INDIANA DEPARTMENT of EDUCATION

2024 INDIANA CONTENT CONNECTORS

SCIENCE

ENVIRONMENTAL SCIENCE

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Indiana Content Connectors Context and Purpose

Introduction

The Indiana Content Connectors for Environmental Science are the result of a process designed to identify, evaluate, synthesize, and create high-quality learning expectations for Indiana students with significant cognitive disabilities.

The Indiana Department of Education (IDOE) convened stakeholder committees to review proposed revisions to Indiana's Alternative Standards, known as content connectors. The content connectors are designed to measure the knowledge and skills of students with the most significant cognitive disabilities and are assessed with the state's alternate assessment. The content connectors are designed to ensure that all Indiana students in this population are prepared with essential knowledge and skills needed to access employment, enrollment, or enlistment leading to service.

What are the Content Connectors and how should they be used?

The Indiana Content Connectors are designed to help educators, parents, students, and community members understand the necessary content for each grade level, and within each content area domain, to access employment, enrollment, or enlistment leading to service. These content connectors should form the basis for strong core instruction for all students at each grade level and content area. The content connectors identify the minimum academic content or skills to which Indiana students need access in order to be prepared for success after graduation, but they are not an exhaustive list.

While the Indiana Content Connectors establish key expectations for knowledge and skills and should be used as the basis for curriculum, the content connectors by themselves do not constitute a curriculum. It is the responsibility of the local school corporation to select and formally adopt curricular tools, including textbooks and any other supplementary materials, that align with Indiana Content Connectors. Additionally, corporation and school leaders should consider the appropriate instructional sequence of the content connectors as well as the length of time needed to teach each one. Every content connector has a unique place in the continuum of learning, but each content connector will not require the same amount of time and attention. A deep understanding of the vertical articulation of the standards will enable educators to make the best instructional decisions. These content connectors must also be complemented by robust, evidence-based instructional practices to support overall student development. By utilizing strategic and intentional instructional practices, other areas such as STEM and employability skills can be integrated with the content connectors.

Acknowledgments

IDOE appreciates the time, dedication, and expertise offered by Indiana's K-12 general and special educators, higher education professors, representatives from business and industry, families, and other stakeholders who contributed to the development of the Indiana Content Connectors. We wish to specially acknowledge the committee members, as well as participants in the public comment period, who dedicated many hours to the review and evaluation of these content connectors designed to prepare Indiana students for success after graduation.

Environmental Science

Standards and content connectors identified as essential for mastery by the end of the course are indicated with gray shading and an "E."

Indiana Academic Standards	Content Connectors
Environmental Systems	
HS-ENV1-1: Environmental Systems Students who demonstrate understanding can: Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. [Clarification Statement: Examples of changes in ecosystem conditions could include modest biological or physical changes, such as moderate hunting or a seasonal flood; and extreme changes, such as volcanic eruption or sea level rise.]	**HS-ENV1-1a:** Use evidence to evaluate how interactions in ecosystems can contribute to stable conditions, lead to changes (e.g., moderate hunting, seasonal flood, volcanic eruption, sea level rise), or result in a new ecosystem.
HS-ENV1-2: Environmental Systems Students who demonstrate understanding can: Use a computational representation to illustrate that humans are part of Earth's ecosystems and how human activities can, deliberately or inadvertently, alter ecosystems.	**HS-ENV1-2a:** Use a computational representation to support the claim that human activities can alter ecosystems.
	HS-ENV1-2b: Use a computational representation to illustrate how the ocean, atmosphere, or biosphere are changed by human activities.
HS-ENV1-3: Environmental Systems Students who demonstrate understanding can: Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity. [Clarification Statement: Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere. An example of the far-reaching impacts from human activity is how an increase in atmospheric carbon dioxide results in an increase in photosynthetic biomass on land and an increase in ocean acidification, with resulting	**HS-ENV1-3a:** Use graphical or mathematical representations to illustrate the relationships among the hydrosphere, atmosphere, cryosphere, and/or biosphere.
	HS-ENV1-3b: Use representations to determine how the relationships among Earth systems are changed by human activities.

