Washington

5th Grade

www.disney.com/planetchallenge

Foreword

Establishing Learning Goals

The Disney Planet Challenge Class Project has two goals:

1. To provide an opportunity for students to identify and focus on one environmental issue in their local area, learn about and investigate ways to address the issue, and develop and take action to improve the environment.

2. To provide an opportunity for students to develop content knowledge and understanding that align with state content standards in English-language arts, mathematics, science, history/social science, and visual and performing arts.

Through the Class Project, teachers identify learning goals for their students based on the content knowledge and understandings that align with state content standards in science, mathematics, English-language Arts, and the visual and performing arts. It is recommended that teachers carefully select the standards that are best taught through project-based learning.

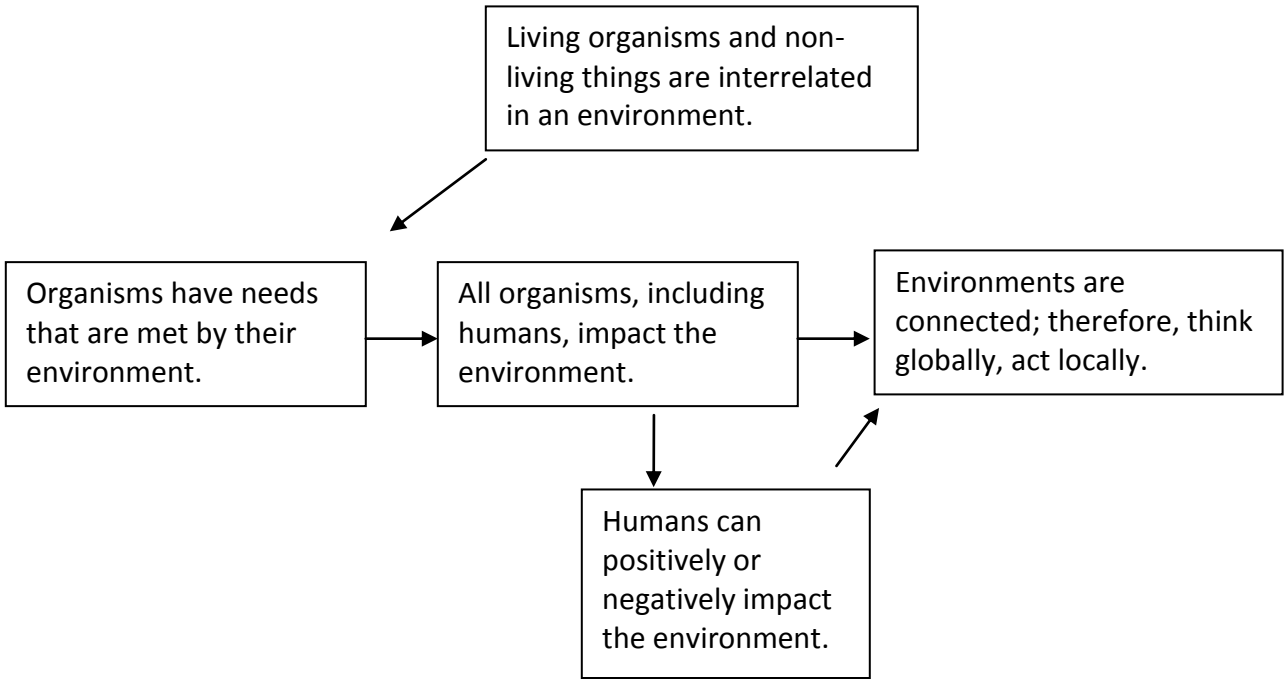
The following state content standards for students in grades 4-6 are strongly suggested as a starting point for identifying student learning goals for the Class Project:

- Science--life, Earth, physical science and environmental science standards as well as inquiry or investigation and experimentation standards;
- Mathematics--mathematical reasoning, graphing standards and statistics, data analysis, and probability standards;
- English-Language Arts--writing, reading, speaking, and listening standards; and
- Visual and Performing Arts--creative expression standards and web-based technology standards.

Developing a Conceptual Flow

Research from *How People Learn* (Bransford, Brown, Cocking, National Research Council, 2000) indicates that expert learners have conceptual frameworks from which to draw for understanding and solving new problems. To help students become experts, teachers should consider the major concepts that the Class Projects will address and create a conceptual flow; i.e., an instructional sequence of those concepts. See Chapter 4 in *Assessment Centered Teaching: A Reflective Process*, (DiRanna, Osmundson, Topps, Barakos, Gearhart, Cerwin, Carnahan, Strang, Corwin, 2008) for detailed instructions on how to construct a conceptual flow.

A generic conceptual flow that might guide each Class Project is shown below. This flow would be modified based on the topic the students select for their project as well as the selection of appropriate content standards.



