Grade 1 Science-Technology-Engineering

Introduction: The diocesan Science-Technology-Engineering curriculum guidelines are adapted from the *Next Generation Science Standards* (NGSS) http://www.nextgenscience.org/ and are based on the *2016 MA Science & Technology/Engineering Framework* (MA STE) [available: http://www.doe.mass.edu/frameworks/current.html and in separate sections along with other resources at: http://www.doe.mass.edu/stem/review.html] These resources should be explored since they include a wealth of information beyond the standards. The diocesan guidelines use the same numbering system for the standards in order to facilitate searches for lessons and other resources. The order of the standards does not imply a recommended instructional sequence. "Common Core Connections" from NGSS are included for grades K-5 to suggest ways to include science in other subjects (and vice versa.) "Assessment boundaries" indicate what may be included on future MCAS tests and are included here since they frequently offer further clarification of the performance expectations at that level. "Not included from NGSS", "Clarification statements" and the set of standards themselves are not intended to be restrictive in any way. A standard followed by an asterisk "*" indicates an engineering design practice.

Grades Pre-K–2: Overview of Science and Engineering Practices: The development of science and engineering practices begins very early, even as babies and young children inquire about and explore how the world works. Formal education should advance students' development of the skills necessary to engage in scientific inquiry and engineering design. These are the skills that provide the foundation for the scientific and technical reasoning that is so critical to success in civic life, postsecondary education, and careers. Inclusion of science and engineering practices in standards only speaks to the types of performances students should be able to demonstrate at the end of instruction at a particular grade; the standards do not limit what educators and students should or can be engaged in through a well-rounded curriculum.

Pre-K through grade 2 standards integrate all eight science and engineering practices. Pre-K standards ask students to demonstrate an ability to ask questions, set up simple investigations, analyze evidence, observations, and data for patterns, and use evidence to explain or develop ideas about how phenomena work. Kindergarten standards call for students to show further development of investigation and communication skills, as well as application of science concepts to designing solutions to problems, and to now use information obtained from text and media sources. Grade 1 standards call for students to continue developing investigation skills, including their ability to pose scientific questions as well as their ability to analyze observations and data and to effectively use informational sources. Grade 1 standards also call for students to demonstrate their ability to craft scientific explanations using evidence from a variety of sources. Grade 2 standards call for students to use models in a scientific context and further their skills in a number of the practices, including investigations, data analysis, designing solutions, argumentation, and use of informational sources.

Some examples of specific skills students should develop in these grades:

1. Raise questions about how different types of environments provide homes for living things; ask and/or identify questions that can be answered by an investigation.

2. Use a model to compare how plants and animals depend on their surroundings; develop and/or use a model to represent amounts, relationships, and/or patterns in the natural world; distinguish between a model and the actual object and/or process the model represents.

3. Conduct an investigation of light and shadows; plan and conduct an investigation collaboratively to produce data to answer a question; make observations and/or relative measurements to collect data that can be used to make comparisons.

4. Analyze data to identify relationships among seasonal patterns of change; use observations to describe patterns and/or relationships in the natural world and to answer scientific questions.

5. Decide when to use qualitative vs. quantitative information; use counting and numbers to describe patterns in the natural world.

6. Use information from observations to construct an evidence-based account of nature.

7. Construct an argument with evidence for how plants and animals can change the environment; distinguish between opinions and evidence in one's own explanations; listen actively to others to indicate agreement or disagreement based on evidence.

8. Obtain information to compare ways that parents and their offspring behave to survive; obtain information using various texts, text features, or other media to answer a question.

While presented as distinct skill sets, the eight practices intentionally overlap and interconnect. Skills such as those outlined above should be reflected in curricula and instruction that engage students in an integrated use of the practices.

Grade 1 Focus - Describing Patterns: In grade 1, students have more fluency with language, number sense, and inquiry skills. This allows them to describe patterns of motion between the Sun, Moon, and stars in relation to the Earth. From this understanding they can identify seasonal patterns from sunrise and sunset data that will allow them to predict future patterns. Building from their experiences in pre-K and kindergarten observing and describing daily weather, they can now examine seasonal data on temperature and rainfall to describe patterns over time. Grade 1 students investigate sound and light through various materials. They describe patterns in how light passes through and sounds differ from different types of materials and use this to design and build a device to send a signal. Students compare the ways different animals and plants use their body parts and senses to do the things they need to do to grow and survive, including typical ways parents keep their young safe so they will survive to adulthood. They notice that though there are differences between plants or animals of the same type, the similarities of behavior and appearance are what allow us to identify them as belonging to a group. Grade 1 students begin to understand the power of patterns to predict future events in the natural and designed world.

Grade 1: Earth and Space Sciences

ESS1. Earth's Place in the Universe

Students who demonstrate understanding can:

1-ESS1-1. Use observations of the Sun, Moon, and stars to describe that each appears to rise in one part of the sky, appears to move across the sky, and appears to set.

1-ESS1-2. Analyze provided data to identify relationships among seasonal patterns of change, including relative sunrise and sunset time changes, seasonal temperature and rainfall or snowfall patterns, and seasonal changes to the environment.
   Clarification Statement: Examples of seasonal changes to the environment can include foliage changes, bird migration, and differences in amount of insect activity.