impacts on sea organism health and marine populations.]	
HS-ENV1-4: Environmental Systems Students who demonstrate understanding can: Analyze data regarding differences between systems in equilibrium and systems in disequilibrium. Use corresponding data to support how steady state is achieved through negative and positive feedback loops.	**HS-ENV1-4a:** Use data to compare Earth systems in equilibrium to Earth systems in disequilibrium.
	HS-ENV1-4b: Use data from a diagram of Earth's global climate system to describe how feedback loops stabilize changes in the system.
HS-ENV1-5: Environmental Systems Students who demonstrate understanding can: Evaluate, measure, and communicate biological, chemical, and physical (abiotic and biotic) factors within an ecosystem.	**HS-ENV1-5a:** Use data to evaluate, measure, and communicate a factor (e.g., biological, chemical, physical) within an ecosystem.
HS-ENV1-6: Environmental Systems Students who demonstrate understanding can: Use a model to locate and describe the major Earth biomes. Analyze data to assess how biomes are determined by climate (temperature and precipitation patterns) that support specific kinds of plants.	**HS-ENV1-6a:** Use a model to locate and describe the major Earth biomes based on descriptions.
	HS-ENV1-6b: Use a model to describe that there is a relationship between the major Earth biomes and Earth's global climate system.
HS-ENV1-7: Environmental Systems Students who demonstrate understanding can: Observe the difference between weather and climate. Observe how weather can be influenced by global climatic patterns, such as El Niño and La Niña. Use a model or simulation to observe the factors that influence weather and climate, the action of gravitational forces, and the rotation of the Earth.	**HS-ENV1-7a:** Use a model to observe the difference between weather and climate.
	HS-ENV1-7b: Use a model to demonstrate how absorption, reflection, and redistribution of solar energy influence climate systems.
HS-ENV1-8: Environmental Systems Students who demonstrate understanding can: Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth	**HS-ENV1-8a:** Analyze data to predict the impact of climate change (e.g., precipitation, temperature) on Earth Systems.

systems. [Clarification Statement: Examples of evidence, for both data and climate model outputs, should show how projected climate changes (such as precipitation and temperature) and their associated impacts (such as on sea level, glacial ice volumes, or atmosphere and ocean composition) are dependent on emission scenarios.]	
Flow of Matter and Energy	
HS-ENV2-1: Flow of Matter and Energy Students who demonstrate understanding can: Construct and revise an explanation based on evidence for the cycling of matter through sources and sinks and how energy is transferred.	**HS-ENV2-1a:** Use a diagram of sources and sinks to identify the movement of matter.
	HS-ENV2-1b: Identify evidence which supports claims about energy transfer through sources and sinks.
HS-ENV2-2: Flow of Matter and Energy Students who demonstrate understanding can: Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. (These mathematical representations may include ecological pyramids of number, biomass, and energy.)	**HS-ENV2-2a:** Use mathematical representations to support claims regarding the movement of matter and energy through an ecosystem in a food web.
HS-ENV2-3: Flow of Matter and Energy Students who demonstrate understanding can: Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. [Clarification Statement: Examples of the causes of climate change differ by timescale, over 1-10 years: large volcanic eruption, ocean circulation; 10-100s of years: changes in human activity, ocean circulation, solar output; 10-100s of thousands of years: changes to Earth's orbit and the orientation of its axis; and 10-100s of millions of years: long-term changes in atmospheric composition.]	**HS-ENV2-3a:** Use a model to describe how variations in Earth's orbit and tilt can lead to changes in climate by affecting the amount of sunlight reaching the Earth.
	HS-ENV2-3b: Use a model to describe interactions relating to the flow of energy into and out of Earth's systems that have changed the Earth's climate at a variety of time scales from sudden (e.g., volcanic ash clouds) to intermediate (e.g., ice ages) to very long-term (e.g., tectonic cycles).

<table>
<tr><td>HS-ENV2-4: Flow of Matter and Energy
Students who demonstrate understanding can:

Analyze and interpret the data on the benefits and disadvantages of the different sources of energy including fossil fuels, nuclear energy, hydroelectric, wind, solar, geothermal and biofuels.</td><td>HS-ENV2-4a: Use data to compare the benefits and disadvantages of various energy forms (e.g., fossil fuels, nuclear energy, hydroelectric, wind, solar, geothermal, and biofuels).</td></tr>
<tr><td rowspan="2">HS-ENV2-5: Flow of Matter and Energy
Students who demonstrate understanding can:

Use a model or simulation to analyze how layers of energy-rich organic material have been gradually turned into great coal beds and oil pools by the pressure of the overlying earth. Observe that by burning these fossil fuels, people are passing stored energy back into the environment as heat and releasing large amounts of matter such as carbon dioxide and other air pollutants.</td><td>HS-ENV2-5a: Use a model or simulation to analyze how fossil fuels are formed and the environmental effects of burning fossil fuels.</td></tr>
<tr><td>HS-ENV2-5b: Use a model or simulation to analyze how the availability of fossil fuels has shaped where people live and their way of life.</td></tr>
<tr><td>HS-ENV2-6: Flow of Matter and Energy
Students who demonstrate understanding can:

Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios. [Clarification Statement: Emphasis is on the conservation, recycling, and reuse of resources (such as minerals and metals) where possible, and on minimizing impacts where it is not. Examples include developing best practices for agricultural soil use, mining (for coal, tar sands, and oil shales), and pumping (for petroleum and natural gas). Science knowledge indicates what can happen in natural systems—not what should happen. Discuss how environmental costs can be left out of cost-benefit analyses.]</td><td>HS-ENV2-6a: Compare cost-benefit ratios of design solutions for developing, managing, and utilizing energy and mineral resources.</td></tr>
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HS-ENV2-7: Flow of Matter and Energy Students who demonstrate understanding can: Analyze computational tools and other technologies that allow for the management of natural resources. Evaluate the trade-offs of these tools regarding human physical and cultural needs versus sustainability and biodiversity.	**HS-ENV2-7a:** Use data to evaluate how tools and other technologies used to manage natural resources address human cultural needs and sustainability issues, including the trade-offs of these tools.
Natural Hazards	
HS-ENV3-1: Natural Hazards Students who demonstrate understanding can: Construct an explanation based on evidence for how natural Earth hazards, such as earthquakes, tornadoes, and hurricanes, affect the environment and human activity on both a short-term and long-term scale. [Clarification Statement: Discuss and evaluate the hazard, exposure, and vulnerability of human populations based upon the development of society].	**HS-ENV3-1a:** Use evidence to explain that natural Earth hazards (e.g. earthquakes, tornadoes, and hurricanes) can have both short-term and long-term effects on the environment and human activity. [Clarification Statement: Discuss the hazard, exposure, and vulnerability of human populations based upon the development of society].
Biodiversity	
HS-ENV4-1: Biodiversity Students who demonstrate understanding can: Use a model or simulation to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.	**HS-ENV4-1a:** Use a model or simulation to support explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
HS-ENV4-2: Biodiversity Students who demonstrate understanding can: Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. [Clarification Statement: Examples of human activities can include urbanization, building dams, hunting, pollution, bioaccumulation and biomagnification of toxins, and dissemination of invasive species.]	**HS-ENV4-2a:** Describe how human activity affects Earth's environment and biodiversity and how people can help reduce their impact.

The Effect of Human Population and Activities on the Environment	
HS-ENV5-1: The Effect of Human Population and Activities on the Environment Students who demonstrate understanding can: Analyze and interpret data on how the size and rate of growth of the human population in any location is affected by economic, political, religious, technological, and environmental (resource availability) factors.	**HS-ENV5-1a:** Analyze data to describe the effect of an economic, political, religious, technological, or environmental factor on the size of the human population.
	HS-ENV5-1b: Identify why biodiversity in an ecosystem is important (e.g., humans depend on the Earth for resources; supports and enhances life on Earth; aids humanity by preserving landscapes of recreational or inspirational value).
HS-ENV5-2: The Effect of Human Population and Activities on the Environment Students who demonstrate understanding can: Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. [Clarification Statement: Examples of factors that affect the management of natural resources include costs of resource extraction and waste management, per-capita consumption, and the development of new technologies. Examples of factors that affect human sustainability include agricultural efficiency, levels of conservation, and urban planning.]	**HS-ENV5-2a:** Use data to describe the relationships among management of natural resources, the sustainability of human populations, and biodiversity.
HS-ENV5-3: The Effect of Human Population and Activities on the Environment Students who demonstrate understanding can: Design, evaluate and refine a technological solution that reduces impacts of human activities on natural systems. [Clarification Statement: Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or areal changes in land surface use (such as for urban development, agriculture and livestock, or surface mining). Examples for limiting future impacts could range from local	**HS-ENV5-3a:** Design and evaluate a technological solution that reduces impacts of human activities on natural systems. [Clarification Statement: Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or areal changes in land surface use (such as for urban development, agriculture and livestock, or surface mining). Examples for limiting future impacts could range from local efforts (such as reducing, reusing, and recycling resources, including water conservation efforts) to large-scale geoengineering design solutions (such as

efforts (such as reducing, reusing, and recycling resources, including water conservation efforts) to large-scale geoengineering design solutions (such as altering global temperatures by making large changes to the atmosphere or ocean).]	altering global temperatures by making large changes to the atmosphere or ocean).]
Environmental Policy	
HS-ENV6-1: Environmental Policy Students who demonstrate understanding can: Conduct an investigation to evaluate the effectiveness of environmental policies and/or organizations (Clean Water Act, Clean Air Act, Endangered Species Act, Species Survival Plan, Resource Conservation and Recovery Act, Department of Energy, and the World Health Organization).	**HS-ENV6-1a:** Interpret data from an environmental policy and/or organization (Clean Water Act, Clean Air Act, Endangered Species Act, Species Survival Plan, Resource Conservation and Recovery Act, Department of Energy, and the World Health Organization) to explain the intended outcome of the policy and/or organization.
HS-ENV6-2: Environmental Policy Students who demonstrate understanding can: Construct an argument to explain that environmental policies/decisions have negative and positive impacts on people, societies, and the environment.	**HS-ENV6-2a:** Use evidence to explain positive and negative effects of environmental policies/decisions on people, societies, and/or the environment.