K-12 SCIENCE EDUCATION VISION

A K-12 Dublin City Schools science education engages *all students* in critical thinking and problem solving as they experience science and engineering. We believe that students can become scientifically literate citizens equipped with the knowledge and skills demanded by the ever-changing future, whether in the workforce or higher education.

We believe in developing our learners through high quality experiences that include:

- A challenging, collaborative and inquiry based environment.
- Opportunities to solve and investigate real-world problems that require critical and global thinking.
- Opportunities for students to build an identity as a scientist, able to interpret the natural world, participate productively in scientific practices and contribute to society in meaningful ways.
- Opportunities to research, generate and evaluate evidence and explanations that uphold or refute scientific data.

We believe these learning experiences will grow independent, confident students who will become creative, innovative adults that are capable of using informed scientific judgement to improve their world.

Instructional Agreements for Science Learning within the Dublin City Schools

1. Learning goals will be communicated to guide students through the expectations of science learning using a variety of instructional techniques and technology integration.
2. Teachers will ensure a safe, challenging learning environment focused on inquiry and science exploration.
3. Teachers will provide support to students as they learn to frame questions, assess and analyze data, and create and critique explanations – all important components of scientific and engineering practices.
4. Content standards will be learned in partnership with Ohio's Cognitive Demands for Science, Science and Engineering Practices and Nature of Science practices.

Dublin City Schools Science Graded Course of Study

Nature of Science	
One goal of science education is to help students become scientifically literate citizens able to use science as a way of knowing about the natural and material world. All students should have sufficient understanding of scientific knowledge and scientific processes to enable them to distinguish what is science from what is not science and to make informed decisions about career choices, health maintenance, quality of life, community and other decisions that impact both themselves and others.	
Scientific Inquiry, Practice and Applications	All students must use these scientific processes with appropriate laboratory safety techniques to construct their knowledge and understanding in all science content areas.
Science is a Way of Knowing	Science assumes the universe is a vast single system in which basic laws are consistent. Natural laws operate today as they did in the past and they will continue to do so in the future. Science is both a body of knowledge that represents a current understanding of natural systems and the processes used to refine, elaborate, revise and extend this knowledge.
Science is a Human Endeavor	Science has been, and continues to be, advanced by individuals of various races, genders, ethnicities, languages, abilities, family backgrounds and incomes.
Scientific Knowledge is Open to Revision in Light of New Evidence	Science is not static. Science is constantly changing as we acquire more knowledge.

Scientific and Engineering Practices:

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Ohio's Cognitive Demands for Science	
Cognitive Demand	**Description**
DESIGNING TECHNOLOGICAL/ ENGINEERING SOLUTIONS USING SCIENCE CONCEPTS	Requires students to solve science-based engineering or technological problems through application of scientific inquiry. Within given scientific constraints, propose or critique solutions, analyze and interpret technological and engineering problems, use science principles to anticipate effects of technological or engineering design, find solutions using science and engineering or technology, consider consequences and alternatives, and/or integrate and synthesize scientific information.
DEMONSTRATING SCIENCE KNOWLEDGE	Requires students to use scientific practices and develop the ability to think and act in ways associated with inquiry, including asking questions, planning and conducting investigations, using appropriate tools and techniques to gather and organize data, thinking critically and logically about relationships between evidence and explanations, constructing and analyzing alternative explanations, and communicating scientific arguments. (Slightly altered from National Science Education Standards)
INTERPRETING AND COMMUNICATING SCIENCE CONCEPTS	Requires students to use subject-specific conceptual knowledge to interpret and explain events, phenomena, concepts and experiences using grade-appropriate scientific terminology, technological knowledge and mathematical knowledge. Communicate with clarity, focus and organization using rich, investigative scenarios, real-world data and valid scientific information.
RECALLING ACCURATE SCIENCE	Requires students to provide accurate statements about scientifically valid facts, concepts and relationships. Recall only requires students to provide a rote response, declarative knowledge or perform routine mathematical tasks. This cognitive demand refers to students' knowledge of science fact, information, concepts, tools, procedures (being able to describe how) and basic principles.

