

Alignment with Indiana's Science Standards

This document evaluates the state's Education Standards for Science to determine alignment with content found in Cogno board games. Grades 3-8 were analyzed.



Highlighting Key

Indicates a significant amount of material addresses the standard

Indicates a moderate amount of material is present to develop student understanding of the standard

GRADE THREE

Standard 1

The Nature of Science and Technology

Students, working collaboratively, carry out investigations. They question, observe, and make accurate measurements. Students increase their use of tools, record data in journals, and communicate results through chart, graph, written, and verbal forms.

The Scientific View of the World

3.1.1 Recognize and explain that when a scientific investigation is repeated, a similar result is expected.

Scientific Inquiry

3.1.4 Discuss the results of investigations and consider the explanations of others.

The Scientific Enterprise

3.1.5 Demonstrate the ability to work cooperatively while respecting the ideas of others and communicating one's own conclusions about findings.

Standard 2

Scientific Thinking

Students use a variety of skills and techniques when attempting to answer questions and solve problems. They describe their observations accurately and clearly, using numbers, words, and sketches, and are able to communicate their thinking to others.

Computation and Estimation

3.2.1 Add and subtract whole numbers* mentally, on paper, and with a calculator.

Critical Response Skills

3.2.7 Ask "How do you know?" in appropriate situations and attempt reasonable answers when others ask the same question.

Standard 3

The Physical Setting

*Students observe changes of Earth and the sky. They continue to explore the concepts of energy**

and motion*.

The Universe

3.3.1 Observe and describe the apparent motion of the sun and moon over a time span of one day.

3.3.2 Observe and describe that there are more stars in the sky than anyone can easily count, but they are not scattered evenly.

* energy: what is needed to make things move

* motion: the change in position of an object in a certain amount of time

Matter* and Energy

3.3.8 Investigate and describe how moving air and water can be used to run machines like windmills and waterwheels.

* matter: anything that has mass* and takes up space

* mass: a measure of how much matter is in an object

Forces of Nature

3.3.9 Demonstrate that things that make sound do so by vibrating, such as vocal cords and musical instruments.

Standard 4

The Living Environment

Students learn about an increasing variety of organisms. They use appropriate tools and identify similarities and differences among them. Students explore how organisms satisfy their needs in typical environments.

Diversity of Life

3.4.1 Demonstrate that a great variety of living things can be sorted into groups in many ways using various features, such as how they look, where they live, and how they act, to decide which things belong to which group.

Interdependence of Life and Evolution

3.4.4 Describe that almost all kinds of animals' food can be traced back to plants.

Human Identity

3.4.9 Explain that some diseases are caused by germs and some are not. Note that diseases caused by germs may be spread to other people. Also understand that washing hands with soap and water reduces the number of germs that can get into the body or that can be passed on to other people.

Standard 5

The Mathematical World

Students apply mathematics in scientific contexts. Students make more precise and varied measurements when gathering data. Based upon collected data, they pose questions and solve problems. Students use numbers to record data and construct graphs and tables to communicate their findings.

Numbers

3.5.1 Select and use appropriate measuring units, such as centimeters (cm) and meters (m), grams (g) and kilograms (kg), and degrees Celsius (°C).

Reasoning and Uncertainty

3.5.5 Explain that one way to make sense of something is to think of how it relates to something more familiar.

Standard 6

Common Themes

Students work with an increasing variety of systems and begin to modify parts in systems and models and notice the changes that result. They question why change occurs.

Models and Scale

3.6.3 Explain how a model of something is different from the real thing but can be used to learn something about the real thing.

Constancy and Change

3.6.5 Observe that and describe how some changes are very slow and some are very fast and that some of these changes may be hard to see and/or record.

GRADE FOUR

Standard 1

The Nature of Science and Technology

Students, working collaboratively, carry out investigations. They observe and make accurate measurements, increase their use of tools and instruments, record data in journals, and communicate results through chart, graph, written, and verbal forms.

The Scientific Enterprise

4.1.3 Explain that clear communication is an essential part of doing science since it enables scientists to inform others about their work, to expose their ideas to evaluation by other scientists, and to allow scientists to stay informed about scientific discoveries around the world.

