Appendix 1

Acronyms

|  |  |
| --- | --- |
| CC | climate change  |
| DCI | Disciplinary Core Idea  |
| DRR | Disaster Risk Reduction  |
| IPCC | Intergovernmental Panel on Climate Change  |
| NGSS | Next Generation Science Standards  |
| NJDOE | New Jersey Department of Education  |
| NJSLS | New Jersey Student Learning Standards  |
| NRC | National Research Council  |
| PE | Performance Expectation  |
| UNESCO | United Nations Educational, Scientific and Cultural Organization  |
| UNICEF | United Nations Children’s Fund |
| UNISDR | United Nations International Strategy for Disaster Reduction  |
| USA | United States of America  |
| USGCRP | United States Global Change Research Program  |

Appendix 2

**Table 2.1.**

The positioning of ESS3.D: Global Climate Change within the Next Generation Science Standards (NGSS), by Disciplines, Disciplinary Core Ideas (DCIs) and sub-Ideas.

|  |  |  |
| --- | --- | --- |
| **Physical Science** | **Life Science** | **Earth and Space Science** |
| **PS1 Matter and Its Interactions**PS1A Structure and Properties of matterPS1B Chemical Reactions PS1C Nuclear Processes**PS2 Motion and Stability: Forces and Interactions**PS2A Forces and Motion PS2B Types of InteractionsPS2C Stability and Instability in Physical Systems**PS3 Energy**PS3A Definitions of Energy*PS3B Conservation of Energy and Energy Transfer*PS3C Relationship Between Energy and ForcesPS3D Energy and Chemical Processes in Everyday LifePS4 Waves and Their Applications in Technologies for Information Transfer**PS4 Waves and Their Applications in Technologies for Information Transfer**PS4A Wave PropertiesPS4B Electromagnetic RadiationPS4C Information Technologies and Instrumentation | **LS1 From Molecules to Organisms: Structures and Processes**LS1A Structure and FunctionLS1B Growth and Development of OrganismsLS1C Organization for Matter and Energy Flow in OrganismsLS1D Information Processing**LS2 Ecosystems: Interactions, Energy, and Dynamics**LS2A Interdependent Relationships in Ecosystems*LS2B Cycles of Matter and Energy Transfer in Ecosystems*LS2C Ecosystem Dynamics, Functioning, and ResilienceLS2D Social Interactions and Group Behavior**LS3 Heredity: Inheritance and Variation of Traits**LS3A Inheritance of Traits LS3B Variation of Traits**LS4 Biological Evolution: Unity and Diversity**LS4A Evidence of Common Ancestry LS4B Natural SelectionLS4C AdaptationLS4D Biodiversity and Humans | **ESS1 Earth’s Place in the Universe**ESS1A The Universe and Its StarsESS1B Earth and the Solar SystemESS1C The History of Planet Earth**ESS2 Earth’s Systems**ESS2A Earth Materials and SystemsESS2B Plate Tectonics and Large-Scale System InteractionsESS2C The Roles of Water in Earth’s Surface Processes*ESS2D Weather and Climate* ESS2E Biogeology**ESS3 Earth and Human Activity**  *ESS3A Natural Resources*  *ESS3B Natural Hazards**ESS3C Human Impacts on Earth Systems****ESS3D Global Climate Change*** |

*Note*. From “How to Read the Next Generation Science Standards (NGSS)”, by NGSS Lead States, 2013, p. 3. DCIs and sub-ideas which are potentially related to CC are highlighted by italics.

**Appendix 3**

**Table 2.2.** NGSS High-School Level Framework: Science Domains and their Topics.

|  |  |  |
| --- | --- | --- |
| **Physical Sciences** | **Life Sciences** | **Earth and Space Sciences** |
| Structure and Properties of Matter | Structure and Function | Space Systems |
| Chemical Reactions | Matter and Energy in | History of Earth |
| Forces and Interactions | Organisms and Ecosystems | Earth's Systems |
| Energy | Interdependent Relationships in Ecosystems | Weather and Climate |
| Waves and Electromagnetic Radiation | Inheritance and Variation of Traits | Human Sustainability |
|  | Natural Selection and Evolution |  |

*Note.* Adapted from NGSS Lead States, 2013. <https://www.nextgenscience.org/overview-topics>.

APPENDIX 4

**Table 3.1.**

*Climate change Core Ideas and Performance Expectation in the 2020 New Jersey Student Learning Standards (NJSLS), by Grade-Bands and Content Areas*

