# Bill Nye the Science Guy
## Outer Space

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Implementation Guide

Welcome to Disney’s Bill Nye DVD collection!
With the help of this Guide you can bring instructional DVDs into your science curriculum.

What’s on the DVD?
Bill Nye DVDs expand the educational features of Bill Nye the Science Guy programs. Each DVD provides students with science content through video clips aligned with National Science Education Standards (NSES) and a host of other resources.

Short video clips aligned with the NSES provide a unique opportunity for you to enhance your lessons using DVD technology. Now you can show a video clip, or even short segments of a clip, on command. But there are a host of other features, too! See the chart below for a summary.

From the Main menu, there are three chief sections:

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watch Program Menu</td>
<td>From this menu, you can play the program straight through or use the clips to customize your viewing.</td>
</tr>
<tr>
<td>Teacher Support</td>
<td>From this menu, you can access this Teacher’s Guide, the Glossary, Internet Links, and the Quiz.</td>
</tr>
<tr>
<td>Bonus Materials</td>
<td>Use this menu to try a different discussion starter, download a special screen-saver, or check out never-before-seen footage.</td>
</tr>
</tbody>
</table>

From the Watch Program menu, you can:

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Play Program</td>
<td>Play the entire program from start to finish.</td>
</tr>
<tr>
<td>Bilingual Mode</td>
<td>View the entire program or clips in English or Spanish.</td>
</tr>
<tr>
<td>Glossary Mode</td>
<td>Make links to Glossary terms appear during the program.</td>
</tr>
<tr>
<td>Program Overview</td>
<td>View the program introduction, in which Bill discusses the topic covered.</td>
</tr>
<tr>
<td>Try This</td>
<td>Show students demonstrating science concepts.</td>
</tr>
<tr>
<td>Way Cool Scientist</td>
<td>Meet a real scientist who talks about his or her area of study.</td>
</tr>
<tr>
<td>Bill’s Demonstration</td>
<td>Look at a science demonstration conducted by Bill Nye.</td>
</tr>
<tr>
<td>Music Video</td>
<td>Enjoy a short music video that summarizes the topic in an age-appropriate and entertaining manner.</td>
</tr>
<tr>
<td>Science Standards</td>
<td>Take advantage of short video clips from the program, which are aligned with National Science Education Standards.</td>
</tr>
</tbody>
</table>
From the **Teacher Support** menu, you can:

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science Quiz</td>
<td>Give students a quiz to take independently or as a class. Seven to ten quiz items are aligned with the National Science Education Standards. The items are in multiple-choice or true-false format. Each wrong answer links to a standards-aligned video clip. At the end of the quiz, a scoring function reveals the number of correct initial answers.</td>
</tr>
<tr>
<td>Glossary</td>
<td>Check out definitions of key terms and view video clips that reinforce the concepts.</td>
</tr>
<tr>
<td>DVD Features</td>
<td>View a quick overview of the features found on the DVD.</td>
</tr>
<tr>
<td>Teacher’s Guide</td>
<td>Print out or view this comprehensive Teacher’s Guide in PDF format.</td>
</tr>
<tr>
<td>Internet Link</td>
<td>Link to the Bill Nye area of Disney’s Edustation Web site, where you can find links to Internet sites related to the content of each Bill Nye program.</td>
</tr>
</tbody>
</table>

From the **Bonus Materials** menu, you can:

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonus Material</td>
<td>Find out what <em>wasn’t</em> in the episode! In most cases, there’s more of the Way Cool Scientist interview, Bill Nye outtakes, and an extra discussion starter.</td>
</tr>
<tr>
<td>Additional Clips</td>
<td>See trailers of related DVDs and videos.</td>
</tr>
<tr>
<td>Screen-Saver</td>
<td>Download this cool screen-saver for your computer.</td>
</tr>
</tbody>
</table>

**The Planning Process**

This Guide provides a Lesson Planning Worksheet (see page 12), which can assist you in setting up your instruction around a topic. The following sections of this Implementation Guide are offered to assist your planning process:

- **Determining Objectives and Linking to Standards**
- **The Learning Cycle**
  - Explore
  - Apply
  - Extend
  - Assess
Determining Objectives and Linking to Standards

1. The NSES Teaching Standard A states that science teachers must “select science content and adapt and design curricula to meet the interest, knowledge, understanding, abilities, and experience of students.”