4.1.4 Describe how people all over the world have taken part in scientific investigation for many centuries.

Technology and Science

4.1.5 Demonstrate how measuring instruments, such as microscopes, telescopes, and cameras, can be used to gather accurate information for making scientific comparisons of objects and events.

4.1.7 Discuss and give examples of how technology, such as computers and medicines, has improved the lives of many people, although the benefits are not equally available to all.

4.1.8 Recognize and explain that any invention may lead to other inventions.

Standard 2

Scientific Thinking

Students use a variety of skills and techniques when attempting to answer questions and solve problems. They describe their observations accurately and clearly, using numbers, words, and sketches, and are able to communicate their thinking to others. They compare, explain, and justify both information and numerical functions.*

Computation and Estimation

4.2.1 Judge whether measurements and computations of quantities, such as length, area*, volume*, weight, or time, are reasonable.

4.2.2 State the purpose, orally or in writing, of each step in a computation.

Communication Skills

4.2.4 Use numerical data to describe and compare objects and events.

Critical Response Skills

4.2.6 Support statements with facts found in print and electronic media, identify the sources used, and

expect others to do the same.

4.2.7 Identify better reasons for believing something than “Everybody knows that ...” or “I just know,” and discount such reasons when given by others.

Standard 3

The Physical Setting

Students continue to investigate changes of Earth and the sky and begin to understand the composition and size of the universe. They explore, describe, and classify materials, motion, and energy*.*

The Universe

4.3.1 Observe and report that the moon can be seen sometimes at night and sometimes during the day.

* motion: the change in position of an object in a certain amount of time

* energy: what is needed to make things move

Earth and the Processes That Shape It

4.3.2 Begin to investigate and explain that air is a substance that surrounds us and takes up space, and whose movements we feel as wind.

4.3.4 Describe some of the effects of oceans on climate.

4.3.8 Explain that the rotation of Earth on its axis every 24 hours produces the night-and-day cycle.

Matter* and Energy

4.3.10 Demonstrate that the mass* of a whole object is always the same as the sum of the masses of its parts.

Forces of Nature

4.3.15 Demonstrate that without touching them, a magnet pulls all things made of iron and either pushes or pulls other magnets.

4.3.16 Investigate and describe that without touching them, material that has been electrically charged pulls all other materials and may either push or pull other charged material.

Standard 4

The Living Environment

Students learn about an increasing variety of organisms – familiar, exotic, fossil, and microscopic. They use appropriate tools in identifying similarities and differences among them. They explore how organisms satisfy their needs in their environments.

Interdependence of Life and Evolution

4.4.4 Observe and describe that some source of energy is needed for all organisms to stay alive and grow.

Human Identity

4.4.7 Describe that human beings have made tools and machines, such as x-rays, microscopes, and computers, to sense and do things that they could not otherwise sense or do at all, or as quickly, or as well.

Standard 5

The Mathematical World

Students apply mathematics in scientific contexts. Their geometric descriptions of objects are comprehensive. They realize that graphing demonstrates specific connections between data. They identify questions that can be answered by data distribution.

Reasoning and Uncertainty

4.5.5 Explain how reasoning can be distorted by strong feelings.

GRADE FIVE

Standard 1

The Nature of Science and Technology

Students work collaboratively to carry out investigations. They observe and make accurate measurements, increase their use of tools and instruments, record data in journals, and communicate results through chart, graph, written, and verbal forms. Students repeat investigations, explain inconsistencies, and design projects.

Scientific Inquiry

5.1.2 Begin to evaluate the validity of claims based on the amount and quality of the evidence cited.

The Scientific Enterprise

5.1.3 Explain that doing science involves many different kinds of work and engages men, women, and children of all ages and backgrounds.

Technology and Science

5.1.4 Give examples of technology, such as telescopes, microscopes, and cameras, that enable scientists and others to observe things that are too small or too far away to be seen without them and to study the motion of objects that are moving very rapidly or are hardly moving.

Standard 2

Scientific Thinking

Students use a variety of skills and techniques when attempting to answer questions and solve problems. Students describe their observations accurately and clearly using numbers, words, and sketches, and are able to communicate their thinking to others. They compare, contrast, explain, and justify both information and numerical functions.