| **Core Ideas/ Enduring Understanding** | **Performance Expectations** |
| --- | --- |
| **Kindergarten through Grade 2** |
| ***Visual and Performing Arts*** |
| As dance is experienced, all personal experiences, knowledge and contexts are integrated and synthesized to interpret meaning. | 1.1.2.Cn10b: Using an inquiry-based set of questions examine global issues, including climate change as a topic for dance. |
| Artist's appreciation of media artworks is influenced by their interests, experiences, understandings, and purposes. Identifying the qualities and characteristics of media artworks improves the individual's aesthetic and empathetic awareness. | 1.2.2.Re7b: Identify, share and describe a variety of media artworks created from different experiences in response to global issues including climate change. |
| As theater is created and experienced, personal experiences and knowledge are synthesized to interpret meaning and analyze the way in which the world may be understood. | 1.4.2.Cn11a: With prompting and support, identify similarities and differences in stories and various art forms from one’s own community and from multiple cultures in a guided drama (e.g., process drama, story drama, creative drama) experience about global issues, including climate change. |
| People develop ideas and understandings of society, culture and history through their interactions with and analysis of art. | 1.5.2.Cn11b: Describe why people from different places and times make art about different issues, including climate change. |
| ***Comprehensive Health and Physical Education*** |
| People in the community work to keep us safe. | 2.1.2.CHSS.4: Describe how climate change affects the health of individuals, plants and animals. |
| ***Science*** |
| All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow. | K-LS1-1: Use observations to describe patterns of what plants and animals (including humans) need to survive. |
| Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time. People measure these conditions to describe and record the weather and to notice patterns over time. | K-ESS2-1: Use and share observations of local weather conditions to describe patterns over time. |
| Sunlight warms Earth’s surface. | K-PS3-1: Make observations to determine the effect of sunlight on Earth’s surface.K-PS3-2: Use tools and materials to design and build a structure that will reduce the warming effect of sunlight on an area. |
| Plants and animals can change their environment.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-ESS2-2: Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs. |
| 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. | K-ESS3-1: Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live. |
| 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. | 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. |
| Plants depend on water and light to grow. | Plants depend on water and light to grow. |
| A situation that people want to change or create can be approached as a problem to be solved through engineering. | A situation that people want to change or create can be approached as a problem to be solved through engineering. |
| 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. | 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. |
| Because there is always more than one possible solution to a problem, it is useful to compare and test designs. | 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. |
| ***Social Studies*** |
| Physical and human characteristics affect where people live (settle). | 6.1.2.GeoPP.1: Explain the different physical and human characteristics that might make a location a good place to live (e.g., landforms, climate and weather, resource availability). |
| Environmental characteristics influence the how and where people live. | 6.1.2.Geo.HE.1: Explain how seasonal weather changes, climate, and other environmental characteristics affect people's lives in a place or region.6.1.2.Geo.HE.2: Describe how human activities affect the culture and environmental characteristics of places or regions (e.g., transportation, housing, dietary needs).6.1.2.Geo.HE3: Identify cultural and environmental characteristics of different regions in New Jersey and the United States.6.1.2.Geo.HE.4: Investigate the relationship between the physical environment of a place and the economic activities found there. |
| When all members of the group are given the opportunity to participate in the decision-making process, everyone’s voice is heard. | 6.3.2.CivicsPD.1: With adult guidance and support, bring awareness of a local issue to school and/or community members and make recommendations for change. |
| Global interconnections occur between human and physical systems across different regions of the world. | 6.3.2.GeoGI.1: Investigate a global issue such as climate change, its significance, and share information about how it impacts different regions around the world.6.3.2.GeoGI.2: Collect data and consider sources from multiple perspectives to become informed about an environmental issue and identify possible solutions. |
| ***Computer Science and Design Thinking*** |
| Individuals collect, use, and display data about individuals and the world around them. | 8.1.2.DA.1: Collect and present data, including climate change data, in various visual formats. |
| Computers store data that can be retrieved later. Data can be copied, stored in multiple locations, and retrieved. | 8.1.2.DA.2: Store, copy, search, retrieve, modify, and delete data using a computing device. |
| Data can be used to make predictions about the world. | 8.1.2.DA.3: Identify and describe patterns in data visualizations.8.1.2.DA.4: Make predictions based on data using charts or graphs. |
| Engineering design is a creative process for meeting human needs or wants that can result in multiple solutions. | 8.2.2.ED.1: Communicate the function of a product or device.8.2.2.ED.2: Collaborate to solve a simple problem, or to illustrate how to build a product using the design process.8.2.2.ED.3: Select and use appropriate tools and materials to build a product using the design process. |
| Limitations (constraints) must be considered when engineering designs. | 8.2.2.ED.4: Identify constraints and their role in the engineering design process. |
| ***Career Readiness, Life Literacies, and Key Skills*** |
| There are actions an individual can take to help make this world a better place. | 9.1.2.CR.1: Recognize ways to volunteer in the classroom, school and community.9.1.2.CR.2: List ways to give back, including making donations, volunteering, and starting a business. |
| Critical thinkers must first identify a problem then develop a plan to address it to effectively solve the problem. | 9.4.2.CT.1: Gather information about an issue, such as climate change, and collaboratively brainstorm ways to solve the problem (e.g., K-2-ETS1-1, 6.3.2.GeoGI.2).9.4.2.CT.2: Identify possible approaches and resources to execute a plan (e.g., 1.2.2.CR1b, 8.2.2.ED.3).9.4.2.CT.3: Use a variety of types of thinking to solve problems (e.g., inductive, deductive). |
| Young people can have a positive impact on the natural world in the fight against climate change. | 9.4.2.DC.7: Describe actions peers can take to positively impact climate change (e.g., 6.3.2.CivicsPD.1). |
