeling in K-2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.
- Science and Engineering Practice: Using Mathematics and Computational Thinking. Mathematical and computational thinking in K-2 builds on prior experience and progresses to recognizing that mathematics can be used to describe the natural and designed world(s).

Common Core State Standards ELA and Mathematics

English Language Arts

- CCSS.ELA-LITERACY.RL.1.1 Ask and answer questions about key details in a text.
- CCSS.ELA-LITERACY.RL.1.2 Retell stories, including key details, and demonstrate understanding of their central message or lesson.
- CCSS.ELA-LITERACY.RL.1.3 Describe characters, settings, and major events in a story, using key details.
- CCSS.ELA-LITERACY.W.1.3 Write narratives in which they recount two or more appropriately sequenced events, include some details regarding what happened, use temporal words to signal event order, and provide some sense of closure.
- CCSS.ELA-LITERACY.W.1.6 With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers.

- CCSS.ELA-LITERACY.SL.1.1 Participate in collaborative conversations with diverse partners about *grade 1 topics and texts* with peers and adults in small and larger groups.
    - CCSS.ELA-LITERACY.SL.1.1.A Follow agreed-upon rules for discussions (e.g., listening to others with care, speaking one at a time about the topics and texts under discussion).
    - CCSS.ELA-LITERACY.SL.1.1.B Build on others' talk in conversations by responding to the comments of others through multiple exchanges.
    - CCSS.ELA-LITERACY.SL.1.1.C Ask questions to clear up any confusion about the topics and texts under discussion.
- CCSS.ELA-LITERACY.SL.1.2 Ask and answer questions about key details in a text read aloud or information presented orally or through other media.
- CCSS.ELA-LITERACY.SL.1.4 Describe people, places, things, and events with relevant details, expressing ideas and feelings clearly.
- CCSS.ELA-LITERACY.SL.1.5 Add drawings or other visual displays to descriptions when appropriate to clarify ideas, thoughts, and feelings.

Mathematics

- CCSS.MATH.CONTENT.1.MD.B.3 Tell and write time in hours and half-hours using analog and digital clocks.

Sources

Computer Science Teachers Association. (2017). *CSTA K-12 computer science standards, revised 2017*. Retrieved from http://www.csteachers.org/standards.

National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common core state standards.* Washington, DC: National Governors Association Center for Best Practices, Council of Chief State School Officers.

NGSS Lead States. (2013). *Next generation science standards: For states by states.* Washington, DC: The National Academies Press.

Connections to Standards

PLTW programs are designed to empower students to thrive in an evolving world. As a part of this process, we take connections to standards into account when developing and updating our curriculum. The PLTW Launch modules will address standards from the following:

- Next Generation Science Standards (NGSS)
- Common Core State Standards (CCSS) in English/Language Arts (ELA) and Mathematics

This document lists the standards identified from each of these sources for the Materials Science: Properties of Matter module.

Next Generation Science Standards

- 2-PS1-1 Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
- 2-PS1-2 Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.
- 2-PS1-4 Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.
- PS1.A Structure and Properties of Matter: Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties.
- PS1.A Structure and Properties of Matter: Different properties are suited to different purposes.
- PS1.B Chemical Reactions: Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not. (2-PS1-4)
- K-2-ETS1-1 Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2-ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- K-2-ETS1-3 Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.
- ETS1.A Defining and Delimiting an Engineering Problem: Asking questions, making observations, and gathering information are helpful in thinking about problems.

- ETS1.B Developing Possible Solutions: Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.
- ETS1.C Optimizing the Design Solution: Because there is always more than one possible solution to a problem, it is useful to compare and test designs.
- Science and Engineering Practice: Planning and Carrying Out Investigations. Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.
- Science and Engineering Practice: Analyzing and Interpreting Data. Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.
- Science and Engineering Practice: Constructing Explanations and Designing Solutions. Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.
- Science and Engineering Practice: Engaging in Argument from Evidence. Engaging in argument from evidence in K–2 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s).
- Crosscutting Concept: Patterns. Patterns in the natural world and human designed world can be observed.
- Cross Cutting Concept: Cause and Effect. Events have causes that generate observable patterns.
- Crosscutting Concept: Cause and Effect. Simple tests can be designed to gather evidence to support or refute student ideas about causes.

Common Core State Standards ELA and Mathematics

English Language Arts

- CCSS.ELA-LITERACY.RI.2.1 Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text.
- CCSS.ELA-LITERACY.RI.2.3 Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text.
- CCSS.ELA-LITERACY.RI.2.8 Describe how reasons support specific points the author makes in a text.
- CCSS.ELA-LITERACY.W.2.7 Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).
- CCSS.ELA-LITERACY.W.2.8 Recall information from experiences or gather information from provided sources to answer a question.

Mathematics

- CCSS.MATH.CONTENT.2.MD.D.10 Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph.
- CCSS.MATH.PRACTICE.MP.4 Model with mathematics.
- CCSS.MATH.PRACTICE.MP.5 Use appropriate tools strategically.

Sources

National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common core state standards.* Washington, DC: National Governors Association Center for Best Practices, Council of Chief State School Officers.

NGSS Lead States. (2013). *Next generation science standards: For states by states.* Washington, DC: National Academies Press.

Connections to Standards

PLTW programs are designed to empower students to thrive in an evolving world. As a part of this process, we take connections to standards into account when developing and updating our curriculum. The PLTW Launch modules will address standards from the following:

- Next Generation Science Standards (NGSS)
- Common Core State Standards (CCSS) in English/Language Arts (ELA) and Mathematics

This document lists the standards identified from each of these sources for the Materials Science: Form and Function Module.

Next Generation Science Standards

- 2-PS1-1 Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
- 2-PS1-2 Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.
- PS1.A Structure and Properties of Matter: Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties.
- PS1.A Structure and Properties of Matter: Different properties are suited to different purposes.
- 2-LS2-2 Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.
- LS2.A Interdependent Relationships in Ecosystems: Plants depend on water and light to grow.
- LS2.A Interdependent Relationships in Ecosystems: Plants depend on animals for pollination or to move their seeds around.
- K-2-ETS1-1 Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2-ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- K-2-ETS1-3 Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.
- ETS1.A Defining and Delimiting an Engineering Problem: Asking questions, making observations, and gathering information are helpful in thinking about problems.