Computation and Estimation

5.2.1 Multiply and divide whole numbers* mentally, on paper, and with a calculator.

Communication Skills

5.2.7 Read and follow step-by-step instructions when learning new procedures.

Critical Response Skills

5.2.8 Recognize when and describe that comparisons might not be accurate because some of the conditions are not kept the same.

Standard 3

The Physical Setting

Students continue to investigate changes of Earth and the sky. They explore, describe, and classify materials, motion, and energy*.*

The Universe

5.3.1 Explain that telescopes are used to magnify distant objects in the sky, including the moon and the planets.

5.3.2 Observe and describe that stars are like the sun, some being smaller and some being larger, but they are so far away that they look like points of light.

5.3.3 Observe the stars and identify stars that are unusually bright and those that have unusual

colors, such as reddish or bluish.

* motion: the change in position of an object in a certain amount of time

* energy: what is needed to make things move

Earth and the Processes That Shape It

5.3.5 Observe and explain that clouds and fog are made of tiny droplets of water.

5.3.6 Demonstrate that things on or near Earth are pulled toward it by Earth's gravity*.

Forces of Nature

5.3.11 Investigate and describe that changes in speed* or direction of motion of an object are caused by forces*. Understand that the greater the force, the greater the change in motion and the more massive an object, the less effect a given force will have.

5.3.12 Explain that objects move at different rates, with some moving very slowly and some moving too quickly for people to see them.

5.3.13 Demonstrate that Earth's gravity pulls any object toward it without touching it.

* speed: the rate per unit time at which an object moves

* force: a push or a pull that can cause a change in the motion* of an object

* motion: the change in position of an object in a certain amount of time

Standard 4

The Living Environment

Students learn about an increasing variety of organisms – familiar, exotic, fossil, and microscopic.

They use appropriate tools in identifying similarities and differences among these organisms.

Students explore how organisms satisfy their needs in their environments.

Interdependence of Life and Evolution

5.4.4 Explain that in any particular environment, some kinds of plants and animals survive well, some do not survive as well, and some cannot survive at all.

5.4.5 Explain how changes in an organism's habitat are sometimes beneficial and sometimes harmful.

5.4.6 Recognize and explain that most microorganisms do not cause disease and many are beneficial.

Standard 5

The Mathematical World

Students apply mathematics in scientific contexts. They make more precise and varied measurements in gathering data. Their geometric descriptions of objects are comprehensive, and their graphing demonstrates specific connections. They identify questions that can be answered by data distribution, e.g., "Where is the middle?" and their support of claims or answers with reasons and analogies becomes important.

GRADE SIX

Standard 1

The Nature of Science and Technology

Students design investigations. They use computers and other technology to collect and analyze data; they explain findings and can relate how they conduct investigations to how the scientific enterprise functions as a whole. Students understand that technology has allowed humans to do many things, yet it cannot always provide solutions to our needs.

The Scientific View of the World

6.1.1 Explain that some scientific knowledge, such as the length of the year, is very old and yet is still applicable today. Understand, however, that scientific knowledge is never exempt from review and criticism.

Scientific Inquiry

6.1.2 Give examples of different ways scientists investigate natural phenomena and identify processes all scientists use, such as collection of relevant evidence, the use of logical reasoning, and the application of imagination in devising hypotheses* and explanations, in order to make sense of the evidence.

6.1.3 Recognize and explain that hypotheses are valuable, even if they turn out not to be true, if they lead to fruitful investigations.

Technology and Science

6.1.7 Explain that technology is essential to science for such purposes as access to outer space and other remote locations, sample collection and treatment, measurement, data collection and storage, computation, and communication of information.

6.1.8 Describe instances showing that technology cannot always provide successful solutions for problems or fulfill every human need.

Standard 2

Scientific Thinking

Students use computers and other tools to collect information, calculate, and analyze data. They prepare tables and graphs, using these to summarize data and identify relationships.

Communication Skills

6.2.7 Locate information in reference books, back issues of newspapers and magazines, CD-ROMs, and computer databases.

6.2.8 Analyze and interpret a given set of findings, demonstrating that there may be more than one good way to do so.

Standard 3

The Physical Setting

Students collect and organize data to identify relationships between physical objects, events, and processes. They use logical reasoning to question their own ideas as new information challenges their conceptions of the natural world.