| Digital tools and media resources provide access to vast stores of information that can be searched. | 9.4.2.IML.1: Identify a simple search term to find information in a search engine or digital resource. |
| Digital tools can be used to display data in various ways. | 9.4.2.IML.2: Represent data in a visual format to tell a story about the data (e.g., 2.MD.D.10). |
| A variety of diverse sources, contexts, disciplines, and cultures provide valuable and necessary information that can be used for different purposes. | 9.4.2.IML.3: Use a variety of sources including multimedia sources to find information about topics such as climate change, with guidance and support from adults (e.g., 6.3.2.GeoGI.2, 6.1.2.HistorySE.3, W.2.6, 1-LSI-2) |
| Digital tools have a purpose. | 9.4.2.TL.1: Identify the basic features of a digital tool and explain the purpose of the tool (e.g., 8.2.2.ED.1).9.4.2.TL.2: Create a document using a word processing application.9.4.2.TL.3: Enter information into a spreadsheet and sort the information.9.4.2.TL.4: Navigate a virtual space to build context and describe the visual content.9.4.2.TL.5: Describe the difference between real and virtual experiences.9.4.2.TL.6: Illustrate and communicate ideas and stories using multiple digital tools (e.g., SL.2.5.). |
| **Grades 3 through 5** |
| ***Visual and Performing Arts*** |
| As dance is experienced, all personal experiences, knowledge, and contexts are integrated and synthesized to interpret meaning. | 1.1.5.Cn10b: Use an inquiry-based set of questions to investigate global issues, including climate change, through a variety of dance genres, styles, and cultural lenses. |
| An artist's appreciation of media artworks is influenced by their interests, experiences, understandings, and purposes. Identifying the qualities and characteristics of media artworks improves the individual's aesthetic and empathetic awareness. | 1.2.5.Re7b: Identify, describe, explain and differentiate how various forms, methods and styles in media artworks affect and manage audience experience when addressing global issues including climate change. |
| As theater is created and experienced, personal experiences and knowledge are synthesized to interpret meaning and analyze the way in which the world may be understood. | 1.4.5.Cn11a: Identify, respond to and investigate connections to global issues, including climate change and other content areas in a dramatic/theatrical work. |
| People develop ideas and understandings of society, culture and history through their interactions with and analysis of art. | 1.5.5.Cn11b: Communicate how art is used to inform others about global issues, including climate change. |
| ***Comprehensive Health and Physical Education*** |
| Community professionals and school personnel are available to assist and address health emergencies as well as provide reliable information. | 2.1.5.CHSS.2: Describe how business, non-profit organizations and individuals can work cooperatively to address health problems that are affected by global issues, including climate change. |
| ***Science*** |
| Populations live in a variety of habitats and change in those habitats affects the organisms living there.When the environment changes in ways that affect a place’s physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die. | 3-LS4-4: Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change. |
| Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years. | 3-ESS2-2: Obtain and combine information to describe climates in different regions of the world. |
| A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts. | 3-ESS3-1: Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard. |
| Energy and fuels that humans use are derived from natural sources and their use affects the environment in multiple ways. Some resources are renewable over time and others are not. | 4-ESS3-1: Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. |
| A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts. | 4-ESS3-2: Generate and compare multiple solutions to reduce the impacts of natural Earth processes and climate change have on humans. |
| The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants 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.Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment. | 5-LS2-1: Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. |
| Earth’s major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth’s surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather. | 5-ESS2-1: Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. |
| 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 account. | 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. |
| Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions.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. | 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. |
| Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved.Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. | 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. |
| ***Social Studies*** |
| Human activities affect environmental characteristics of places or regions resulting in positive and negative impacts. | 6.1.5.GeoHE.1: Use a variety of sources from multiple perspectives, including aerial photographs or satellite images to describe how human activity has impacted the physical environment during different periods of time in New Jersey and the United States.6.1.5.GeoHE.2: Cite examples of how technological advances have changed New Jersey and the United States (e.g., energy, transportation, communications).6.1.5.GeoHE.3: Analyze the effects of catastrophic environmental and technological events on human settlements and migration. |
| Regions form and change as a result of unique physical characteristics conditions, economies, and cultures. | 6.1.5.GeoPP.2: Describe how landforms, climate and weather, and availability of resources have impacted where and how people live and work in different regions of New Jersey and the United States. |
| A nation's economy is influenced by its government, human and physical capital, availability of resources, and technological progress. | 6.1.5.EconNM.2: Use data to describe how the resources and regions in New Jersey and other regions of the United States have impacted economic opportunities. |
| Interactions between humans has led to the spread of cultural practices, artifacts, languages, diseases, and other positive and negative attributes as well as changes in environmental characteristics. | 6.1.5.GeoGI.4: Explain how cultural and environmental characteristics affect the distribution and movement of people, goods and ideas. |
| In an interconnected world, increased collaboration is needed by individuals, groups and nations to solve global issues. | 6.3.5.GeoGI.1: Use technology to collaborate with others who have different perspectives to examine global issues, including climate change and propose possible solutions. |
| Through participation in the decision-making process (e.g., voting, petitions, contacting elected officials, serving in their community) people can initiate change. | 6.3.5.CivicsPD.1: Develop an action plan that addresses issues related to climate change and share with school and/or community members. |
| Human activities affect environmental characteristics of places or regions resulting in positive and negative impacts. | 6.3.5.GeoHE.1: Plan and participate in an advocacy project to inform others about the impact of climate change at the local or state level and propose possible solutions. |