- ETS1.B Developing Possible Solutions: Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.
- ETS1.C Optimizing the Design Solution: Because there is always more than one possible solution to a problem, it is useful to compare and test designs.
- Crosscutting Concept: Cause and Effect. Events have causes that generate observable patterns.
- Crosscutting Concept: Structure and Function. The shape and stability of structures of natural and designed objects are related to their function(s).
- Science and Engineering Practice: Asking Questions and Defining Problems. Asking questions and defining problems in K-2 builds on prior experiences and progresses to simple descriptive questions that can be tested.
- Science and Engineering Practice: Developing and Using Models. Modeling in K-2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.
- Science and Engineering Practice: Planning and Carrying Out Investigations. Planning and carrying out investigations to answer questions or test solutions to problems in K-2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.
- Science and Engineering Practice: Analyzing and Interpreting Data. Analyzing data in K-2 builds on prior experiences and progresses to collecting, recording, and sharing observations.
- Science and Engineering Practice: Using Mathematics and Computational Thinking. Mathematical and computational thinking in K-2 builds on prior experience and progresses to recognizing that mathematics can be used to describe the natural and designed world(s).
- Science and Engineering Practice: Constructing Explanations and Designing Solutions. Constructing explanations and designing solutions in K-2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.
- Science and Engineering Practice: Engaging in Argument from Evidence. Engaging in argument from evidence in K-2 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s).
- Science and Engineering Practice: Obtaining, Evaluating, and Communicating Information. Obtaining, evaluating, and communicating information in K-2 builds on prior experiences and uses observations and texts to communicate new information.

Common Core State Standards ELA and Mathematics

English Language Arts

- CCSS.ELA-LITERACY.RI.2.1 Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text.
- CCSS.ELA-LITERACY.RI.2.3 Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text.
- CCSS.ELA-LITERACY.RI.2.8 Describe how reasons support specific points the author makes in a text.
- CCSS.ELA-LITERACY.W.2.7 Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).
- CCSS.ELA-LITERACY.W.2.8 Recall information from experiences or gather information from provided sources to answer a question.

Mathematics

- CCSS.MATH.CONTENT.2.MD.D.10 Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph.
- CCSS.MATH.PRACTICE.MP.4 Model with mathematics.
- CCSS.MATH.PRACTICE.MP.5 Use appropriate tools strategically.

Sources

National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common core state standards.* Washington, DC: National Governors Association Center for Best Practices, Council of Chief State School Officers.

NGSS Lead States. (2013). *Next generation science standards: For states by states.* Washington, DC: National Academies Press.

Connections to Standards

PLTW programs are designed to empower students to thrive in an evolving world. As a part of this process, we take connections to standards into account when developing and updating our curriculum. The PLTW Launch modules will address standards from the following:

- Next Generation Science Standards (NGSS)
- Common Core State Standards (CCSS) in English/Language Arts (ELA) and Mathematics

This document lists the standards identified from each of these sources for The Changing Earth module.

Next Generation Science Standards

- 2-PS1-1 Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
- 2-PS1-2 Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.
- PS1.A Structure and Properties of Matter: Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties.
- PS1.A Structure and Properties of Matter: Different properties are suited to different purposes.
- 2-LS2-2 Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.
- LS2.A Interdependent Relationships in Ecosystems: Plants depend on water and light to grow.
- LS2.A Interdependent Relationships in Ecosystems: Plants depend on animals for pollination or to move their seeds around.
- K-2-ETS1-1 Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2-ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- K-2-ETS1-3 Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.
- ETS1.A Defining and Delimiting an Engineering Problem: Asking questions, making observations, and gathering information are helpful in thinking about problems.

- ETS1.B Developing Possible Solutions: Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.
- ETS1.C Optimizing the Design Solution: Because there is always more than one possible solution to a problem, it is useful to compare and test designs.
- Crosscutting Concept: Cause and Effect. Events have causes that generate observable patterns.
- Crosscutting Concept: Structure and Function. The shape and stability of structures of natural and designed objects are related to their function(s).
- Science and Engineering Practice: Asking Questions and Defining Problems. Asking questions and defining problems in K-2 builds on prior experiences and progresses to simple descriptive questions that can be tested.
- Science and Engineering Practice: Developing and Using Models. Modeling in K-2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.
- Science and Engineering Practice: Planning and Carrying Out Investigations. Planning and carrying out investigations to answer questions or test solutions to problems in K-2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.
- Science and Engineering Practice: Analyzing and Interpreting Data. Analyzing data in K-2 builds on prior experiences and progresses to collecting, recording, and sharing observations.
- Science and Engineering Practice: Using Mathematics and Computational Thinking. Mathematical and computational thinking in K-2 builds on prior experience and progresses to recognizing that mathematics can be used to describe the natural and designed world(s).
- Science and Engineering Practice: Constructing Explanations and Designing Solutions. Constructing explanations and designing solutions in K-2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.
- Science and Engineering Practice: Engaging in Argument from Evidence. Engaging in argument from evidence in K-2 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s).
- Science and Engineering Practice: Obtaining, Evaluating, and Communicating Information. Obtaining, evaluating, and communicating information in K-2 builds on prior experiences and uses observations and texts to communicate new information.

Common Core State Standards ELA and Mathematics

English Language Arts

- CCSS.ELA-LITERACY.RI.2.1 Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text.
- CCSS.ELA-LITERACY.RI.2.3 Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text.
- CCSS.ELA-LITERACY.RI.2.9 Compare and contrast the most important points presented by two texts on the same topic.
- CCSS.ELA-LITERACY.W.2.6 With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers.
- CCSS.ELA-LITERACY.W.2.7 Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).
- CCSS.ELA-LITERACY.W.2.8 Recall information from experiences or gather information from provided sources to answer a question.
- CCSS.ELA-LITERACY.SL.2.2 Recount or describe key ideas or details from a text read aloud or information presented orally or through other media.
- CCSS.ELA-LITERACY.SL.2.5 Create audio recordings of stories or poems; add drawings or other visual displays to stories or recounts of experiences when appropriate to clarify ideas, thoughts, and feelings.

Mathematics

- CCSS.MATH.CONTENT.2.NBT.A Understand place value.
- CCSS.MATH.CONTENT.2.NBT.A.1 Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; e.g., 706 equals 7 hundreds, 0 tens, and 6 ones.
    - CCSS.MATH.CONTENT.2.NBT.A.1.B The numbers 100, 200, 300, 400, 500, 600, 700, 800, 900 refer to one, two, three, four, five, six, seven, eight, or nine hundreds (and 0 tens and 0 ones).
- CCSS.MATH.CONTENT.2.NBT.A.3 Read and write numbers to 1000 using base-ten numerals, number names, and expanded form.
- CCSS.MATH.CONTENT.2.MD.B.5 Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units, e.g., by using drawings (such as drawings of rulers) and equations with a symbol for the unknown number to represent the problem.
- CCSS.MATH.PRACTICE.MP.2 Reason abstractly and quantitatively
- CCSS.MATH.PRACTICE.MP.4 Model with mathematics
- CCSS.MATH.PRACTICE.MP.5 Use appropriate tools strategically.

