Knowledge-Centered 3: Core Disciplinary Ideas of Science		
1	Title Slide	Welcome to this module, Core Disciplinary Ideas of Science, in the Knowledge-Centered teaching series. To advance to the next slide, select the "forward" arrow located on the play bar at the bottom of your screen.
2	Introduction	The National Research Council's (NRC) Framework for K-12 Science Education describes a standard of proficiency in which science is viewed as an evidence-based, model and theory constructing initiative that extends, refines, and revises knowledge. The goal of this framework is to ensure by 12th grade, students will… • Possess an appreciation of science • Retain a sufficient knowledge base of science and engineering to engage in discourse • Become lifelong science learners • And have skills to enter careers in science, engineering, and technology This framework is comprised of three dimensions in which to achieve these goals. These dimensions include scientific and engineering practices, crosscutting concepts, and core disciplinary ideas of science. In this module, we will be discussing knowledge-centered learning as it relates to the third dimension, core disciplinary ideas of science.
3	Learning Objectives	By the end of this module, the learner will be able to apply core disciplinary ideas to their context area.
4	Structure of NGSS Framework	The three dimensions outlined in the Framework for K-12 Science Education were designed to be woven together in science standards, curriculum, instruction, and assessments (NRC, 2018). The first dimension, scientific and engineering practices, describe behaviors and practices that scientists use to engage in investigations and building models and theories regarding the natural world. The National Research Council chooses the term "practices" over "skill" to emphasize that engaging in science requires not only skill, but also specific knowledge to each practice. The second dimension is crosscutting concepts. Crosscutting concepts are the ways of linking different domains of science together, such as: • Patterns, similarity, and diversity • Cause and effect • Scale, proportion and quantity • Systems and system models • Energy and matter • Structure and function • And stability and change (NRC, 2018). These concepts are emphasized by the framework as an important organizational schema for students to relate their knowledge from various science concepts into a consolidated view of the scientific world.

		See files
5	Structure of NGSS Framework	The third and final dimension in which we will focus on within this module is disciplinary core ideas. These core ideas in science are intended to provide structure to the K-12 science curriculum, instruction, and assessments. To be considered as a "core" idea, ideas should meet at least two of the following criteria, but ideally all four: • Have broad importance across multiple sciences or engineering disciplines • Provide a key tool for understanding or investigating more complex ideas and solving problems • Relate to the interests and life experiences of students • And be teachable and learnable over multiple grades at increasing levels of depth and sophistication (NRC, 2018). Before we dive deeper into core disciplinary concepts, click the link on the slide to see the full picture of these three dimensions.
6	Domains (p. 25 – NGSS)	The framework acknowledges four domains of disciplinary ideas: physical science, life science, earth and space science, and engineering, technology and applications of science (NRC, 2018). Within each of these broad domains, there are a limited set of core ideas. The focus on a limited set of core ideas helps to avoid the coverage of multiple disconnected concepts, essentially going a mile wide and an inch deep. This focus allows for a deeper exploration and understanding of important concepts of science, which leads to deeper levels of scientific and engineering investigation in high school and beyond. In a world that is easily accessed by technology, an important role of science education is not to teach "all the facts" but rather to prepare students with a sufficient base of core knowledge so that they can acquire information on their own. By building a strong base of core knowledge, students will leave school better grounded in scientific knowledge and practices, and perhaps carrying a greater interest in science, when the instruction they received in science class emphasized the "big ideas."
7	Experts vs. Novices	One reason for establishing core ideas comes from research regarding experts and novices. Experts understand the core principles of their field, and they use these understandings to make sense of new information and strategize solutions for new problems. On the other hand, novices tend to be knowledgeable of disconnected and isolated facts, which can be challenging to organize and use later. With this in mind, it is assumed that helping students learn the core ideas will enable them to become less like novices and more like experts (NRC, 2018).
8	Core Ideas (PDF p. 139 & 169)	For the purpose of this module, we will be focusing on two domains of disciplinary ideas: life science and earth and space science. Life science focuses on "patterns, processes, and relationships of living organisms" (NRC, 2018). Scientists in the life sciences use observations,

		experiments, hypotheses, tests, models, theory, and technology to explore and explain how life works. Life science ranges from single molecules, organisms and ecosystems, and then to the entire biosphere. Advances made in the life sciences are developing solutions to problems in our world related to food, energy, health, and the environment. There are four core ideas within the life sciences domain, but for the purpose of this module we will focus on two: • Ecosystems: Interactions, Energy, and Dynamics • And Biological Evolution: Unity and Diversity
9	Core Ideas	"Ecosystems: Interactions, Energy, and Dynamics" explores organisms' interactions with each other and their physical environment. "This includes how organisms obtain resources, how they change their environment, how changing environmental factors affect organisms and ecosystems, how social interactions and group behavior play out within and between species, and how these factors all combine to determine ecosystem functioning" (NRC, ****). Key questions in this core idea include: What happens to ecosystems when the environment changes? How do organisms interact in groups so as to benefit individuals? Click on the link within the slide to familiarize yourself with this core disciplinary idea. **See file**
10	Core Ideas	Additionally, "Biological Evolution: Unity and Diversity", explores "changes in the traits of populations of organisms over time" and the factors that account for species' unity and diversity. Key questions in the core idea include: How does the environment influence populations of organisms over multiple generations? What is biodiversity, how do humans effect it, and how does it affect humans? Click on the link within the slide to familiarize yourself with this core disciplinary idea. **See file**
11	Core Ideas	Earth and Space Sciences "investigate processes that operate on Earth and also address its place in the solar system and galaxy" (NRC, ***&). Earth and space science includes an interconnected set of systems such as atmosphere, hydrosphere, geosphere, and the biosphere. An understanding of these set of processes require knowledge of multiple systems' connections. There are three core ideas within the Earth and Space Sciences domain, however we will be focusing on one: Earth & Human Activity, which addresses society's interactions with the planet. This core idea connects earth and space science to human life, explaining how Earth's processes "affect people through natural resources and natural hazards" (NRC, ****). Key questions for this core idea include: How do humans depend of earth's resources? How do natural hazards affect individuals and societies? How do humans change the planet? How do people model and predict the effects of human activities on Earth's climate?

		Click on the link within the slide to familiarize yourself with this core disciplinary idea. **See file**
12	Aligned NGSS & AFNR Standards	To see how the disciplinary core ideas of science align with the science and agriculture education, click the links in the slide. For science teachers, the core disciplinary ideas correspond with the Next Generation Science Standards. Likewise for the agriculture teachers, the core disciplinary ideas have been aligned with the Agriculture, Food and Natural Resources Content Standards. **See files**
13	Review	As we come to a close, let's consider all we have covered so far. We started this module by discussing the three dimensions of science education. We then isolated and described in further detail the core disciplinary ideas that are pertinent to this module series.
14	Sources	DCI Arrangements of the NGSS. (2018). Retrieved from http://nextgenscience.org/overview-dci Earth and Human Activity. (2018). Retrieved from http://nextgenscience.org/dci-arrangement/hs-ess3-earth-and-human-activity Read the Standards. (2018). Retrieved from https://www.nextgenscience.org/search-standards?keys=&tid%5B%5D=107&=Submit
15	Credits	Thank you for viewing this module.