| ***World Languages*** |
| Learning a language involves interpreting meaning from listening, viewing, and reading culturally authentic materials in the target language. | 7.1.NM.IPRET.5: Demonstrate comprehension of brief oral and written messages found in short culturally authentic materials on global issues, including climate change. |
| Interpersonal communication is the exchange of information and the negotiation of meaning between and among individuals. | 7.1.NM.IPERS.6: Exchange brief messages with others about climate in the target regions of the world and in one’s own region using memorized and practiced words, phrases, and simple, formulaic sentences. |
| Presentational communication mode involves presenting information, concepts, and ideas to an audience of listeners or readers on a variety of topics. | 7.1.NM.PRSNT.6: Name and label tangible cultural products associated with climate change in the target language regions of the world. |
| ***Computer Science and Design Thinking*** |
| Individuals can select, organize, and transform data into different visual representations and communicate insights gained from the data. | 8.1.5.DA.3: Organize and present collected data visually to communicate insights gained from different views of the data.8.1.5.DA.4: Organize and present climate change data visually to highlight relationships or support a claim. |
| The technology developed for the human designed world can have unintended consequences for the environment.Technology must be continually developed and made more efficient to reduce the need for non-renewable resources | 8.2.5.ETW.5: Identify the impact of a specific technology on the environment and determine what can be done to increase positive effects and to reduce any negative effects, such as climate change. |
| Engineering design is a systematic and creative process of communicating and collaborating to meet a design challenge.Often, several design solutions exist, each better in some way than the others. | 8.2.5.ED.1: Explain the functions of a system and its subsystems.8.2.5.ED.2: Collaborate with peers to collect information, brainstorm to solve a problem, and evaluate all possible solutions to provide the best results with supporting sketches or models.8.2.5.ED.3: Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task. |
| Engineering design requirements include desired features and limitations that need to be considered. | 8.2.5.ED.4: Explain factors that influence the development and function of products and systems (e.g., resources, criteria, desired features, constraints).8.2.5.ED.5: Describe how specifications and limitations impact the engineering design process.8.2.5.ED.6: Evaluate and test alternative solutions to a problem using the constraints and trade- offs identified in the design process. |
| **Career Readiness, Life Literacies, and Key Skills** |
| Collaboration with individuals with diverse perspectives can result in new ways of thinking and/or innovative solutions. | 9.4.5.CI.1: Use appropriate communication technologies to collaborate with individuals with diverse perspectives about a local and/or global climate change issue and deliberate about possible solutions.9.4.5.CI.2: Investigate a persistent local or global issue, such as climate change, and collaborate with individuals with diverse perspectives to improve upon current actions designed to address the issue. |
| Digital engagement can improve the planning and delivery of climate change actions. | 9.4.5.DC.8: Propose ways local and global communities can engage digitally to participate in and promote climate action. |
| **Grades 6 through 8** |
| ***Visual and Performing Arts*** |
| As dance is experienced, all personal experiences, knowledge and contexts are integrated and synthesized to interpret meaning. | 1.1.8.Cn10b: Employ a variety of research methods to inform the development of original dances about global issues, including climate change. Articulate ways the research deepened understanding of the topic and how big ideas are expressed metaphorically through dance. |
| An artist's appreciation of media artworks is influenced by their interests, experiences, understandings and purposes. Identifying the qualities and characteristics of media artworks improves the individual's aesthetic and empathetic awareness. | 1.2.8.Re7b: Compare, contrast and analyze how various forms, methods and styles in media artworks affect and manage audience experience and create intention when addressing global issues including climate change. |
| As theater is created and experienced, personal experiences and knowledge are synthesized to interpret meaning and analyze the way in which the world may be understood. | 1.4.8.Cn11a: Research the story elements of a staged drama/theater work about global issues, including climate change, and discuss how a playwright might have intended a theatrical work to be produced. |
| People develop ideas and understandings of society, culture and history through their interactions with and analysis of art. | 1.5.8.Cn11b: Analyze and contrast how art forms are used to reflect global issues, including climate change. |
| ***Comprehensive Health and Physical Education*** |
| Advocacy for personal, family, community, and global health can influence and change the interaction of people and their health. | 2.1.8.CHSS.7: Collaborate with other students to develop a strategy to address health issues related to climate change. |
| ***Science*** |
| Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. | MS-LS2-3: Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. |
| Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. | MS-LS2-4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. |
| Biodiversity describes the variety of species found in Earth’s terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem’s biodiversity is often used as a measure of its health.Changes in biodiversity can influence humans’ resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling.There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. | MS-LS2-5: Evaluate competing design solutions for maintaining biodiversity and ecosystem services. |
| All Earth processes are the result of energy flowing and matter cycling within and among the planet’s systems. This energy is derived from the sun and Earth’s hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth’s materials and living organisms. | MS-ESS2-1: Develop a model to describe the cycling of Earth’s materials and the flow of energy that drives this process. |
| Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization and precipitation, as well as downhill flows on land. | MS-ESS2-4: Develop a model to describe the cycling of water through Earth’s systems driven by energy from the sun and the force of gravity. |
| The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns.Because these patterns are so complex, weather can only be predicted probabilistically. | MS-ESS2-5: Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. |
| Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents.Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms and living things. These interactions vary with latitude, altitude and local and regional geography, all of which can affect oceanic and atmospheric flow patterns.The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time and globally redistributing it through ocean currents. | MS-ESS2-6: Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. |
| Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events. | MS-ESS3-2: Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. |
| Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth’s environments can have different impacts (negative and positive) for different living things. | MS-ESS3-3: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. MS-ESS3-4: Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth’s systems. |
| Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth’s mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities. | MS-ESS3-5: Ask questions to clarify evidence of the factors that have caused climate change over the past century. |
| The more precisely a design task’s criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. | MS-ETS1-1: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. |
| There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. | MS-ETS1-2: Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. |
| There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors.Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design. | MS-ETS1-3: Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. |
| A solution needs to be tested, and then modified on the basis of the test results, in order to improve it.Models of all kinds are important for testing solutions.The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. | MS-ETS1-4: Develop a model to generate data for iterative testing and modification of a proposed object, tool or process such that an optimal design can be achieved. |
| ***Social Studies*** |
| The physical and human characteristics of places and regions are connected to human identities and cultures. | 6.2.8.GeoHE.4.b: Use geographic models to determine the impact of environmental modifications made by earlier civilizations on the current day environmental challenges. |
| In a democratic government, there are multiple processes by which individuals can influence the creation of rules, laws, and public policy. | 6.3.8.CivicsPR.4: Use evidence and quantitative data to propose or defend a public policy related to climate change. |
| Economic decision involves setting goals, weighing costs and benefits and identifying the resources available to achieve those goals. | 6.3.8.EconET.2: Assess the impact of government incentives and disincentives on the economy (e.g., patents, protection of private property, taxes). |
| ***World Languages*** |
| Learning a language involves interpreting meaning from listening, viewing, and reading culturally authentic materials in the target language. | 7.1.NM.IPRET.5: Demonstrate comprehension of brief oral and written messages found in short culturally authentic materials on global issues, including climate change. |
| Interpersonal communication between and among people is the exchange of information and the negotiation of meaning. | 7.1.NM.PRSNT.6: Name and label tangible cultural products associated with climate change in the target language regions of the world. |
| Presentational communication involves presenting information, concepts, and ideas to an audience of listeners or readers on a variety of topics. | 7.1.NM.PRSNT.6: Name and label tangible cultural products associated with climate change in the target language regions of the world. |
| ***Computer Science and Design Thinking*** |
| Computer models can be used to simulate events, examine theories and inferences or make predictions. | 8.1.8.DA.6: Analyze climate change computational models and propose refinements. |
| Resources need to be utilized wisely to have positive effects on the environment and society.Some technological decisions involve trade- offs between environmental and economic needs, while others have positive effects for both the economy and environment. | 8.2.8.ETW.4: Compare the environmental effects of two alternative technologies devised to address climate change issues and use data to justify which choice is best. |
| ***Career Readiness, Life Literacies, and Key Skills*** |
| Gathering and evaluating knowledge and information from a variety of sources, including global perspectives, fosters creativity and innovative thinking. | 9.4.8.CI.1: Assess data gathered on varying perspectives), and determine how the data can best be used to design multiple potential solutions. |
| Multiple solutions often exist to solve a problem. | 9.4.8.CT.1: Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change and use critical thinking skills to predict which one(s) are likely to be effective.9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1). |
| Digital technology and data can be leveraged by communities to address effects of climate change. | 9.4.8.DC.8: Explain how communities use data and technology to develop measures to respond to effects of climate change (e.g., smart cities). |
| Sources of information are evaluated for accuracy and relevance when considering the use of information. | 9.4.8.IML.7: Use information from a variety of sources, contexts, disciplines, and cultures for a specific purpose (e.g., 1.2.8.C2a, 1.4.8.CR2a, W.5.8, 6.1.8.GeoSV.3.a, 6.1.8.CivicsDP.4.b, 7.1.NH. IPRET.8).9.4.8.IML.8: Apply deliberate and thoughtful search strategies to access high-quality information on climate change (e.g., 1.1.8.C1b). |
| **Grades 9 through 12** |
| ***Visual and Performing Arts*** |
| As dance is experienced, all personal experiences, knowledge and contexts are integrated and synthesized to interpret meaning. | 1.1.12prof.Cn10b: Research global issues, including climate change, using multiple research methods to inform original dances expressed through multiple genres, styles and varied cultural perspectives.1.1.12acc.Cn10b: Collaboratively investigate global issues, including climate change, to inform the development of an original dance project.1.1.12adv.Cn10b: Investigate and present ways in which dance can be used to communicate new perspectives and/or realizations about global issues, including global warming. |
| An artist's appreciation of media artworks is influenced by their interests, experiences, understandings and purposes. Identifying the qualities and characteristics of media artworks improves the individual's aesthetic and empathetic awareness. | 1.2.12prof.Re7b: Analyze how a variety of media artworks affect audience experience and create intention through multimodal perception when addressing global issues including climate change.1.2.12acc.Re7b: Analyze how a broad range of media artworks affect audience experience, as well as create intention and persuasion through multimodal perception when addressing global issues including climate change.1.2.12adv.Re7b: Survey an exemplary range of media artworks, analyzing methods for managing audience experience, creating intention and persuasion through multimodal perception and systemic communications when addressing global issues including climate change. |