Common Core Connections: ELA/Literacy – W.1.7 Participate in shared research and writing projects (e.g., explore a number of "how-to" books on a given topic and use them to write a sequence of instructions). (1- ESS1-1),(1-ESS1-2) **W.1.8** With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question. (1-ESS1-1),(1-ESS1-2) **Mathematics – MP.2** Reason abstractly and quantitatively. (1-ESS1-2) **MP.4** Model with mathematics. (1-ESS1-2) **MP.5** Use appropriate tools strategically. (1-ESS1-2) **1.OA.A.1** Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations to represent the problem. (1-ESS1-2) **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. (1-ESS1-2)

Grade 1: Life Science

LS1. From Molecules to Organisms: Structures and Processes

1-LS1-1. Use evidence to explain that (a) different animals use their body parts and senses 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, and (b) plants have roots, stems, leaves, flowers, and fruits that are used to take in water, air, and other nutrients, and produce food for the plant.
   Clarification Statement: Descriptions are not expected to include mechanisms such as the process of photosynthesis.

1-LS1-2. Obtain information to compare ways in which the behavior of different animal parents and their offspring help the offspring to survive.

Clarification Statement: Examples of behaviors could include the signals that offspring make (such as crying, cheeping, and other vocalizations) and the responses of the parents (such as feeding, comforting, and protecting the offspring).

Common Core Connections: ELA/Literacy – RI.1.1 Ask and answer questions about key details in a text. (1-LS1-2) **RI.1.2** Identify the main topic and retell key details of a text. (1-LS1-2) **RI.1.10** With prompting and support, read informational texts appropriately complex for grade. (1-LS1-2) **W.1.7** Participate in shared research and writing projects (e.g., explore a number of "how-to" books on a given topic and use them to write a sequence of instructions). (1-LS1- 1) **Mathematics – 1.NBT.B.3** Compare two two-digit numbers based on the meanings of the tens and one digits, recording the results of comparisons with the symbols >, =, and <. (1-LS1-2) **1.NBT.C.4** Add within 100, including adding a two-digit number and a one-digit number, and adding a two-digit number and a multiple of 10, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning uses. Understand that in adding two-digit numbers, one adds tens and tens, ones and ones; and sometimes it is necessary to compose a ten. (1- LS1-2) **1.NBT.C.5** Given a two-digit number, mentally find 10 more or 10 less than the number, without having to count; explain the reasoning used. (1-LS1-2) **1.NBT.C.6** Subtract multiples of 10 in the range 10-90 from multiples of 10 in the range 10-90 (positive or zero differences), using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. (1-LS1-2)

LS3. Heredity: Inheritance and Variation of Traits

1-LS3-1. Use information from observations (first-hand and from media) to identify similarities and differences among individual plants or animals of the same kind.

Clarification Statements: Examples of observations could include that leaves from the same kind of plant are the same shape but can differ in size. Inheritance, animals that undergo metamorphosis, or hybrids are not expected.

Common Core Connections: ELA/Literacy – RI.1.1 Ask and answer questions about key details in a text. (1-LS3-1) **W.1.7** Participate in shared research and writing projects (e.g., explore a number of "how-to" books on a given topic and use them to write a sequence of instructions). (1-LS3- 1) **W.1.8** With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question. (1-LS3-1) **Mathematics – MP.2** Reason abstractly and quantitatively. (1-LS3-1) **MP.5** Use appropriate tools strategically. (1-LS3-1) **1.MD.A.1** Order three objects by length; compare the lengths of two objects indirectly by using a third object. (1-LS3-1)

Grade 1: Physical Science

PS4. Waves and Their Applications in Technologies for Information Transfer

1-PS4-1. Demonstrate that vibrating materials can make sound and that sound can make materials vibrate.

Clarification Statements: Examples of vibrating materials that make sound could include tuning forks, a stretched string or rubber band, and a drum head. Examples of how sound can make materials vibrate could include holding a piece of paper near a speaker making sound and holding an object near a vibrating tuning fork.

1-PS4-3. Conduct an investigation to determine the effect of placing materials that allow light to pass through them, allow only some light through them, block all the light, or redirect light when put in the path of a beam of light.

Clarification Statements: Effects can include some or all light passing through, creation of a shadow, and redirecting light. Quantitative measures are not expected.

1-PS4-4. Use tools and materials to design and build a device that uses light or sound to send a signal over a distance.*

Clarification Statements: Examples of devices could include a light source to send signals, paper cup and string "telephones," and a pattern of drum beats. Technological details for how communication devices work are not expected.

Not included from NGSS: 1-PS4-2. Make observations to construct an evidence-based account that objects can be seen only when illuminated.

Common Core Connections: 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. (1-PS4-2) **W.1.7** Participate in shared research and writing projects (e.g., explore a number of "how-to" books on a given topic and use them to write a sequence of instructions). (1-PS4- 1),(1-PS4-2),(1-PS4-3),(1-PS4-4) **W.1.8** With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question. (1-PS4-1),(1-PS4-2),(1- PS4-3) **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. (1-PS4-1),(1-PS4-2),(1- PS4-3) **Mathematics – MP.5** Use appropriate tools strategically. (1-PS4-4) **1.MD.A.1** Order three objects by length; compare the lengths of two objects indirectly by using a third object. (1-

PS4-4) **1.MD.A.2** Express the length of an object as a whole number of length units, by layering 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. (1-PS4-4)

Grade 1: Technology/Engineering

ETS1. Engineering Design

1.K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change that can be solved by developing or improving an object or tool.*

1.K-2-ETS1-2. Generate multiple solutions to a design problem and make a drawing (plan) to represent one or more of the solutions.*

Found in grade 2: 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.

Common Core Connections: 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. (K-2-ETS1-1) **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. (K-2-ETS1-1) **W.2.8** Recall information from experiences or gather information from provided sources to answer a question. (K-2-ETS1-1) **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. (K-2-ETS1-2)
Mathematics – MP.2 Reason abstractly and quantitatively. (K-2-ETS1-1) **MP.4** Model with mathematics. (K-2-ETS1-1) **MP.5** Use appropriate tools strategically. (K-2-ETS1-1) **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. (K-2-ETS1-1)