The NSES recommends that teachers “integrate . . . a practical structure for the sequence of activities, and the content to be learned.” The primary instructional model recommended by the NSES is inquiry into authentic student-generated questions about natural or designed phenomena. Since most state and local standards documents were derived from the NSES, you will find that your local and state standards match closely with content standards in the Bill Nye DVD.

Each DVD contains a menu of clips that are aligned with the NSES. You can review the standards and their aligned clips in the Science Standards menu under Watch Program. Also, the Standards listed on page 10 of this Guide allow you to look at additional NSES content standards that are addressed on the video. Here’s an example of the content standards and clips aligned with the Bill Nye DVD entitled Blood and Circulation:

Life Science Standards (NSES) Addressed in Blood and Circulation

Life Science:
Structure and function in living systems

- Living systems at all levels of organization demonstrate the complementary nature of structure and function.
  Aligned clips:
  - 1 Blood vessels
  - 2 Heart pump and bloodstream
  - 3 Heart valves and blood circulation
  - 4 White blood cells
  - 5 Capillaries

- The human organism has systems for digestion, respiration, reproduction, circulation, excretion, movement, control, and coordination, and for protection.
  Aligned clips:
  - 6 Heart pump
  - 7 Heart muscle
  - 8 Pumping blood to brain
2. Determine your objectives for the lesson and how these objectives address the standards.

Sample Objectives for *Blood and Circulation*

In this activity students will:
- Observe and describe a body system responsible for supply and transport.
- Use this information to define a body system.
- Ask questions about the circulatory system.
- Explain how structure complements function in organs of the circulatory system.
- Cite examples of current research related to this system.

3. Design a learning cycle of instructional experiences and assessments for the students to engage in that will help students meet these standards. Students may be given teacher-planned investigations or may be guided to design their own investigations.

The Learning Cycle

The learning cycle is a sequence of activities that involve students in the learning process. The sequence found here is based on research from Lawson, Abraham, and Renner published in 1989. That has been adapted to include: Explore, Apply, Extend and Assess:

**Explore:** Involves assessing students’ prior knowledge and providing opportunities for students to interact with content from the video.

**Apply:** Includes having students use the content learned during the Explore section in a new way that is meaningful to future learning.

**Extend:** Allows students to conduct further research around an area of interest within the topic.

**Assess:** Provides strategies meant to inform students and teachers about the content and processes that have been learned.

**Explore**

The NSES Teaching Standard B states: “Teachers of science guide and facilitate learning.” This standard addresses the constant need to balance your predetermined goals with allowing students to set and meet their own learning goals.

*Focus and Support Inquiries:* Support student inquiries by making decisions about “when to provide information” and “when to connect students with other sources.” Knowing the best time to intervene is often determined by allowing students to ask questions and to explore concepts openly.
The NSES Teaching Standard C states: “Teachers of science engage in ongoing assessment of their teaching and of student learning.”

Assess in Order to Guide Teaching: The Program Overview or the Discussion Starter on the DVD can be used to gauge students’ prior knowledge. You can use student responses to make decisions about appropriate instruction and adaptations in order to meet the needs of individual students. Assessment can be in the form of student reflections from standards-aligned video clips or answers to questions found on the science quiz. Or, as in the following example, a simple graphic organizer can facilitate a formative assessment.

Example: T-Chart from Blood and Circulation

1. Ask students to fill out the “Know-New” T-Chart (see page 14). Have them list what they already know about the circulatory system (heart, blood vessels, blood, etc.) on the left side of their charts.

2. Show the Program Overview for Blood and Circulation. On the right side of the chart, have students list new things they have learned from watching the clip. Walk around the room and assist students in filling in their T-Charts. Replay the program as necessary to allow students to review sections of interest.

3. Once students have completed their charts, ask them to share what they have listed in the “New” column. Write these on the board. Have students write their own working definitions of the circulatory system. Once students have completed their definitions, collect and review their work to assess prior knowledge.

Conduct direct vocabulary instruction in the Explore phase. Research suggests that:

- Students must encounter words in context more than once to learn them.
- Instruction in new words enhances learning those words in context.
- One of the best ways to learn a new word is to associate an image with it.
- Direct vocabulary instruction on words that are critical to new content produces the most powerful learning.