| People develop ideas and understandings of society, culture and history through their interactions with and analysis of art. | 1.5.12prof.Cn11b: Describe how knowledge of global issues, including climate change may influence personal responses to art.1.5.12acc.Cn11b: Compare uses of art in a variety of societal, cultural and historical contexts and make connections to global issues, including climate change.1.5.12adv.Cn11b: Assess the impact of an artist or group of artists on global issues, including climate change. |
| ***Comprehensive Health and Physical Education*** |
| Local, state, and global advocacy organizations provide accurate and reliable resources and strategies designed to address common health and social issues. | 2.1.12.CHSS.8: Investigate how local, state and global agencies are addressing health issues caused by climate change and share this information in an appropriate setting. |
| ***Science*** |
| The foundation for Earth’s global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy’s re-radiation into space. | HS-ESS2-2: Analyze geoscience data to make the claim that one change to Earth’s surface can create feedbacks that cause changes to other Earth systems. |
| The foundation for Earth’s global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy’s re-radiation into space.Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate. | HS-ESS2-4: Use a model to describe how variations in the flow of energy into and out of Earth’s systems result in changes in climate. |
| Resource availability has guided the development of human society. | HS-ESS3-1: Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards and changes in climate have influenced human activity. |
| All forms of energy production and other resource extraction have associated economic, social, environmental and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors.When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics and to consider social, cultural and environmental impacts. | HS-ESS3-2: Evaluate competing design solutions for developing, managing and utilizing energy and mineral resources based on cost-benefit ratios. |
| The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. | HS-ESS3-3: Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations and biodiversity. |
| Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation.When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics and to consider social, cultural and environmental impacts. | HS-ESS3-4: Evaluate or refine a technological solution that reduces impacts of human activities on climate change and other natural systems. |
| Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict and manage current and future impacts. | HS-ESS3-5: 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 systems. |
| Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them.Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities. | HS-ETS1-1: Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. |
| Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. | HS-ETS1-2: Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. |
| When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics and to consider social, cultural and environmental impacts. | HS-ETS1-3: Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability and aesthetics as well as possible social, cultural and environmental impacts. |
| Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. | HS-ETS1-4: Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem. |
| ***Social Studies*** |
| Economic globalization affects economic growth, labor markets, human rights guarantees, the environment, resource allocation, income distribution and culture. | 6.1.12.EconGE.3.a: Analyze how technological developments transformed the economy, created international markets and affected the environment in New Jersey and the nation. |
| Political and economic decisions throughout time have influenced cultural and environmental characteristics of various places and regions. | 6.1.12.GeoHE.6.a: Compare and contrast issues involved in the struggle between the unregulated development of natural resources and efforts to conserve and protect natural resources during the period of industrial expansion. |
| Human settlement activities impact the environmental and cultural characteristics of specific places and regions. | 6.1.12.GeoHE.5.a: Generate/make an evidence-based argument regarding the impact of rapid urbanization on the environment and on the quality of life in cities.6.1.12.GeoHE.8.a: Determine the impact of the expansion of agricultural production into marginal farmlands and other ineffective agricultural practices on people and the environment. |
| Political and economic decisions throughout time have influenced cultural and environmental characteristics. | 6.1.12.GeoHE.13.a: Construct an argument on the effectiveness of environmental movements, their influence on public attitudes and the efficacy of the government’s environmental protection agencies and laws.6.1.12.GeoHE.14.a: Evaluate the impact of individual, business and government decisions and actions on the environment and climate change and assess the efficacy of government policies and agencies in New Jersey and the United States in addressing these decisions. |
| Long-term climate variability has influenced human migration and settlement patterns, resource use and land use at local-to-global scales. | 6.1.12.GeoHE16.a: Explain why natural resources (i.e., fossil fuels, food, and water) continue to be a source of conflict and analyze how the United States and other nations have addressed issues concerning the distribution and sustainability of natural resources and climate change. |
| Resources impact what is produced and employment opportunities. | 6.2.12.EconET.3.a: Determine how, and the extent to which, scientific and technological changes, transportation and new forms of energy brought about social, economic and cultural changes in the world. |
| Understanding the interrelated patterns of change by examining multiple events allows for a clearer understanding of the significance of individuals and groups. | 6.2.12.HistoryCC.3.b: Explain how industrialization and urbanization affected class structure, family life, the daily lives of men, women, and children and the environment. |
| Economic globalization affects economic growth, labor markets, human rights guarantees, the environment, resource allocation, income distribution and culture. | 6.2.12.EconGE.5.a: Evaluate the role of the petroleum industry in world politics, the global economy and the environment. |
| Demographic shifts and migration patterns both influence and are impacted by social, economic and political systems. | 6.2.12.GeoPP.6.a: Make evidence-based inferences to determine the global impact of increased population growth, migration and changes in urban-rural populations on natural resources and land use. |
| Human and civil rights support the worth and dignity of the individual. | 6.2.12.CivicsHR.6.b: Make an evidence-based argument on the tensions between national sovereignty and global priorities regarding economic development and environmental sustainability and its impact on human rights. |
| Constitutions, laws, treaties and international agreements seek to maintain order at the national, regional and international levels of governance. | 6.2.12.CivicsPI.6.a: Use historic case studies or a current event to assess the effectiveness of multinational organizations in attempting to solve global issues. |