Sources

National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common core state standards.* Washington, DC: National Governors Association Center for Best Practices, Council of Chief State School Officers.

NGSS Lead States. (2013). *Next generation science standards: For states by states.* Washington, DC: National Academies Press.

Connections to Standards

PLTW programs are designed to empower students to thrive in an evolving world. As a part of this process, we take connections to standards into account when developing and updating our curriculum. The PLTW Launch modules will address standards from the following:

- Computer Science Teachers Association K-12 Computer Science Standards
- Next Generation Science Standards (NGSS)
- Common Core State Standards (CCSS) in English/Language Arts (ELA) and Mathematics

This document lists the standards identified from each of these sources for the Grids and Games module.

Computer Science Teachers Association K-12 CS Standards

- 1A-CS-01 Select and operate appropriate software to perform a variety of tasks, and recognize that users have different needs and preferences for the technology they use.
- 1A-DA-05 Store, copy, search, retrieve, modify, and delete information using a computing device and define the information stored as data.
- 1A-AP-09 Model the way programs store and manipulate data by using numbers or other symbols to represent information.
- 1A-AP-10 Develop programs with sequences and simple loops, to express ideas or address a problem.
- 1A-AP-11 Decompose (break down) the steps needed to solve a problem into a precise sequence of instructions.
- 1A-AP-12 Develop plans that describe a program's sequence of events, goals, and expected outcomes.
- 1A-AP-14 Debug (identify and fix) errors in an algorithm or program than includes sequences and simple loops.
- 1A-AP-15 Using correct terminology, describe steps taken and choices made during the iterative process of program development.

Next Generation Science Standards

- ETS1.A Defining and Delimiting Engineering Problems
    - Asking questions, making observations, and gathering information are helpful in thinking about problems.
    - Before beginning to design a solution, it is important to clearly understand the problem.
- ETS1.B Developing Possible Solutions: Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas from a problem's solutions to other people.
- ETS1.C Optimizing the Design Solution: Because there is always more than one possible solution to a problem, it is useful to compare and test designs.
- Science and Engineering Practice: Asking Questions and Defining Problems. Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions that can be tested.
- Science and Engineering Practice: Use tools and/or materials to design and/or build a device that solves a specific problem or a solution to a specific problem.
- Science and Engineering Practice: Generate and/or compare multiple solutions to a problem.
- Science and Engineering Practice: With guidance, plan and conduct an investigation in collaboration with peers (for K).

Common Core State Standards ELA and Mathematics

English Language Arts

- CCSS.ELA-LITERACY.SL.2.1 Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.
- CCSS.ELA-LITERACY.SL.2.1.A Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).
- CCSS.ELA-LITERACY.SL.2.1.B Build on others' talk in conversations by linking their comments to the remarks of others.
- CCSS.ELA-LITERACY.SL.2.1.C Ask for clarification and further explanation as needed about the topics and texts under discussion.

Mathematics

- CCSS.MATH.CONTENT.2.OA.B.2 Fluently add and subtract within 20 using mental strategies. By end of grade 2, know from memory all sums of two one-digit numbers.
- CCSS.MATH.CONTENT.2.OA.C.3 Work with equal groups of objects to gain foundations for multiplication.
- CCSS.MATH.CONTENT.2.NBT.B.5 Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.
- CCSS.MATH.CONTENT.2.MD.B.6 Represent whole numbers as lengths from 0 on a number line diagram with equally spaced points corresponding to the numbers 0, 1, 2, ..., and represent whole-number sums and differences within 100 on a number line diagram.
- CCSS.MATH.CONTENT.2.MD.C.7 Tell and write time from analog and digital clocks to the nearest five minutes, using a.m. and p.m.
- CCSS.MATH.CONTENT.2.G.A.2 Partition a rectangle into rows and columns of same-size squares and count to find the total number of them.
- CCSS.MATH.CONTENT.2.G.A.3 Partition circles and rectangles into two, three, or four equal shares, describe the shares using the words halves, thirds, half of, a third of, etc., and describe the whole as two halves, three thirds, four fourths. Recognize that equal shares of identical wholes need not have the same shape.

Sources

Computer Science Teachers Association. (2017). *CSTA K-12 computer science standards, revised 2017*. Retrieved from http://www.csteachers.org/standards.

National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common core state standards.* Washington, DC: National Governors Association Center for Best Practices, Council of Chief State School Officers.

NGSS Lead States. (2013). *Next generation science standards: For states by states.* Washington, DC: National Academies Press.

Connections to Standards

PLTW programs are designed to empower students to thrive in an evolving world. As a part of this process, we take connections to standards into account when developing and updating our curriculum. The PLTW Launch modules will address standards from the following:

- Next Generation Science Standards (NGSS)
- Common Core State Standards (CCSS) in English/Language Arts (ELA) and Mathematics

This document lists the standards identified from each of these sources for the Stability and Motion: Science of Flight module.

Next Generation Science 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.
- 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.
- PS2.A Forces and 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.
- 3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- 3-5-ETS1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
- ETS1.A Defining and Delimiting Engineering Problems: Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into accounts.

- ETS1.B Developing Possible Solutions: Research on a problem should be carried out before beginning to design a solution. At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.
- Crosscutting Concept: Influence of Science, Engineering, and Technology on Society and the Natural World. People's needs and wants change over time, as do their demands for new and improved technologies.
- Crosscutting Concept: Influence of Science, Engineering, and Technology on Society and the Natural World. Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.
- Crosscutting Concept: Patterns. Patterns of change can be used to make predictions.
- Crosscutting Concept: Cause and Effect. Cause and effect relationships are routinely identified.
- Crosscutting Concept: Cause and Effect. Cause and effect relationships are routinely identified, tested, and used to explain change.

Common Core State Standards ELA and Mathematics

English Language Arts

- CCSS.ELA-LITERACY.RI.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.
- CCSS.ELA-LITERACY.RI.3.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.
- CCSS.ELA-LITERACY.RI.3.8 Describe the logical connection between particular sentences and paragraphs in a text (e.g., comparison, cause/effect, first/second/third in a sequence).
- CCSS.ELA-LITERACY.W.3.7 Conduct short research projects that build knowledge about a topic.
- CCSS.ELA-LITERACY.W.3.8 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.
- CCSS.ELA-LITERACY.SL.3.3 Ask and answer questions about information from a speaker, offering appropriate elaboration and detail.

Mathematics

- CCSS.MATH.CONTENT.3. MD.B.4 Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units— whole numbers, halves, or quarters.
- CCSS.MATH.PRACTICE.MP.2 Reason abstractly and quantitatively.
- CCSS.MATH.PRACTICE.MP.5 Use appropriate tools strategically.

Sources

National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common core state standards.* Washington, DC: National Governors Association Center for Best Practices, Council of Chief State School Officers.

