McGraw-Hill Education is your partner in delivering a balanced learning experience to meet the needs of your diverse 21st century classroom and students. This Three-Dimensional Learning Guide is your blueprint for a hands-on, student inquiry classroom to meet the new science standards.

This Guide will take you through the programs by highlighting how to implement Inquiry and Student-led exploration, disciplinary core ideas, crosscutting concepts, and science and engineering practices.

Each chapter starts with a visual phenomenon, online guiding questions in the Phenomenon Bank, and a Launch Lab to spark student inquiry. Multiple opportunities for Student Exploration and Investigation foster collaboration throughout each lesson. Formative assessment and student self-evaluation guide learning.

Look for these icons throughout this guide to show where to find the NGSS tools of the High School Programs.
High School Science helps ease the transition to Next Generation Science Standards (NGSS)*. Our high school science programs ensure you are fully aligned to:

- Performance Expectations
- Science and Engineering Practices
- Disciplinary Core Ideas (DCIs)
- Crosscutting Concepts

We are committed to ensuring that you have the tools and resources necessary to meet the expectations for the Next Generation Science Standards.

**What is NGSS?**

The purpose of *A Framework for K-12 Science Education* and the NGSS is to act as the foundation for science education while describing a vision of what it means to be proficient in science. It emphasizes the importance of the practices of science and engineering to learning critical thinking skills as well as content.

**Why NGSS?**

The NGSS were developed in an effort to create unified standards in science education that consider content, practices, pedagogy, curriculum, and professional development. The standards provide all students with an internationally benchmarked education in science.

*Next Generation Science Standards is a registered trademark of Achieve. Neither Achieve nor the lead states and partners that developed the Next Generation Science Standards was involved in the production of, and does not endorse, this product.*
The Science and Engineering Practices Handbook, found in the Student Center and Teacher Center online ConnectEd, introduces students to the skills they will use in science investigations and engineering projects. It explains the Crosscutting Concepts as well as the eight Science and Engineering Practices defined by A Framework for K-12 Science Education.

This useful tool eases the transition to the NGSS by providing definitions, examples, and Quick Practice activities to be used as reference while students develop their projects and meet performance expectations.
The **Big Idea** is the overarching concept for chapter. It helps provide the framework for understanding the details that follow. The **phenomenon photo** generates student interest, prompting them to ask their own questions. The **LaunchLab** provides a hands-on start to the inquiry process.

Start with the **Big Idea**, the hands-on **LaunchLab**, and an engaging phenomenon to spark student investigation and collaboration.
Each section provides multiple opportunities for student exploration, investigation, and collaboration with:

- PBLs
- Applying Practices
- WebQuests
- Mini Labs
- Labs
- Virtual Labs

Each section opener builds on the framework started by the Chapter Opener Big Idea with the Main Idea and Essential Questions. Reading begins with a link to the student’s real-world or to prior knowledge.

Support three-dimensional learning with opportunities question, explore, gather evidence, conclude, and apply.
Student exploration, investigation, and solution design options are throughout the Student Edition and the online Student Center and Teacher Center.

1. Project Based Learning
2. Applying Practices built on NGSS performance expectations
3. Labs and Mini Labs
4. Virtual Labs
5. Webquests
6. Research and writing activities on each chapter’s feature
7. Document-based questions and data analysis activities
Investigation and Solution Design: PBL

Real-world student-led projects, such as the PBL’s found online in ConnectED, engage students to apply three-dimensional learning. Project rubrics provide key information for assessing students’ work.

PBLs correlate to NGSS performance expectations and spark student inquiry and solutions design.
Investigation and Solution Design: Applying Practices

Evaluating Impacts of Environmental Change on Populations

The Isthmus of Panama

Introduction
Anthropogenic is a term used to describe human and natural changes to the physical environment. Fertilizers contribute to the expansion of some species and the decline—sometimes to extinction—of others. The expansion of natural and anthropogenic factors in Panama is currently a key topic of debate among scientists.

The formation of the Isthmus of Panama created a land bridge between North America and South America and a new route for the migration of land plants and animals between the two continents. This route facilitated the migration of species from the Atlantic to the Pacific Oceans. The Isthmus of Panama is a narrow strip of land that connects the Atlantic and Pacific Oceans. This made the Panama Canal a crucial waterway constructed to help ships travel more efficiently between the Atlantic and Pacific Oceans.