| Global economic activities involve decisions based on national interests, the exchange of different units of exchange, decisions of public and private institutions and the ability to distribute goods and services safely. | 6.2.12.EconGE.6.a: Evaluate efforts of governmental, non-governmental, and international organizations to address economic imbalances, social inequalities, climate change, health and/or illiteracy. |
| Global interconnections create complex spatial patterns at multiple scales that continue to change over time. | 6.3.12.GeoGI.1: Collaborate with students from other countries to develop possible solutions to an issue of environmental justice, including climate change and water scarcity and present those solutions to relevant national and international governmental and/or nongovernmental organizations. |
| ***World Languages*** |
| Learning a language involves interpreting meaning from listening, viewing, and reading culturally authentic materials in the target language. | 7.1.NH.IPRET.8: Demonstrate comprehension of brief oral and written messages using contextualized culturally authentic materials on global issues, including climate change.7.1.IL.IPRET.6: Using contextual authentic cultural resources, identify reasons for climate change in the target culture and in students’ own community.7.1.IM.IPRET.9: Use information gathered from culturally authentic resources to identify possible solutions to the effects of climate change.7.1.IH.IPRET.8: Collect, share and analyze data related to global issues including climate change.7.1.AL.IPRET.10: Collect, share and analyze data related to global issues including climate change. |
| Interpersonal communication between and among people is the exchange of information and the negotiation of meaning.Speakers and writers gain confidence and competence as they progress along the proficiency continuum. | 7.1.NH.IPERS.6: Using information from brief oral and written messages on global issues and exchange information with classmates and others about global issues, including climate change.7.1.IL.IPERS.6: Exchange information with classmates and with native speakers of the target language about the effects of climate change on the target language region(s) of the world and suggest a few possible solutions.7.1.IM.IPERS 6: Exchange information from a variety of resources with classmates about global issues, including climate change.7.1.IH.IPERS.6: Compare and contrast global issues in a group discussion, with emphasis on climate change and its impact on the target language regions of the world and the people who live in those areas.7.1.AL.IPERS.6: Converse with members of the target culture with understanding about contemporary global issues, including climate change. |
| Presentational communication involves presenting information, concepts and ideas to an audience of listeners or readers on a variety of topics.Speakers and writers gain confidence and competence as they progress along the proficiency continuum. | 7.1.NH.PRSNT.6: Tell or write a few details about the impact of climate change in the target language regions of the world and compare those impacts with climate change in the student's community and/or different regions in the United States.7.1.IL.PRSNT.5: Compare and contrast global issues facing the target language regions of the world and those facing the students’ own regions.7.1.IM.PRSNT.7: Compare cultural perspectives regarding the degradation of the environment of the target culture(s), including the effects of climate change, with those of students’ own culture.7.1.IH.PRSNT.6: Explain cultural perspectives of the target language people regarding climate change and compare and contrast those perspectives with ones held by people in the students’ own culture.7.1.AL.PRSNT.6: Analyze how cultural perspectives about climate change over time and compare with changing perspectives in one’s own culture. |
| ***Computer Science and Design Thinking*** |
| Individuals select digital tools and design automated processes to collect, transform, generalize, simplify and present large data sets in different ways to influence how other people interpret and understand the underlying information. | 8.1.12.DA.1: Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change. |
| Development and modification of any technological system needs to take into account how the operation of the system will affect natural resources and ecosystems.Impacts of technological systems on the environment need to be monitored and must inform decision-making.Many technologies have been designed to have a positive impact on the environment and to monitor environmental change over time. | 8.2.12.ETW.3: Identify a complex, global environmental or climate change issue, develop a systemic plan of investigation and propose an innovative sustainable solution. |
| Engineering design is a complex process in which creativity, content knowledge, research and analysis are used to address local and global problems.Decisions on trade-offs involve systematic comparisons of all costs and benefits and final steps that may involve redesigning for optimization. | 8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.8.2.12.ED.2: Create scaled engineering drawings for a new product or system and make modification to increase optimization based on feedback.8.2.12.ED.3: Evaluate several models of the same type of product and make recommendations for a new design based on a cost benefit analysis.8.2.12.ED.4: Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs and aesthetic and ethical considerations and share this information with an appropriate audience. |
| Engineering design evaluation, a process for determining how well a solution meets requirements, involves systematic comparisons between requirements, specifications, and constraints. | 8.2.12.ED.5: Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics).8.2.12.ED.6: Analyze the effects of changing resources when designing a specific product or system (e.g., materials, energy, tools, capital, labor). |
| ***Career Readiness, Life Literacies, and Key Skills*** |
| Network connectivity and computing capability extended to objects, sensors and everyday items not normally considered computers allows these devices to generate, exchange and consume data with minimal human intervention.Technologies such as Artificial Intelligence (AI) and blockchain can help minimize the effect of climate change. | 9.4.12.DC.8: Explain how increased network connectivity and computing capabilities of everyday objects allow for innovative technological approaches to climate protection. |
| Solutions to the problems faced by a global society require the contribution of individuals with different points of view and experiences. | 9.4.12.GCA.1: Collaborate with individuals analyze a variety of potential solutions to climate change effects and determine why solutions may work better than others (e.g., political, economic, cultural). |
| In order for members of our society to participate productively, information needs to be shared accurately and ethically. | 9.4.12.IML.5: Evaluate, synthesize and apply information on climate change from various sources appropriately.9.4.12.IML.6: Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender and age diversity. |
| Accurate information may help in making valuable and ethical choices. | 9.4.12.IML.7: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change. |