NGSS Lead States. (2013). *Next generation science standards: For states by states.* Washington, DC: National Academies Press.

Connections to Standards

PLTW programs are designed to empower students to thrive in an evolving world. As a part of this process, we take connections to standards into account when developing and updating our curriculum. The PLTW Launch modules will address standards from the following:

- Next Generation Science Standards (NGSS)
- Common Core State Standards (CCSS) in English/Language Arts (ELA) and Mathematics

This document lists the standards identified from each of these sources for the Stability and Motion: Forces and Interactions module.

Next Generation Science 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 that a pattern can be used to predict future motion.
- 3-PS2-3 Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.
- 3-PS2-4 Define a simple design problem that can be solved by applying scientific ideas about magnets.
- 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.
- PS2.A Forces and 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.
- PS2.B Types of Interactions: Electric, and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other.
- 3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

- 3-5-ETS1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
- ETS1.A Defining and Delimiting Engineering Problems: Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into accounts.
- ETS1.B Developing Possible Solutions: Research on a problem should be carried out before beginning to design a solution. At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.
- Crosscutting Concept: Influence of Science, Engineering, and Technology on Society and the Natural World. People's needs and wants change over time, as do their demands for new and improved technologies.
- Crosscutting Concept: Influence of Science, Engineering, and Technology on Society and the Natural World. Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.
- Crosscutting Concept: Patterns. Patterns of change can be used to make predictions.
- Crosscutting Concept: Cause and Effect. Cause and effect relationships are routinely identified.
- Crosscutting Concept: Cause and Effect. Cause and effect relationships are routinely identified, tested, and used to explain change.

Common Core State Standards ELA and Mathematics

English Language Arts

- CCSS.ELA-LITERACY.RI.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.
- CCSS.ELA-LITERACY.RI.3.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.
- CCSS.ELA-LITERACY.RI.3.8 Describe the logical connection between particular sentences and paragraphs in a text (e.g., comparison, cause/effect, first/second/third in a sequence).
- CCSS.ELA-LITERACY.W.3.7 Conduct short research projects that build knowledge about a topic.
- CCSS.ELA-LITERACY.W.3.8 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.

- CCSS.ELA-LITERACY.SL.3.3 Ask and answer questions about information from a speaker, offering appropriate elaboration and detail.

Mathematics

- CCSS.MATH.CONTENT.3.MD.A.2 Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem.
- CCSS.MATH.CONTENT.3.MD.B.4 Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units — whole numbers, halves, or quarters.
- CCSS.MATH.PRACTICE.MP.2 Reason abstractly and quantitatively.
- CCSS.MATH.PRACTICE.MP.5 Use appropriate tools strategically.

Sources

National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common core state standards.* Washington, DC: National Governors Association Center for Best Practices, Council of Chief State School Officers.

NGSS Lead States. (2013). *Next generation science standards: For states by states.* Washington, DC: National Academies Press.

Connections to Standards

PLTW programs are designed to empower students to thrive in an evolving world. As a part of this process, we take connections to standards into account when developing and updating our curriculum. The PLTW Launch modules will address standards from the following:

- Next Generation Science Standards (NGSS)
- Common Core State Standards (CCSS) in English/Language Arts (ELA) and Mathematics

This document lists the standards identified from each of these sources for the Variation of Traits module.

Next Generation Science Standards

- LS3-1 Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.
- LS3-2 Use evidence to support the explanation that traits can be influenced by the environment.
- LS3.A Inheritance of Traits: Many characteristics of organisms are inherited from their parents. Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment.
- LS3.B Variation of Traits: Different organisms vary in how they look and function because they have different inherited information. The environment also affects the traits that an organism develops.
- ETS1-1 Define a simple problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- Science and Engineering Practices: Asking Questions and Defining Problems. Asking questions and Builds on K-2 experiences and progresses to specifying qualitative relationships.
- Science and Engineering Practices: Developing and Using Models. Builds on K-2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.

- Science and Engineering Practices: Planning and Carrying out Investigations. Builds on K-2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.
- Science and Engineering Practices: Analyzing and Interpreting Data. Builds on K-2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used.
- Science and Engineering Practices: Using Mathematics and Computational Thinking. Builds on K-2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions.
- Science and Engineering Practices: Constructing Explanations and Designing Solutions. Builds on K-2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.
- Science and Engineering Practices: Obtaining, Evaluating, and Communicating Information. Builds on K-2 experiences and progresses to evaluating the merit and accuracy of ideas and methods.
- Crosscutting Concept: Patterns. Patterns can be used as evidence to support an explanation.
- Crosscutting Concept: Cause and Effect. Cause and effect relationships are routinely identified, tested, and used to explain change.

Common Core State Standards ELA and Mathematics

English Language Arts

- CCSS.ELA-LITERACY.RI.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.
- CCSS.ELA-LITERACY.RI.3.2 Determine the main idea of a text; recount the key details and explain how they support the main idea.
- CCSS.ELA-LITERACY.W.3.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
    - CCSS.ELA-LITERACY.W.3.2.B Develop the topic with facts, definitions, and details.
    - CCSS.ELA-LITERACY.W.3.2.D Provide a concluding statement or section.
- CCSS.ELA-LITERACY.SL.3.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3 topics and texts, building on others' ideas and expressing their own clearly.

- CCSS.ELA-LITERACY.SL.3.2 Determine the main ideas and supporting details of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.
- CCSS.ELA-LITERACY.SL.3.6 Speak in complete sentences when appropriate to task and situation in order to provide requested detail or clarification.

Mathematics

- CCSS.MATH.CONTENT.3.MD.B.3 Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs.
- CCSS.MATH.PRACTICE.MP.2 Reason abstractly and quantitatively.
- CCSS.MATH.PRACTICE.MP.5 Use appropriate tools strategically.

Sources

National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common core state standards.* Washington, DC: National Governors Association Center for Best Practices, Council of Chief State School Officers.

NGSS Lead States. (2013). *Next generation science standards: For states by states.* Washington, DC: National Academies Press.

Connections to Standards

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- Computer Science Teachers Association K-12 Computer Science (CS) Standards
- Next Generation Science Standards (NGSS)
- Common Core State Standards (CCSS) in English/Language Arts (ELA) and Mathematics

This document lists the standards identified from each of these sources for the Programming Patterns module.

Computer Science Teachers Association K-12 CS Standards

- 1B-CS-02 Model how computer hardware and software work together as a system to accomplish tasks.
- 1B-AP-09 Create programs that use variables to store and modify data.
- 1B-AP-10 Create programs that include sequences, events, loops, and conditionals.
- 1B-AP-11 Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process.
- 1B-AP-13 Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences.
- 1B-AP-15 Test and debug (identify and fix) a program or algorithm to ensure it runs as intended.
- 1B-AP-16 Take on varying roles, with teacher guidance, when collaborating with peers during the design, implementation, and review stages of program development.
- 1B-IC-19 Brainstorm ways to improve the accessibility and usability of technology products for the diverse needs and wants of users.