The Universe

6.3.1 Compare and contrast the size, composition, and surface features of the planets that comprise the solar system, as well as the objects orbiting them. Explain that the planets, except Pluto, move around the sun in nearly circular orbits.

6.3.2 Observe and describe that planets change their position relative to the background of stars.

6.3.3 Explain that Earth is one of several planets that orbit the sun, and that the moon, as well as many artificial satellites and debris, orbit around Earth.

Earth and the Processes That Shape It

6.3.4 Explain that we live on a planet which appears at present to be the only body in the solar system capable of supporting life.

6.3.7 Understand and describe the scales involved in characterizing Earth and its atmosphere. Describe that Earth is mostly rock, that three-fourths of its surface is covered by a relatively thin layer of water, and that the entire planet is surrounded by a relatively thin blanket of air.

6.3.8 Explain that fresh water, limited in supply and uneven in distribution, is essential for life and also for most industrial processes. Understand that this resource can be depleted or polluted, making it unavailable or unsuitable for life.

6.3.11 Identify and explain the effects of oceans on climate.

Matter* and Energy*

6.3.17 Recognize and describe that energy is a property of many objects and is associated with heat, light, electricity, mechanical motion, and sound.

6.3.19 Investigate that materials may be composed of parts that are too small to be seen without magnification.

6.3.20 Investigate that equal volumes* of different substances usually have different masses as well as different densities*.

* matter: anything that has mass* and takes up space

* mass: a measure of how much matter is in an object

* energy: what is needed to make things move

* volume: a measure of the size of a three-dimensional object

* density: the density of a sample is the sample's mass divided by its volume

Forces of Nature

6.3.21 Investigate, using a prism for example, that light is made up of a mixture of many different colors of light, even though the light is perceived as almost white.

6.3.22 Demonstrate that vibrations in materials set up wavelike disturbances, such as sound and earthquake waves*, that spread away from the source.

Standard 4

The Living Environment

Students recognize that plants and animals obtain energy in different ways, and they can describe some of the internal structures of organisms related to this function. They examine the similarities and differences between humans and other species. They use microscopes to observe cells and recognize cells as the building blocks of all life.*

Diversity of Life

6.4.3 Describe some of the great variety of body plans and internal structures animals and plants have that contribute to their being able to make or find food and reproduce.

* chlorophyll: a substance found in green plants that is needed for photosynthesis*

* photosynthesis: a process by which green plants use energy from sunlight to make their own food

Interdependence of Life and Evolution

6.4.8 Explain that in all environments, such as freshwater, marine, forest, desert, grassland, mountain, and others, organisms with similar needs may compete with one another for resources, including food, space, water, air, and shelter. Note that in any environment, the growth and survival of organisms depend on the physical conditions.

6.4.10 Describe how life on Earth depends on energy from the sun.

GRADE SEVEN

Standard 1

The Nature of Science and Technology

Students further their scientific understanding of the natural world through investigations, experiences, and readings. They design solutions to practical problems by using a variety of scientific methodologies.

The Scientific View of the World

7.1.1 Recognize and explain that when similar investigations give different results, the scientific challenge is to judge whether the differences are trivial or significant, which often takes further studies to decide.

The Scientific Enterprise

7.1.5 Identify some important contributions to the advancement of science, mathematics, and technology that have been made by different kinds of people, in different cultures, at different times.

Technology and Science

7.1.7 Explain how engineers, architects, and others who engage in design and technology use scientific knowledge to solve practical problems.

Standard 3

The Physical Setting

Students collect and organize data to identify relationships between physical objects, events, and processes. They use logical reasoning to question their own ideas as new information challenges their conceptions of the natural world.

The Universe

7.3.1 Recognize and describe that the sun is a medium-sized star located near the edge of a disk-shaped galaxy of stars and that the universe contains many billions of galaxies and each galaxy contains many billions of stars.

7.3.2 Recognize and describe that the sun is many thousands of times closer to Earth than any other star, allowing light from the sun to reach Earth in a few minutes. Note that this may be compared to time spans of longer than a year for all other stars.

Earth and the Processes That Shape It

7.3.3 Describe how climates sometimes have changed abruptly in the past as a result of changes in Earth's crust, such as volcanic eruptions or impacts of huge rocks from space.