Use the DVD Glossary with the linked video clips to expose students to new vocabulary words in context, along with associated video images. You can also find a printed version of the glossary terms in this Guide on page 16.
Example: Using the Glossary for Direct Vocabulary Instruction

*Blood and Circulation*

1. Present students with a brief explanation or description of the new term or phrase from the glossary. For example: “Capillary: A small blood vessel that connects arteries and veins.”

2. Present students with a nonlinguistic representation of the new term or phrase. Show the video clip associated with the term “capillary.”

3. Ask students to generate their own verbal description of “capillary.”

4. Ask students to create their own nonlinguistic representation of “capillary.”

5. Periodically ask students to review the accuracy of their explanations and representations. This can be done after the Apply activities.

Apply

Based on the information you gained from the Explore assessments, design appropriate activities for your students. Check the experiments listed in the Episode Guide (see page 11) for explanations of the demonstrations from the Bill Nye program as well as for additional experiments designed to help apply the knowledge gained.

In the following example from *Blood and Circulation*, the standards-based video clips provide background information, and an experiment from the Guide helps students apply what they have learned about arteries and veins.

Example: The Structure and Function of Arteries and Veins

1. Have students begin “Know-New” T-Charts, focusing on what they already know about the structure and function of blood vessels, arteries, and veins.

2. Watch the following chapters from the Bill Nye DVD *Blood and Circulation*:
   - Blood vessels
   - Heart pump and bloodstream
   - Capillaries

3. Complete the “Know-New” T-Charts.

4. Give students copies of the Student Recording Sheet (see page 15) and have them fill the sheets out as they conduct their experiments.

5. Do the experiment entitled “Pump it Up!” from the *Blood and Circulation* Episode Guide, in which students observe the apparent effects of pressure on arteries and veins.

6. Write down any remaining questions about the structure and function of blood vessels, arteries, and veins.
Extend

The NSES Teaching Standard D states: “Teachers of science design and manage learning environments that provide students with the time, space, and resources needed for learning science.” School administrators, parents, and the community can assist teachers in providing local resources that make science lessons pertinent and meaningful.

Identify and Use Resources Outside of the School: “The school science program must extend beyond the walls of the school.” Each Bill Nye DVD contains resources designed to facilitate such understanding, including:

- Way Cool Scientist, found in both Watch Program and Bonus Materials, in which scientists discuss their current areas of study. This real-world connection often results in a deeper student understanding of a particular career.

- Disney’s Edustation Web site, where relevant Internet links provide a starting point for students to further explore science topics.

- Try these video clips, with activities parents and students can do at home. The questions generated by students from these experiences can be used as foundations from which they may conduct their own research.

- Standards-aligned video clips and Bill’s demonstration video clips, which can help generate topics for further research. After viewing the clips, have students list their questions, perhaps about the most current developments in a topic. By conducting online or library research, students will find answers to their questions and will learn about a topic in greater depth.

Example: Conducting Student Research Using Blood and Circulation

Ask students to choose one of the questions they had after completing the activities from Blood and Circulation. An example of a student research question might be, “How has the technology related to artificial hearts advanced in the last ten years?” Explain to students that they will be conducting research to find answers to their questions. Some students may want to complete online or library research, others may want to ask an expert in the field, while others may want to design and conduct a scientific investigation. Encourage students to write a detailed procedure for finding answers to their questions. Ask students to find one or more examples of current research dealing with the circulatory system that is related to their question. Note: Students with similar questions may work together to complete the assignment.
Assess

Once students have conducted the research, you may choose to assess them in a number of different ways:

■ By having students write about what they learned in a journal.
■ By having students submit projects or reports.
■ By having students take the program quiz to gauge their understanding of certain facts in the video. You can either print the quiz (found in this Guide on page 18) and have each student complete it individually or use the DVD screen version and the scoring feature for whole-class assessment.
■ By designing other standards-aligned questions to augment those that are provided.

While the quiz will provide you with information about what the students have learned, it does not assess how students have processed the information. Below you will find assessment ideas that can be used to measure both content and process.

A Sample Assessment for Blood and Circulation

1. Explain to students that an important aspect of scientific inquiry is to communicate findings to others. In this assessment, students will present the following information to their peers:
   ■ The question they investigated.
   ■ The method that was used to find answers to their question.
   ■ Problems or successes during the search.
   ■ Answers to their question.
   ■ Current research related to their question.
   ■ New questions that have arisen.