Next Generation Science Standards

- 3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

- 3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- 3-5-ETS1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
- ETS1.A Defining and Delimiting Engineering Problems—Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into accounts.
- ETS1.B Developing Possible Solutions—Research on a problem should be carried out before beginning to design a solution. At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.
- Crosscutting Concept: Influence of Science, Engineering, and Technology on Society and the Natural World—People's needs and wants change over time, as do their demands for new and improved technologies.
- Crosscutting Concept: Influence of Science, Engineering, and Technology on Society and the Natural World—Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.
- Crosscutting Concept: Cause and Effect—Cause and effect relationships are routinely identified.
- Crosscutting Concept: Cause and Effect—Cause and effect relationships are routinely identified, tested, and used to explain change.

Common Core State Standards ELA and Mathematics

English Language Arts

- CCSS.ELA-LITERACY.L.3.1 Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
- CCSS.ELA-LITERACY.L.3.1.A Explain the function of nouns, pronouns, verbs, adjectives, and adverbs in general and their functions in particular sentences.
- CCSS.ELA-LITERACY.RI.3.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.
- CCSS.ELA-LITERACY.SL.3.1.B Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).

Mathematics

- CCSS.MATH.PRACTICE.MP1 Make sense of problems and persevere in solving them.
- CCSS.MATH.PRACTICE.MP2 Reason abstractly and quantitatively.
- CCSS.MATH.PRACTICE.MP5 Use appropriate tools strategically.
- CCSS.MATH.PRACTICE.MP8 Look for and express regularity in repeated reasoning.

Sources

Computer Science Teachers Association. (2017). *CSTA K-12 computer science standards, revised 2017*. Retrieved from http://www.csteachers.org/standards.

National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common core state standards.* Washington, DC: National Governors Association Center for Best Practices, Council of Chief State School Officers.

NGSS Lead States. (2013). *Next generation science standards: For states by states.* Washington, DC: National Academies Press.

Connections to Standards

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- Next Generation Science Standards (NGSS)
- Common Core State Standards (CCSS) in English/Language Arts (ELA) and Mathematics

This document lists the standards identified from each of these sources for the Energy: Collisions module.

Next Generation Science Standards

- 4-PS3-1 Use evidence to construct an explanation relating the speed of an object to the energy of that object.
- 4-PS3-3 Ask questions and predict outcomes about the changes in energy that occur when objects collide.
- 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.
- 3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- 3-5-ETS1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
- ETS1.A Defining and Delimiting Engineering Problems: Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into accounts.

- ETS1.B Developing Possible Solutions: Research on a problem should be carried out before beginning to design a solution. At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.
- Science and Engineering Practices: Asking Questions and Defining Problems. Asking questions and Builds on K-2 experiences and progresses to specifying qualitative relationships.
- Science and Engineering Practices: Developing and Using Models. Builds on K-2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.
- Science and Engineering Practices: Planning and Carrying Out Investigations. Builds on K-2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.
- Science and Engineering Practices: Analyzing and Interpreting Data. Builds on K-2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used.
- Science and Engineering Practices: Using Mathematics and Computational Thinking. Builds on K-2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions.
- Science and Engineering Practices: Constructing Explanations and Designing Solutions. Builds on K-2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.
- Science and Engineering Practices: Obtaining, Evaluating, and Communicating Information. Builds on K-2 experiences and progresses to evaluating the merit and accuracy of ideas and methods.
- Crosscutting Concept: Scale, Proportion, and Quantity. Natural objects and/or observable phenomena exist from the very small to the immensely large or from very short to very long periods of time. Standards units are used to measure and describe physical quantities such as weight, time, temperature, and volume.
- Crosscutting Concept: Systems and System Models. A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot.
- Crosscutting Concept: Systems and System Models. A system can be described in terms of its components and their interactions.
- Crosscutting Concept: Energy and Matter. Energy can be transferred in various ways and between objects.
- Crosscutting Concept: Structure and Function. Different materials have substructures, which can sometimes be observed.
- Crosscutting Concept: Structure and Function. Substructures have shapes and parts that serve functions.

- Crosscutting Concept: Patterns. Patterns of change can be used to make predictions.
- Crosscutting Concept: Cause and Effect. Cause and effect relationships are routinely identified, tested, and used to explain change.
- Crosscutting Concept: Influence of Science, Engineering, and Technology on Society and the Natural World. People's needs and wants change over time, as do their demands for new and improved technologies.
- Crosscutting Concept: Influence of Science, Engineering, and Technology on Society and the Natural World. Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.

Common Core State Standards ELA and Mathematics

English Language Arts

- CCSS.ELA-LITERACY.RI.4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.
- CCSS.ELA-LITERACY.RI.4.3 Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.
- CCSS.ELA-LITERACY.RI.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.
- CCSS.ELA-LITERACY.W.4.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
- CCSS.ELA-LITERACY.W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic.
- CCSS.ELA-LITERACY.W.4.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.
- CCSS.ELA-LITERACY.W.4.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.

Mathematics

- CCSS.MATH.CONTENT.4.OA.A.3 Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.
- CCSS.MATH.PRACTICE.MP.4 Model with mathematics.
- CCSS.MATH.PRACTICE.MP.5 Use appropriate tools strategically.

Sources

National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common core state standards.* Washington, DC: National Governors Association Center for Best Practices, Council of Chief State School Officers.

NGSS Lead States. (2013). *Next generation science standards: For states by states.* Washington, DC: National Academies Press.

Connections to Standards

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- Next Generation Science Standards (NGSS)
- Common Core State Standards (CCSS) in English/Language Arts (ELA) and Mathematics

This document lists the standards identified from each of these sources for the Energy: Conversion module.

Next Generation Science Standards

- 4-PS3-2 Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
- 4-PS3-4 Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
- 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.
- PS2.A Forces and 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.
- PS2.B Types of Interactions: Electric, and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other.
- 3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- 3-5-ETS1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
- ETS1.A Defining and Delimiting Engineering Problems: Possible solutions to a problem are limited by available materials and resources (constraints). The success of a

designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into accounts.