The Panama Canal was constructed in the early 20th century to provide an opportunity for once-isolated fish communities to come together and share the space as invasive species. The construction of the Panama Canal also connected the Rio Chagres and Rio Grande rivers of Panama, providing an opportunity for once-isolated fish communities to come together and share the space as invasive species.

Task
Your task is to research the natural formation of the Panama Canal, its changes during its existence, and the impacts of these changes on the physical environment.

Process
You will use your resources to answer the following questions.

1. What changes in the distribution or disappearance of traits in species have occurred since the construction of the Panama Canal? Make a claim and back it up with evidence regarding specific species.

2. How might the migration of organisms have impacted land populations in terms of specific species? Make a claim and back it up with evidence.

3. What are the major current threats to the Panama Canal? Make a claim and back it up with evidence regarding specific species.

Presentation: Socratic Seminar

Once you have completed your research, you should use your findings to answer the overall theme question: "Can environmental changes cause extinction?" You will use this information to aid in preparing for your contribution to a Socratic Seminar discussion held in your classroom.

Common norms for Socratic Seminars include:

- Being respectful and attentive to the group
- Participating in the discussion
- Listening to the opinions of others
- Avoiding side conversations
- Keeping the discussion focused on the topic

The Socratic Seminar format for this activity will encourage students to think critically about the impact of the Panama Canal on the physical environment.

Resources
Many resources can be used to assist your research. These include journal articles, websites, and scientific news and magazines. You might also visit a university, science museum, or a laboratory to interview an expert in the field.

Evaluation
Read the following rubric to see how you will be scored on your research and presentation.

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Total Score

Applying Practices activities correlate to NGSS performance expectations and apply specific science and engineering practices to DCIs.
Interpreting Data

How do populations change in size?

Birthrate and death rate change the size of a population. In the 1700s the death rate of sea otters in central California was extremely high because many people hunted them. By the 1930s only about 50 sea otters remained. Today, the Marine Mammal Protection Act protects sea otters from being hunted. Every spring, scientists survey the central California Coast to determine the numbers of adult and young sea otters (called pups) in the population. The numbers on the graph indicate population sizes at the end of a breeding season.

Learn It

Most scientists collect some type of data when testing a hypothesis. Once data are collected, scientists look for patterns or trends in the data and draw conclusions. This process is called interpreting data.

Try It

1. The above graph shows changes in adult and pup sea otter populations over many years. Assume that the number of pups seen during the survey represents all the pups that were born and survived in one year—the birthrate. For example, in the 1997 breeding season, the birthrate was 300.


3. In each breeding season, the population increases by the number of pups born and decreases by the number of sea otters that die. Use the following equation to find the death rate for 2002.

   \[ \text{Death rate in 2002} = \text{population size in 2001} + \text{birthrate in 2002} - \text{population size in 2002} \]

   Apply It

4. Calculate the death rate in 2004 and compare it to the death rate in 2002.

5. What environmental factors might account for the difference in the death rate between 2002 and 2004?

6. How do you think the population size changed in 2009 and 2010?

7. Key Concept

   Determine how the birthrate compared to the death rate in 2002 and 2004. Explain how these rates affected the population sizes in 2002 and 2004.

Labs, MiniLabs, and Data Analysis Labs require students to use the science practices to investigate, explain, and apply disciplinary core ideas and cross-cutting concepts.
WebQuests require students to apply select Science and Engineering Practices (SEPs), DCIs, and Cross-cutting Concepts to new situations. WebQuests also are found online within ConnectED.

WebQuests are found within our online resources in ConnectED.
Additional Student Activities

Optional student activities such as Enrichment Resources, Real-World Biology, Environmental Explorations, and other help further understanding of the core disciplinary ideas..

Student Activities online help students foster engagement, and extend understanding.
A variety of assessment types offer “pen and paper” assessment, online quizzes and tests, and performance task assessment.

Numerous options for formative and summative assessment help provide comprehensive insight into student learning.

Built-in assessment strands throughout the High School Science programs will inform instruction and keep students on track.
Professional Development around NGSS is Found under the Professional Development menu item in ConnectED.

NGSS Implementation videos provide guidance for teaching **Science and Engineering Practices**. These valuable videos are found online within the Professional Development menu in ConnectED.

Professional development resources provide teaching strategies and implementation support.