7.3.5 Recognize and explain that heat energy carried by ocean currents has a strong influence on climate around the world.

Matter* and Energy*

7.3.11 Explain that the sun loses energy by emitting light. Note that only a tiny fraction of that light reaches Earth. Understand that the sun's energy arrives as light with a wide range of wavelengths*, consisting of visible light and infrared* and ultraviolet radiation*.

7.3.14 Explain that energy in the form of heat is almost always one of the products of an energy transformation, such as in the examples of exploding stars, biological growth, the operation of machines, and the motion of people.

7.3.15 Describe how electrical energy can be produced from a variety of energy sources and can be transformed into almost any other form of energy, such as light or heat.

* matter: anything that has mass* and takes up space

* mass: a measure of how much matter is in an object

* energy: what is needed to make things move

* wavelength: the distance between two consecutive, similar points on a wave*

* wave: a traveling disturbance that carries energy from one place to another

* infrared radiation: electromagnetic radiation having wavelengths longer than those of red light but shorter than microwaves

* ultraviolet radiation: electromagnetic radiation having wavelengths shorter than those of visible light but longer than those of x-rays

Forces of Nature

7.3.17 Investigate that an unbalanced force, acting on an object, changes its speed* or path of motion or both, and know that if the force always acts toward the same center as the object moves, the object's path may curve into an orbit around the center.

7.3.18 Describe that light waves, sound waves, and other waves move at different speeds in different materials.

7.3.19 Explain that human eyes respond to a narrow range of wavelengths of the electromagnetic

spectrum*.

* speed: the rate per unit time at which an object moves

* electromagnetic spectrum: the arrangement of electromagnetic waves* in order of wavelength and frequency*

* electromagnetic waves: a combination of electric and magnetic fields, each regenerating the other, that carry energy through space – light and radio waves are examples

Standard 4

The Living Environment

Students begin to trace the flow of matter and energy through ecosystems. They recognize the fundamental difference between plants and animals and understand its basis at the cellular level. Students distinguish species, particularly through an examination of internal structures and functions. They use microscopes to observe cells and recognize that cells function in similar ways in all organisms.

Interdependence of Life and Evolution

7.4.6 Explain how food provides the fuel and the building material for all organisms.

GRADE EIGHT

Standard 1

The Nature of Science and Technology

Students design and carry out increasingly sophisticated investigations. They understand the reason for isolating and controlling variables in an investigation. They realize that scientific knowledge is subject to change as new evidence arises. They examine issues in the design and use of technology, including constraints, safeguards, and trade-offs.

The Scientific View of the World

8.1.1 Recognize that and describe how scientific knowledge is subject to modification as new information challenges prevailing theories and as a new theory* leads to looking at old observations in a new way.

* theory: an explanation supported by substantial evidence

The Scientific Enterprise

8.1.4 Explain why accurate record keeping, openness, and replication are essential for maintaining an investigator's credibility with other scientists and society.

Technology and Science

8.1.7 Explain why technology issues are rarely simple and one-sided because contending groups may have different values and priorities.

8.1.8 Explain that humans help shape the future by generating knowledge, developing new technologies, and communicating ideas to others.

Standard 2

Scientific Thinking

Students use computers to organize and compare information. They perform calculations and determine the appropriate units for the answers. They weigh the evidence for or against an argument, as well as the logic of the conclusions.

Communication

8.2.7 Participate in group discussions on scientific topics by restating or summarizing accurately what others have said, asking for clarification or elaboration, and expressing alternative positions.

Standard 3

The Physical Setting

Students collect and organize data to identify relationships between physical objects, events, and processes. They use logical reasoning to question their own ideas as new information challenges their conceptions of the natural world.

The Universe

8.3.1 Explain that large numbers of chunks of rock orbit the sun and some of this rock interacts with Earth.

Earth and the Processes That Shape It

8.3.2 Explain that the slow movement of material within Earth results from heat flowing out of the deep interior and the action of gravitational forces on regions of different density*.

8.3.5 Explain that everything on or anywhere near Earth is pulled toward Earth's center by a gravitational force.

Matter and Energy*

8.3.8 Explain that all matter is made up of atoms* which are far too small to see directly through an optical microscope. Understand that the atoms of any element* are similar but are different from atoms of other elements. Further understand that atoms may stick together in well-defined molecules or may be packed together in large arrays. Also understand that different arrangements of atoms into groups comprise all substances.