2. Distribute the rubric found in the Lesson Planning Worksheet (see page 13) to students so they know how they will be assessed. Make sure students understand the criteria found in the rubric. Before you begin, you may want to allow students to make changes to the rubric so that it is clearer or makes more sense from their perspectives.

3. Allow students time to gather information to answer their questions and to prepare for their presentations. As students conduct this work, walk around the room and ask questions to assess their progress and provide input as needed.

4. Take a few minutes to clarify the rules of the presentation with the students. You may want to have multiple copies of the rubric available so that peers can rate the presentations.

5. As presentations are made, assess the quality of the student’s work as thoroughly and as equitably as you possibly can.

Congratulations! You have now completed the steps to set up a lesson plan using the Lesson Planning Worksheet. You have also explored many of the features of the Bill Nye DVD as well as the supplemental information found in this Teacher’s Guide. And most important, you’ve made significant strides toward incorporating DVD technology into your day-to-day instruction.
Science as Inquiry

Understandings about scientific inquiry

- Different kinds of questions suggest different kinds of scientific investigations. Some investigations involve observing and describing objects, organisms, or events; some involve collecting specimens; some involve experiments; some involve seeking more information; some involve discovery of new objects and phenomena; and some involve making models.

- Technology used to gather data enhances accuracy and allows scientists to analyze and quantify results of investigations.

Earth and Space Science

Earth in the solar system

- The earth is the third planet from the sun in a system that includes the moon, the sun, eight other planets and their moons, and smaller objects, such as asteroids and comets. The sun, an average star, is the central and largest body in the solar system.

- Most objects in the solar system are in regular and predictable motion. Those motions explain such phenomena as the day, the year, phases of the moon, and eclipses.

History and Nature of Science

History of science

- In historical perspective, science has been practiced by different individuals in different cultures. In looking at the history of many peoples, one finds that scientists and engineers of high achievement are considered to be among the most valued contributors to their culture.
Nifty Questions in This Episode | Awesome Answers
--- | ---
How fast does light travel? | Light travels at a rate of 300,000 kilometers per second; 9.5 trillion kilometers per year equals a light year.
What is the Great Red Spot on Jupiter? | The Great Red Spot on Jupiter is a hurricane larger than the Earth.
What is the name of the North Star? Where is it? | The North Star is called Polaris. You can see it over the North Pole, at the end of Little Dipper’s handle.
Do meteorites hit the Earth? | Ten tons of meteorites hit the Earth daily. Most are the size of a grain of sand.

Experiments shown on the video:

IT’S A MATTER OF DEGREES

**Objective:** To construct an astrolabe.

- Use a letter-size piece of cardboard or stiff paper.
- Place the paper in front of you, with the long side facing you.
- Attach a pencil to one end of a 20-centimeter piece of string.
- Place the other end of the string in the lower left-hand corner of your paper and hold it down with your thumb.
- Holding the pencil, start at the upper left corner of the paper and draw an arc.
- Place a protractor at the lower left-hand corner and mark off increments of ten degrees, totaling 90 degrees (from left to right).
- Using a ruler, start at the lower left corner and draw lines from the degree marks through the drawn arc.
- Cut off the excess paper along the arc.
- Turn the astrolabe so that the 10-degree mark points down, and the 90-degree mark points up.
- Tape a drinking straw along the top edge of the astrolabe.
- Fasten a string with tape at the top straight edge and tie a weighted object to the bottom of string.
- Look through the straw and record the degrees of the objects.

More interesting stuff to do:

STARLIGHT, FLASHLIGHT

**Objective:** To create a model of a constellation.

- Hold a clothes hanger with one hand holding the hooked part, the other hand holding the straight part opposite the first hand.
  - Pull your hands apart, stretching the hanger and forming a square.
- Cover the square hanger with two layers of black tissue paper.
- Draw three or four constellations on the tissue paper (from a star chart, marking the stars).
- Punch small holes through the stars of the constellation on your tissue paper.
- Using a large flashlight in a darkened room, place the tissue-paper “star map” over the flashlight.
- Turn the flashlight on and point the “star map” and light beam at the ceiling of the room.
- See the stars and constellations? Have the entire class try the “star map.”

HANDY-DANDY PLANET HOPPER

**Objective:** To design a space creature who can live in diverse conditions and climates.

- Take into account the following:
  - daily temperatures of 150 degrees Celsius (daytime) and 72 degrees Celsius (nighttime);
  - an atmosphere of poisonous gases;
  - ultraviolet radiation that passes through the atmosphere;
  - dry, red soil, with large cracks.
- The creature you design must have the body parts (including appendages) necessary to enable it to survive.
As presentations are made, assess the quality of the student's work as thoroughly and as equitably as you possibly can. The following criteria can be used to assist in your assessment.