GRADE 2

Grade 2 Course Goals:

Students in second grade will focus on developing the skills for systematic discovery to understand the science of the physical world around them in greater depth by using scientific inquiry. Students in second grade will learn that living and nonliving things may move and that the atmosphere is made of air and water that move. They begin to understand that a moving object has energy and that changes in energy and movement can cause change to organisms and the environments in which they live.

Strand Connections:

Living and nonliving things may move. A moving object has energy. Air moving is wind and wind can make a windmill turn. Changes in energy and movement can cause change to organisms and the environments in which they live.

EARTH AND SPACE SCIENCE (ESS)	
Topic: Air and Water in the Atmosphere This topic focuses on air and water as they relate to weather and weather changes that can be observed and measured.	
Content Statement	**Content Elaboration**
2.ESS.1: The atmosphere is primarily made up of air. Air has properties that can be observed and measured. The transfer of energy in the atmosphere causes air movement, which is felt as wind. Wind speed and direction can be measured.	In the earlier grades, wind is measured but not with a numerical value or directional data (e.g., wind may be moving faster/slower than yesterday and is coming from a different direction). Wind can change the shape of the land (e.g., sand dunes, rock formations). In grade 2, wind is measured with a numeric value and direction (e.g., wind speed is 6 mph, wind direction is west to east). Air takes up space (volume) and has mass (differentiating between mass and weight is not necessary at this grade level). Heating and cooling of air (transfer of energy) results in movement of air (wind). The direction and speed of wind and the air temperature can be measured using a variety of instruments, such as windsocks, weather vanes, thermometers or simple anemometers. Weather events that are related to wind (e.g., tornadoes, hurricanes) are included in this content. Monitoring weather changes using technology (e.g., posting/sharing classroom data with other classes at the school or at other schools) can lead to review and questioning of data and evaluation of wind patterns that may be documented. Experiments, models (including digital/virtual) and investigations are

	conducted to demonstrate the properties of air, wind and wind-related weather events. Questions, comparisons and discussions related to actual data and the analysis of the data is an important way to deepen the content knowledge.
2.ESS.2: Water is present in the atmosphere. Water is present in the atmosphere as water vapor. When water vapor in the atmosphere cools, it forms clouds, fog, rain, ice, snow, sleet or hail. Note: The emphasis at this grade level is investigating condensation and evaporation, not memorizing the water cycle itself. Note: The emphasis is not in naming cloud types, but in relating the characteristics of the clouds with weather.	The physical properties of water (from grade 1) are expanded to include water vapor (water in the air). The different states of water are observed in weather events, nature and/or classroom investigations. The concepts of condensation and evaporation are explored through experimentation and observation. The different parts of the water cycle are explored and discussed. The focus is on investigation and understanding, not on vocabulary. Water can change from liquid to vapor and from vapor to liquid. When water in the atmosphere cools because of a change in energy, it often forms small droplets of liquid water or ice that can be seen as clouds. The small water droplets can then form raindrops. Water droplets can change to solid by freezing into snow, sleet or hail. Cloud formation and types of clouds are introduced as they relate to weather. Clouds are moved by wind. Factors such as water contamination/pollution can be introduced within this content statement as they relate to pollutants that can enter waterways through precipitation, evaporation and condensation. Experiments and investigations that demonstrate the conditions required for condensation or evaporation to occur lead to a deeper understanding of these concepts. Appropriate tools and technology can be used to observe, share results or document data. Relating the required conditions to actual weather observations, collecting and documenting data, drawing conclusions from the data and discussions about the findings are included for this content statement.
2.ESS.3: Long- and short-term weather changes occur due to changes in energy. Changes in energy affect all aspects of weather, including temperature, precipitation, and wind.	Weather is a result of energy change. Heating (from sunlight) and cooling of water, air and land are directly related to wind, evaporation, condensation, freezing, thawing and precipitation. Density and convection should not be introduced at this grade level. Weather patterns (long-term) and fronts (short-term) can be documented through consistent measuring of temperature, air pressure, wind speed and direction, and precipitation. Some forms of severe weather can occur in specific regions/areas, scientists forecast severe weather events. Weather data can be measured, collected and documented over a period of time and then connected to observable forms of energy (e.g., wind causes a sailboat to move, the sun can heat the sidewalk). Experiments and investigations (both inside and outside of the classroom) are used to demonstrate the connection between weather and energy. Discussion of energy at this grade level should be limited to observable changes.