*Note*. From <https://www.nj.gov/education/standards/climate/learning/gradeband/index.shtml> Copyright n.d. by New Jersey Department of Education.

**Appendix 5**

**Analysis of CC inclusion in the New Jersey Student Learning Standards, by Grade Bands**

The analysis addresses the contents, organization, and progression across the Grade Bands. Science is excluded from the analysis.

**Grade Band K–2**. This Grade Band lacks CC content scoping and information organization. Instead, CC appears as a title only, scattered, undefined and unspecified. This was found across all Content Areas. For example, Social Science Performance Expectation (PE) 6.3.2.GeoGI.1 states: “**Investigate a global issue such as climate change**, its significance, and share information about how it impacts different regions around the world” (NJSLS, 2020), while in Computer Science and Design Thinking, Performance Expectation 8.1.2.DA.1 states: “Collect and present data, including **climate change data**, in various visual formats” (NJSLS, 2020). In Career Readiness, Life Literacies, and Key Skills, Performance Expectation 9.4.2.CT.1 it states: “**Gather information** **about** an issue, such as **climate change**, and collaboratively **brainstorm ways to solve the problem**” (NJSLS, 2020).

Taken together, The PEs lack contents, and are unlikely age-appropriate. These PEs appear to leave young children to navigate CC on their own, according to their own level of incidentally constructed everyday knowledge. This approach suggests that at best, children are put at risk of developing inaccurate conceptions about CC, and at worst, they are put at risk of developing CC-anxiety from being exposed to unsupervised, potentially threatening content. As a foundation for further acquisition of structured CC education, this approach seems more harmful then beneficial.

**Grade Band 3–5.** In this Grade Band CC continues to appear by title only across the Content Areas, in a similar way to its appearance in Grade Band K–2, at times repeating the same standards. Here too, the curriculum refrains from selecting CC content in an age-appropriate way, often presenting Standards that are evidently not age-appropriate and disconnected from their affiliated Core Ideas. For example, Comprehensive Health and Physical Education, PE 2.1.5.CHSS.2 states: “Describe how business, non-profit organizations and individuals can work cooperatively to address health problems that are affected by global issues, including **climate change**” (NJSLS, 2020). It is highly unlikely that children in Grades 3–5 would be capable of addressing such a complex question without having developed the necessary foundational knowledge required for dealing with this multi-system global issue. Furthermore, this PE seems vastly remote and disconnected from its associated modest core idea, stating “Community professionals and school personnel are available to assist and address health emergencies as well as provide reliable information” (NJSLS, 2020). Similarly in the other Content Areas, CC appears by title only, content-devoid, and decontextualized.

**Grade Band 6–8.** In this Grade Band CC content knowledge continues to be unspecified, with overly complex standards, disregarding students’ preparedness and age-appropriateness. For example, Expectation Performance 6.3.8.CivicsPR.4 requires the application of complex considerations of climate science and technology, economy, and climate policy to effectively meet the expectation to: “Use evidence and quantitative data to propose or defend a public policy related to climate change” (NJSLS, 2020). The curriculum does not specify the foundational content that would allow students to perform according to this expectation. Performance Expectation 8.1.8.DA.6 brings this idea to absurdity when putting forward the expectation that students “Analyze climate change computational models and **propose refinements**” (NJSLS, 2020). It is unlikely that students in Grades 6–8 have sufficient mathematical and computational knowledge to understand how CC models are produced, let alone **refine** them.

**Grades 9–12**. In this Grade Band Social Studies outlines contents in the social aspects of CC, while Science addresses the science aspects of CC in depth and details. The CC contents in Social Studies include: Economic and social globalization, economic growth, labor markets, human rights, environment, resource and income distribution, and culture; political and economic decisions affect the environment; the expansion of agricultural production into marginal farmlands; CC in the public sphere and in government decisions; effect on public attitudes; government efficacy in relation to CC: natural resources as a source of conflict; the effect of science and technology on social, economic, and cultural changes; effects of industrialization and urbanization; the role of the petroleum industry in politics, economy and the environment; population growth, migration and urbanization; national sovereignty and global priorities regarding economic development and environmental sustainability and its impact on human rights; constitutions, laws, treaties and international agreements. With the exception of Science and Social Studies, across the other Content Areas CC continues to appear as a title mostly devoid of content.

In summary, in the New Jersey CC curriculum, the early Grade Bands are dedicated to establishing foundational scientific and social studies knowledge, mainly through the application of the NGSS, where specific CC contents are gradually introduced in Grade Band 6–8, becoming more detailed and specific in Grade Band 9–12 in Science and Social Studies. However, there is no clear thematic organization, limited identification of thematically related key concepts, and lack of learning progression.