Name of Student: 

Question Investigated: 

<table>
<thead>
<tr>
<th>Initial Question</th>
<th>Methods for Finding Answers</th>
<th>Results</th>
<th>Communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Question is broad and not well defined</td>
<td>1. Students do not share planned or actual methods.</td>
<td>1. Student results are undefined.</td>
<td>1. Student is not prepared to speak.</td>
</tr>
<tr>
<td>2. Question is defined but limited to single-answer responses.</td>
<td>2. Students share methods but they are unclear or vague.</td>
<td>2. Student results are incomplete and do not adequately answer the question.</td>
<td>2. Presenter has distracting mannerisms and avoids eye contact with the audience.</td>
</tr>
<tr>
<td>3. Question is clear and might elicit multiple responses that may lead to new ideas and additional questions.</td>
<td>3. Students share methods but not the problems or successes of using the methods.</td>
<td>3. Student results are complete, adequately answer the question, and include current research related to the question.</td>
<td>3. Presentation is clean and clear with some eye contact and very few distractions.</td>
</tr>
<tr>
<td>4. Question is engaging and provokes new ways of thinking about an issue.</td>
<td>4. Students share methods and problems or successes in using the methods.</td>
<td>4. Student results are complete, include current research, and have resulted in one or more additional questions.</td>
<td>4. Presentation is exceptional and unique. Presenter uses regular eye contact and avoids distractions.</td>
</tr>
</tbody>
</table>
**Bill Nye the Science Guy**

**Student “Know / New” Chart**

<table>
<thead>
<tr>
<th>Know</th>
<th>New</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write down what you know about the topic of the video.</td>
<td>Write down information from the video that is new to you.</td>
</tr>
</tbody>
</table>
Bill Nye the Science Guy

Student Recording Sheet

Name ____________________________________________ Date ____________________

Title of Experiment __________________________________________________________

Question: (What are you testing?) _____________________________________________

_________________________________________________________________________

Procedure: (Describe the experiment) __________________________________________

_________________________________________________________________________

Materials: (List what you used) ________________________________________________

_________________________________________________________________________

Observations: (Record what happened) _________________________________________

_________________________________________________________________________

Results: (Make your own data table)

_________________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________

Conclusions: (Use your observations and results to describe what you learned)

_________________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________
Glossary
Outer Space

Fold and cut to use as flashcards.

Speed of Light
The rate at which light travels, defined as 300,000 kilometers/second.

Light Year
The distance that light can travel in one year, defined as 9.5 trillion kilometers.

Constellation
A group of stars that forms a pattern or picture in the sky. We give these patterns a name to help us find certain stars or recognize them.
**POLARIS**
The star that is almost directly above the North Pole. Polaris does not appear to move in the sky. It is currently called the North Star.

**Astrolabe**
An instrument that can be used to measure the latitude of an object in the sky, such as a star or planet.

**ATOM**
The smallest part of an element that still has the properties of that element. All matter in the universe is made of atoms.
True or False? Circle T or F

1. The distances in outer space are huge! T or F
2. In Bill’s model of the sun and the Earth, they were a few centimeters apart. T or F
3. Sound is the fastest thing in the universe. T or F
4. The sun, moon, and planets of our solar system are like dots compared with the size of the galaxy. T or F
5. Constellations were given names from ancient Greek and Roman mythology. T or F
6. The Earth’s rotation is wobbly. T or F
7. The Earth’s rotation causes the stars to appear to move in the sky. T or F

Multiple Choice: Circle the letter of the best answer

8. What is the name of the objects that hit the Earth every day?
   A. Asteroids
   B. Stars
   C. Meteorites
   D. Planets

9. What did Eratosthenes calculate using distances between two cities and the length of a shadow?
   A. Distance to the stars
   B. Circumference of the Earth
   C. Distance to Polaris
   D. None of the above

10. What tool can be used to measure the motion of planets in our solar system?
    A. Astrolabe
    B. Microscope
    C. Ruler
    D. Compass
Answer Key

Outer Space

1. T
2. F
3. F
4. T
5. T
6. T
7. T
8. C
9. B
10. A