- ETS1.B Developing Possible Solutions: Research on a problem should be carried out before beginning to design a solution. At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.
- Science and Engineering Practices: Asking Questions and Defining Problems. Asking questions and Builds on K-2 experiences and progresses to specifying qualitative relationships.
- Science and Engineering Practices: Developing and Using Models. Builds on K-2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.
- Science and Engineering Practices: Planning and Carrying Out Investigations. Builds on K-2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.
- Science and Engineering Practices: Analyzing and Interpreting Data. Builds on K-2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used.
- Science and Engineering Practices: Using Mathematics and Computational Thinking. Builds on K-2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions.
- Science and Engineering Practices: Constructing Explanations and Designing Solutions. Builds on K-2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.
- Science and Engineering Practices: Obtaining, Evaluating, and Communicating Information. Builds on K-2 experiences and progresses to evaluating the merit and accuracy of ideas and methods.
- Crosscutting Concept: Patterns. Patterns can be used as evidence to support an explanation.
- Crosscutting Concept: Cause and Effect. Cause and effect relationships are routinely identified, tested, and used to explain change.
- Crosscutting Concept: Influence of Science, Engineering, and Technology on Society and the Natural World. People’s needs and wants change over time, as do their demands for new and improved technologies.
- Crosscutting Concept: Influence of Science, Engineering, and Technology on Society and the Natural World. Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.

Common Core State Standards ELA and Mathematics

English Language Arts

- CCSS.ELA-LITERACY.RI.4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.
- CCSS.ELA-LITERACY.RI.4.3 Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.
- CCSS.ELA-LITERACY.RI.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.
- CCSS.ELA-LITERACY.RI.4.10 By the end of year, read and comprehend informational texts, including history/social studies, science, and technical texts, in the grades 4-5 text complexity band proficiently, with scaffolding as needed at the high end of the range.
- CCSS.ELA-LITERACY.W.4.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
- CCSS.ELA-LITERACY.W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic.
- CCSS.ELA-LITERACY.W.4.8 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.
- CCSS.ELA-LITERACY.SL.4.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly.
- CCSS.ELA-LITERACY.SL.4.3 Identify the reasons and evidence a speaker provides to support particular points.

Mathematics

- CCSS.MATH.PRACTICE.MP.4 Model with mathematics.
- CCSS.MATH.PRACTICE.MP.5 Use appropriate tools strategically.

Sources

National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common core state standards.* Washington, DC: National Governors Association Center for Best Practices, Council of Chief State School Officers.

NGSS Lead States. (2013). *Next generation science standards: For states by states.* Washington, DC: National Academies Press.

Connections to Standards

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- Computer Science Teachers Association K-12 Computer Science (CS) Standards
- Next Generation Science Standards (NGSS)
- Common Core State Standards (CCSS) in English/Language Arts (ELA) and Mathematics

This document lists the standards identified from each of these sources for the Input/Output: Computer Systems module.

Computer Science Teachers Association K-12 CS Standards

- 1B-CS-01 Describe how internal and external parts of computing devices function to form a system.
- 1B-CS-02 Model how computer hardware and software work together as a system to accomplish tasks.
- 1B-NI-04 Model how information is broken down into smaller pieces, transmitted as packets through multiple devices over networks and the Internet, and reassembled at the destination.
- 1B-NI-05 Discuss real-world cybersecurity problems and how personal information can be protected.
- 1B-DA-06 Organize and present collected data visually to highlight relationships and support a claim.
- 1B-DA-07 Use data to highlight or propose cause-and-effect relationships, predict outcomes, or communicate an idea.
- 1B-AP-09 Create programs that use variables to store and modify data.
- 1B-AP-10 Create programs that include sequences, events, loops, and conditionals.
- 1B-AP-11 Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process.
- 1B-AP-13 Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences.
- 1B-AP-15 Test and debug (identify and fix) a program or algorithm to ensure it runs as intended.

- 1B-AP-16 Take on varying roles, with teacher guidance, when collaborating with peers during the design, implementation, and review stages of program development.
- 1B-IC-19 Brainstorm ways to improve the accessibility and usability of technology products for the diverse needs and wants of users.

Next Generation Science Standards

- 3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- 3-5-ETS1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
- ETS1.A Defining and Delimiting Engineering Problems: Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into accounts.
- ETS1.B Developing Possible Solutions: Research on a problem should be carried out before beginning to design a solution. At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.
- ETS1.C Optimizing the Design Solution: Because there is always more than one possible solution to a problem, it is useful to compare and test designs.

Common Core State Standards ELA and Mathematics

English Language Arts

- CCSS.ELA-LITERACY.L.4.1 Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
- CCSS.ELA-LITERACY.RI.4.3 Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.
- CCSS.ELA-LITERACY.SL.4.1.B Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).

Mathematics

- CCSS.MATH.PRACTICE.MP1 Make sense of problems and persevere in solving them.
- CCSS.MATH.PRACTICE.MP2 Reason abstractly and quantitatively.
- CCSS.MATH.PRACTICE.MP4 Model with Mathematics.
- CCSS.MATH.PRACTICE.MP5 Use appropriate tools strategically.

Sources

Computer Science Teachers Association. (2017). *CSTA K-12 computer science standards, revised 2017*. Retrieved from http://www.csteachers.org/standards.

National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common core state standards.* Washington, DC: National Governors Association Center for Best Practices, Council of Chief State School Officers.

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Connections to Standards

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- Next Generation Science Standards (NGSS)
- Common Core State Standards (CCSS) in English/Language Arts (ELA) and Mathematics

This document lists the standards identified from each of these sources for Input/Output: Human Brain.

Next Generation Science Standards

- 4-LS1-2 Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.
- 4-LS1-2 Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.
- LS1.A Structure and Function: Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.
- LS1.D Information Processing: Different sense receptors are specialized for particular kinds of information, which may then be processed by an animal's brain. Animals are able to use their perceptions and memories to guide their actions.
- ETS1-1 Define a simple problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- ETS1.A Defining and Delimiting Engineering Problems: Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into accounts.
- ETS1.B Developing Possible Solutions: Research on a problem should be carried out before beginning to design a solution. At whatever stage, communicating with peers

about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.

- Science and Engineering Practices: Asking Questions and Defining Problems. Asking questions and Builds on K-2 experiences and progresses to specifying qualitative relationships.
- Science and Engineering Practices: Developing and Using Models. Builds on K-2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.
- Science and Engineering Practices: Planning and Carrying Out Investigations. Builds on K-2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.
- Science and Engineering Practices: Analyzing and Interpreting Data. Builds on K-2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used.
- Science and Engineering Practices: Using Mathematics and Computational Thinking. Builds on K-2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions.
- Science and Engineering Practices: Constructing Explanations and Designing Solutions. Builds on K-2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.
- Science and Engineering Practices: Obtaining, Evaluating, and Communicating Information. Builds on K-2 experiences and progresses to evaluating the merit and accuracy of ideas and methods.
- Crosscutting Concept: Cause and Effect. Cause and effect relationships are routinely identified, tested, and used to explain change.
- Crosscutting Concept: Scale, Proportion, and Quantity. Natural objects and/or observable phenomena exist from the very small to the immensely large or from very short to very long periods of time. Standards units are used to measure and describe physical quantities such as weight, time, temperature, and volume.
- Crosscutting Concept: Systems and System Models. A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot.
- Crosscutting Concept: Systems and System Models. A system can be described in terms of its components and their interactions.
- Crosscutting Concept: Energy and Matter. Energy can be transferred in various ways and between objects.
- Crosscutting Concept: Structure and Function. Different materials have substructures, which can sometimes be observed.
- Crosscutting Concept: Structure and Function. Substructures have shapes and parts that serve functions.