8.3.10 Explain that increased temperature means that atoms have a greater average energy of motion and that most gases expand when heated.

8.3.12 Explain that no matter how substances within a closed system interact with one another, or how they combine or break apart, the total mass of the system remains the same. Understand that the atomic theory explains the conservation of matter: if the number of atoms stays the same no matter how they are rearranged, then their total mass stays the same.

8.3.13 Explain that energy cannot be created or destroyed but only changed from one form into another.

* energy: what is needed to make things move

* atom: the smallest particle of an element that has the properties of that element

Forces of Nature

8.3.16 Explain that every object exerts gravitational force on every other object and that the force depends on how much mass the objects have and how far apart they are.

8.3.17 Explain that the sun's gravitational pull holds Earth and the other planets in their orbits, just as the planets' gravitational pull keeps their moons in orbit around them.

Standard 4

The Living Environment

Students trace the flow of matter and energy through ecosystems. They understand that the total amount of matter remains constant and that almost all food energy has its origin in sunlight.*

Interdependence of Life and Evolution

8.4.5 Explain that energy can be transferred from one form to another in living things.

8.4.8 Describe how environmental conditions affect the survival of individual organisms and how entire species may prosper in spite of the poor survivability or bad fortune of individuals.

Indiana Earth & Space Science Standards

Standard 1

Principles of Earth and Space Science

Students investigate, through laboratory and fieldwork, the universe, Earth, and the processes that shape Earth. They understand that Earth operates as a collection of interconnected systems that may be changing or may be in equilibrium. Students connect the concepts of energy, matter, conservation, and gravitation to Earth, the solar system, and the universe. Students utilize knowledge of the materials and processes of Earth, planets, and stars in the context of the scales of time and size.

The Universe

ES.1.1 Understand and discuss the nebular theory concerning the formation of solar systems. Include in the discussion the roles of planetesimals and protoplanets.

ES.1.2 Differentiate between the different types of stars found on the Hertzsprung-Russell Diagram. Compare and contrast the evolution of stars of different masses. Understand and discuss the basics of the fusion processes that are the source of energy of stars.

ES.1.3 Compare and contrast the differences in size, temperature, and age between our sun and other stars.

ES.1.4 Describe Hubble's law. Identify and understand that the "Big Bang" theory is the most widely accepted theory explaining the formation of the universe.

ES.1.5 Understand and explain the relationship between planetary systems, stars, multiple-star systems, star clusters, galaxies, and galactic groups in the universe.

ES.1.6 Discuss how manned and unmanned space vehicles can be used to increase our knowledge and understanding of the universe.

ES.1.7 Describe the characteristics and motions of the various kinds of objects in our solar system, including planets, satellites, comets, and asteroids. Explain that Kepler's laws determine the orbits of the planets.

ES.1.8 Discuss the role of sophisticated technology, such as telescopes, computers, space probes, and particle accelerators, in making computer simulations and mathematical models in order to form a scientific account of the universe.

ES.1.9 Recognize and explain that the concept of conservation of energy is at the heart of advances in fields as diverse as the study of nuclear particles and the study of the origin of the universe.

Earth

ES.1.14 Understand and explain the role of differential heating and the role of Earth's rotation on the movement of air around the planet.

Processes That Shape Earth

Standard 2

Historical Perspectives of Earth and Space Science

Students gain understanding of how the scientific enterprise operates through examples of historical events. Through the study of these events, they understand that new ideas are limited by the context in which they are conceived, are often rejected by the scientific establishment, sometimes spring from unexpected findings, and grow or transform slowly through the contributions of many different investigators.

ES.2.3 Understand that and describe how Johannes Kepler, a German astronomer who lived at about the same time as Galileo, used the unprecedented precise observational data of the Danish astronomer Tycho Brahe. Know that Kepler showed mathematically that Copernicus's idea of a sun-centered system worked better than any other system if uniform circular motion was replaced with variable speed, but predictable, motion along off-center ellipses.

Please note that use of these standards does not imply this state's endorsement of Cognio.