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PHYSICAL SCIENCE (PS)	
Topic: The Relationship Between Force and Motion This topic focuses on observing the relationship between forces and motion.	
Content Statement	**Content Elaboration**
2.PS.1: Forces change the motion of an object. Motion can increase, change direction or stop depending on the force applied. The change in motion of an object is related to the size of the force. Some forces act without touching, such as using a magnet to move an object or objects falling to the ground.	Forces are needed to change the movement of an object by speeding up, slowing down, stopping or changing direction. Some forces act when an object is in contact with another object (e.g., physically pushing or pulling). Other forces act when objects are not in contact with each other (e.g., magnetic, gravitational, electrical). Gravitational, static electrical and magnetic forces are introduced through observation and experimentation only. The definitions of these forces should not be the focus of instruction. Earth's gravity pulls any object toward it, without touching the object. Static electricity also can pull or push objects without touching the object. Magnets can pull some objects to them (attraction) or push objects away from them (repulsion). Gravity, static electricity and magnets can be explored through experimentation, testing and investigation at this grade level. For a particular object, larger forces cause larger changes in motion. A strong kick to a rock is able to cause more change in motion than a weak kick to the same rock. Real-world experiences and investigations are used for this concept. There often is confusion between the concepts of force and energy. Force can be thought of as a push or pull between two objects and energy as the property of an object that can cause change. A force acting on an object can sometimes result in a change in energy. The difference between force and energy will be developed over time and is not appropriate at this grade level. Note: Introducing fields, protons, electrons or mathematical manipulations of positive and negative to explain observed phenomena is not appropriate at this grade level.

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LIFE SCIENCE (LS)	
Topic: Interactions within Habitats - Living Things and Their Environment This topic focuses on how ecosystems work by observations of simple interactions between the biotic/living and abiotic/nonliving parts of an ecosystem. Just as living things impact the environment in which they live, the environment impacts living things.	
Content Statement	**Content Elaboration**
2.LS.1: Living things cause changes on Earth. Living things function and interact with their physical environments. Living things cause changes in the environments where they live; the changes can be very noticeable or slightly noticeable, fast or slow. Note: At this grade level, discussion is limited to changes that can be easily observed.	The environment is a combination of the interactions between living and nonliving components. Living things can cause changes in their ecosystems, which can be observed. These interactions can cause changes in groups of living things and the physical environment (e.g., soil, rocks, water). Conducting investigations (in nature or virtually) to document specific changes in the ecosystem, as well as the results of those changes, are used to demonstrate this concept (e.g., moles tunneling in a lawn, beavers or muskrats building dams, plants growing in cracks of rocks). Maps or charts can be used to document the location of specific types of living things found in the local area. The impact and actions of living things are investigated and explored. The focus is not limited to human interaction with the environment (such as resource use or recycling) and includes activities such as observing earthworm compost bins, ant farms and weeds growing on vacant lots.
2.LS.2: All organisms alive today result from their ancestors, some of which may be extinct. Not all kinds of organisms that lived in the past are represented by living organisms today. Some kinds of organisms become extinct when their basic needs are no longer met or the environment changes.	Fossils are preserved physical traces of past living things (e.g., shells, bones, leaves, tracks, imprints, eggs, scat). Some fossils look similar to plants and animals that are alive today, while others are very different from anything alive today. Extinction refers to the disappearance of the last individual of a kind of organism. Extinction generally occurs as a result of changed conditions where the basic needs are not met. Some kinds of living things that once lived on Earth have completely disappeared (e.g., saber-tooth cat, trilobite, mastodon). Plants and animals alive today resemble organisms that once lived on Earth (e.g., ferns, sharks).