Common Core State Standards ELA and Mathematics

English Language Arts

- CCSS.ELA-LITERACY.RL.4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.
- CCSS.ELA-LITERACY.RI.4.2 Determine the main idea of a text and explain how it is supported by key details; summarize the text.
- 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.
- 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.
- CCSS.ELA-LITERACY.W.4.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
- CCSS.ELA-LITERACY.W.4.2.D Use precise language and domain-specific vocabulary to inform about or explain the topic.
- CCSS.ELA-LITERACY.W.4.2.E Provide a concluding statement or section related to the information or explanation presented.
- CCSS.ELA-LITERACY.W.4.4 Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.
- CCSS.ELA-LITERACY.W.4.3 Write narratives to develop real or imagined experiences or events using effective technique, descriptive details, and clear event sequences.
- CCSS.ELA-LITERACY.W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic.
- CCSS.ELA-LITERACY.W.4.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.
- CCSS.ELA-LITERACY.SL.4.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly.
- CCSS.ELA-LITERACY.SL.4.4 Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.

Mathematics

- CCSS.MATH.CONTENT.4.MD.A.2 Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money,

including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit.

- CCSS.MATH.CONTENT.4.MD.A.1 Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit.
- CCSS.MATH.PRACTICE.MP.2 Reason abstractly and quantitatively.
- CCSS.MATH.PRACTICE.MP.4 Model with mathematics.
- CCSS.MATH.PRACTICE.MP.5 Use appropriate tools strategically.

Sources

National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common core state standards.* Washington, DC: National Governors Association Center for Best Practices, Council of Chief State School Officers.

NGSS Lead States. (2013). *Next generation science standards: For states by states.* Washington, DC: National Academies Press.

Connections to Standards

PLTW programs are designed to empower students to thrive in an evolving world. As a part of this process, we take connections to standards into account when developing and updating our curriculum. The PLTW Launch modules will address standards from the following:

- Next Generation Science Standards (NGSS)
- Common Core State Standards (CCSS) in English/Language Arts (ELA) and Mathematics

This document lists the standards identified from each of these sources for the Robotics and Automation module.

Next Generation Science Standards

- 5-ESS3-1 Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.
- ESS3.C Human Impacts on Earth Systems: Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.
- 3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- 3-5-ETS1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
- ETS1.A Defining and Delimiting Engineering Problems: Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into accounts.
- ETS1.B Developing Possible Solutions: Research on a problem should be carried out before beginning to design a solution. At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.
- Science and Engineering Practices: Using Mathematics and Computational Thinking. Builds on K-2 experiences and progresses to extending quantitative measurements to a

variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions.

- Science and Engineering Practices. Constructing Explanations and Designing Solutions. Builds on K-2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.
- Crosscutting Concept: Cause and Effect. Cause and effect relationships are routinely identified, tested, and used to explain change.
- Crosscutting Concept: Systems and System Models. A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot.
- Crosscutting Concept: Systems and System Models. A system can be described in terms of its components and their interactions.
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- Crosscutting Concept: Structure and Function. Substructures have shapes and parts that serve functions.
- Crosscutting Concept: Influence of Science, Engineering, and Technology on Society and the Natural World. People's needs and wants change over time, as do their demands for new and improved technologies.
- Crosscutting Concept: Influence of Science, Engineering, and Technology on Society and the Natural World. Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.

Common Core State Standards ELA and Mathematics

English Language Arts

- CCSS.ELA-LITERACY.RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.
- CCSS.ELA-LITERACY.RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.
- CCSS.ELA-LITERACY.RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.
- CCSS.ELA-LITERACY.W.5.7 Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.
- CCSS.ELA-LITERACY.W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.
- CCSS.ELA-LITERACY.W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.

Mathematics

- CCSS.MATH. PRACTICE.MP.2 Reason abstractly and quantitatively.
- CCSS.MATH. PRACTICE.MP.4 Model with mathematics.
- CCSS.MATH. PRACTICE.MP.5 Use appropriate tools strategically.

Sources

National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common core state standards.* Washington, DC: National Governors Association Center for Best Practices, Council of Chief State School Officers.

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- Next Generation Science Standards (NGSS)
- Common Core State Standards (CCSS) in English/Language Arts (ELA) and Mathematics

This document lists the standards identified from each of these sources for the Robotics and Automation: Challenge module.

Next Generation Science Standards

- 3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- 3-5-ETS1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
- ETS1.A Defining and Delimiting Engineering Problems: Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into accounts.
- ETS1.B Developing Possible Solutions: Research on a problem should be carried out before beginning to design a solution. At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.
- Science and Engineering Practices: Using Mathematics and Computational Thinking. Builds on K-2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions.
- Science and Engineering Practices: Constructing Explanations and Designing Solutions. Builds on K-2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.

- Crosscutting Concept: Cause and Effect. Cause and effect relationships are routinely identified, tested, and used to explain change.
- Crosscutting Concept: Systems and System Models. A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot.
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Common Core State Standards ELA and Mathematics

English Language Arts

- CCSS.ELA-LITERACY.RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.
- CCSS.ELA-LITERACY.RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.
- CCSS.ELA-LITERACY.RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.
- CCSS.ELA-LITERACY.W.5.7 Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.
- CCSS.ELA-LITERACY.W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.
- CCSS.ELA-LITERACY.W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.

Mathematics

- CCSS.MATH.CONTENT.5.G.A.1 Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x-coordinate, y-axis and y-coordinate).
- CCSS.MATH.CONTENT.5.G.A.1 Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x-coordinate, y-axis and y-coordinate).
- CCSS.MATH. PRACTICE.MP.2 Reason abstractly and quantitatively.
- CCSS.MATH. PRACTICE.MP.4 Model with mathematics.
- CCSS.MATH. PRACTICE.MP.5 Use appropriate tools strategically.

Sources

National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common core state standards.* Washington, DC: National Governors Association Center for Best Practices, Council of Chief State School Officers.

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Connections to Standards

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- Next Generation Science Standards (NGSS)
- Common Core State Standards (CCSS) in English/Language Arts (ELA) and Mathematics

This document lists the standards identified from each of these sources for the Infection: Detection module.

Next Generation Science Standards

- LS2.A Interdependent Relationships in Ecosystems: Some organisms, such as fungi and bacteria, break down dead organisms (both plants or their parts and animals) and therefore operate as “decomposers.” Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem.
- ETS1-1 Define a simple problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- ETS1.A Defining and Delimiting Engineering Problems: Possible solutions to a problem are limited by available materials and resources (constraints).
- ETS1.B Developing Possible Solutions:
    - Research on a problem should be carried out before beginning to design a solution.
    - At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.
- Science and Engineering Practices: Asking Questions and Defining Problems. Asking questions and Builds on K-2 experiences and progresses to specifying qualitative relationships.

- Science and Engineering Practices: Developing and Using Models. Builds on K-2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.
- Science and Engineering Practices: Planning and Carrying Out Investigations. Builds on K-2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.
- Science and Engineering Practices: Analyzing and Interpreting Data. Builds on K-2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used.
- Science and Engineering Practices: Using Mathematics and Computational Thinking. Builds on K-2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions.
- Science and Engineering Practices: Constructing Explanations and Designing Solutions. Builds on K-2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.
- Science and Engineering Practices: Obtaining, Evaluating, and Communicating Information. Builds on K-2 experiences and progresses to evaluating the merit and accuracy of ideas and methods.
- Crosscutting Concept: Patterns. Similarities and differences in patterns can be used to sort, classify, communicate, and analyze simple rates of change for natural phenomena and design products.
- Crosscutting Concept: Patterns. Patterns of change can be used to make predictions.
- Crosscutting Concept: Patterns. Patterns can be used as evidence to support an explanation.
- Crosscutting Concept: Cause and Effect. Cause and effect relationships are routinely identified, tested, and used to explain change.
- Crosscutting Concept: Scale, Proportion, and Quantity. Natural objects and/or observable phenomena exist from the very small to the immensely large or from very short to very long periods of time. Standards units are used to measure and describe physical quantities such as weight, time, temperature, and volume.
- Crosscutting Concept: Systems and System Models. A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot.
- Crosscutting Concept: Systems and System Models. A system can be described in terms of its components and their interactions.
- Crosscutting Concept: Structure and Function. Different materials have substructures, which can sometimes be observed.
- Crosscutting Concept: Structure and Function. Substructures have shapes and parts that serve functions.

Common Core State Standards ELA and Mathematics

English Language Arts

- CCSS.ELA-LITERACY.RI.5.2 Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text.
- CCSS.ELA-LITERACY.RI.5.3 Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text.
- 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.
- CCSS.ELA-LITERACY.RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.
- CCSS.ELA-LITERACY.RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.
- CCSS.ELA-LITERACY.RI.5.10 By the end of the year, read and comprehend informational texts, including history/social studies, science, and technical texts, at the high end of the grades 4-5 text complexity band independently and proficiently.
- CCSS.ELA-LITERACY.RF.5.4 Read with sufficient accuracy and fluency to support comprehension.
- CCSS.ELA-LITERACY.W.5.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
- CCSS.ELA-LITERACY.W.5.4 Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1-3.)
- CCSS.ELA-LITERACY.W.5.6 With some guidance and support from adults, use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others; demonstrate sufficient command of keyboarding skills to type a minimum of two pages in a single sitting.
- CCSS.ELA-LITERACY.W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.
- CCSS.ELA-LITERACY.SL.5.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 5 topics and texts, building on others' ideas and expressing their own clearly.
- CCSS.ELA-LITERACY.L.5.3 Use knowledge of language and its conventions when writing, speaking, reading, or listening.
- CCSS.ELA-LITERACY.L.5.4 Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 5 reading and content, choosing flexibly from a range of strategies.

Commented [PR1]: I would delete this – only use the portion that's applicable to our purpose. Or replace the whole thing with "…"

- CCSS.ELA-LITERACY.L.5.5 Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.

Mathematics

- CCSS.MATH.CONTENT.5.MD.A.1 Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.
- CCSS.MATH.CONTENT.5.NBT.A.1 Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.
- CCSS.MATH.CONTENT.5.NBT.A.2 Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.
- CCSS.MATH.CONTENT.5.NBT.A.3 Read, write, and compare decimals to thousandths.

Sources

National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common core state standards.* Washington, DC: National Governors Association Center for Best Practices, Council of Chief State School Officers.

NGSS Lead States. (2013). *Next generation science standards: For states by states.* Washington, DC: National Academies Press.

Connections to Standards

PLTW programs are designed to empower students to thrive in an evolving world. As a part of this process, we take connections to standards into account when developing and updating our curriculum. The PLTW Launch modules will address standards from the following:

- Computer Science Teachers Association K-12 Computer Science (CS) Standards
- Next Generation Science Standards (NGSS)
- Common Core State Standards (CCSS) in English/Language Arts (ELA) and Mathematics

This document lists the standards identified from each of these sources for the Infection: Modeling and Simulation module.

Computer Science Teachers Association K-12 CS Standards

- 1B-AP-09 Create programs that use variables to store and modify data.
- 1B-AP-10 Create programs that include sequences, events, loops, and conditionals.
- 1B-AP-11 Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process.
- 1B-AP-13 Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences.
- 1B-AP-15 Test and debug (identify and fix) a program or algorithm to ensure it runs as intended.
- 1B-AP-16 Take on varying roles, with teacher guidance, when collaborating with peers during the design, implementation, and review stages of program development.
- 1B-IC-17 Describe choices made during program development using code comments, presentations, and demonstrations.

Next Generation Science Standards

- 3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

- 3-5-ETS1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
- ETS1.A Defining and Delimiting Engineering Problems: Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into accounts.
- ETS1.B Developing Possible Solutions: Research on a problem should be carried out before beginning to design a solution. At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.
- Crosscutting Concept: Influence of Science, Engineering, and Technology on Society and the Natural World. People's needs and wants change over time, as do their demands for new and improved technologies.
- Crosscutting Concept: Influence of Science, Engineering, and Technology on Society and the Natural World. Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.
- Crosscutting Concept: Cause and Effect. Cause and effect relationships are routinely identified.
- Crosscutting Concept: Cause and Effect. Cause and effect relationships are routinely identified, tested, and used to explain change.

Common Core State Standards Mathematics

- CCSS.MATH.CONTENT.5.G.1 Practice.MP1 Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x-coordinate, y-axis and y-coordinate).
- CCSS.MATH.CONTENT.5.G.2 Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.

Sources

Computer Science Teachers Association. (2017). *CSTA K-12 computer science standards, revised 2017*. Retrieved from http://www.csteachers.org/standards.

National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common core state standards.* Washington, DC: National Governors Association Center for Best Practices, Council of Chief State School Officers.

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