Lesson Sequence Flow

The following eight lessons are suggested as a guide to complete the Disney Planet Challenge Class Project. The actual time for each lesson will vary depending on the topic and the complexity of the question the students are investigating:

Lesson 1 Choosing the project
In this lesson, students brainstorm possible topics for the Class Project. Students will refine their project and questions after further content input in Lesson 2 and additional research in Lesson 3.
Estimated Teaching Time: 1 class period

Lesson 2 Background Science Lesson(s) based on learning goals
When students have selected a preliminary topic, the teacher selects appropriate science standards to address as a foundation for students to begin their project. For example, if the project is about water quality, the students should understand the specific grade science content standards that address water quality.
Estimated Teaching Time: 1-3 class periods

Lesson 3 Select the project and refine investigation questions
In this lesson students use their knowledge from Lesson 2, their ideas from Lesson 1, and further investigation to refine their topic and the Class Project's investigation questions.
Estimated Teaching Time: 2-5 class periods spread over a couple of weeks

Lesson 4 Determine project goals and action plan
With a refined topic and questions, students now determine the actual goal(s) of their project and describe their action plan to reach these goals.
Estimated Teaching Time: 1-3 class periods

Lesson 5 Investigate the project: Research
During this lesson students use many means of "research" to gather information about their project. This includes reading, internet searches, conducting interviews, having guest speakers, etc. It also includes learning about special components of the project. For example, if students are making community booklets, they would investigate how to design, print, and distribute the booklets.
Estimated Teaching Time: Many class periods spread over several months depending on the complexity of the project

Lesson 6 Investigate the project: Conduct an experiment

If the project lends itself to scientific experimentation where students can discover cause-and-effect relationships, Lesson 6 helps students learn the skills to conduct an experiment with controls and variables. Not all projects have a testable question for experimentation. However, projects with an experimental component are desirable.
Estimated Teaching Time: Several to many class periods depending on the complexity of the experiment(s).

Lesson 7 Synthesize findings: Reflect on process
Students have been involved in many activities and investigations. Lesson 7 helps students summarize their findings and make conclusions about the effectiveness of their actions. This lesson also allows students to reflect on their efforts.
Estimated Teaching Time: 3-8 class periods spread over several weeks

Lesson 8 Prepare portfolio
The Class Project is complete when it is displayed in a portfolio and submitted to the Disney Planet Challenge. This lesson helps students think creatively about the best way to display their question(s), action plan, and findings as well as their hard work.
Estimated Teaching Time: 4-6 class periods spread over several weeks

Disney Planet Challenge Handbook: In addition to these sample lessons, use the Disney Planet Challenge Handbook as a resource for completing the project.

Vignette
An Example of How a Class Project Might Unfold

Ed West, a 5th grade teacher in District USA, decided that he had looked at the Disney Planet Challenge posters long enough. It was time, this year, to encourage his students to DO the Class Project! He was unsure of exactly where to begin.

He knew the Class Project information usually came to his school in the fall and that the project was usually due in March. He decided to get a "jump start" by doing a little investigation of his own. Ed realized that if he knew more about common environmental issues in his community, he would be able to help his students become more aware of local environmental issues. Ed consulted the Disney Planet Challenge web site to get a list of agencies and organizations that address environmental issues. At the same web site, he located his local and state environmental education coordinator and decided to contact a local agency for assistance with the Class Project.

Ed also reviewed the Washington state science standards in his Disney's Planet Challenge customized lesson plans to determine what Standards he thought might best be addressed in a project-based learning experience. He knew that this kind of learning would require language arts and mathematical skills as well as scientific inquiry/investigation/experimentation skills. He also knew the topic his students selected should resonate with one of the science content standards.

Ed again consulted the Disney Planet Challenge Handbook and realized that a major portion of this project-based learning was grounded in scientific inquiry, investigation, and experimentation. He decided that the Class Project would emphasize these standards:

4-5 INQA
Question Scientific *investigation*s involve asking and answering *questions* and comparing the answers with *evidence* from the real world.
4-5 INQB
Investigate Scientists plan and conduct different kinds of *investigation*s, depending on the *questions* they are trying to answer. Types of *investigation*s include systematic *observations* and descriptions, *field studies*, *models*, and *open-ended explorations* as well as *controlled experiments*.
4-5 INQC
Investigate An *experiment* involves a *comparison*. For an *experiment* to be valid and fair, all of the things that can possibly change the outcome of the *experiment* should be kept the same, if possible.
4-5 INQD
Investigate *Investigation*s involve systematic collection and recording of relevant *observations* and data.
4-5 INQE
Investigate Repeated *trials* are necessary for *reliability*.

4-5 INQF
Models A scientific *model* is a simplified representation of an object, event, *system*, or process created to understand some aspect of the *natural world*. When learning from a *model,* it is important to realize that the *model* is not exactly the same as the thing being modeled.
4-5 INQG
Explain Scientific explanations emphasize *evidence*, have logically consistent arguments, and use known scientific *principles*, *model*s, and *theories*.
Generate a conclusion from a scientific *investigation* and show how the conclusion is supported by *evidence* and other scientific *principles*.*c
4-5 INQH
Communicate Scientists communicate the results of their *investigation*s verbally and in writing. They review and ask *questions* about the results of other scientists' work.
4-5 INQI
Intellectual Honesty Scientists report the results of their *investigation*s honestly, even when those results show their predictions were wrong or when they cannot *explain* the results.

When Ed considered his state math standards, he found a close match to the suggestions in the Disney Planet Challenge Handbook where students gather data, chart and graph the data, and then interpret the graphs. Likewise, Ed knew that he could consult the History Social Science Standards to see what might be included once his students selected the topic.

Ed recognized that the Class Project would require that he integrate language arts skills with science learning in an authentic way. His students would need to write coherent paragraphs and essays, do persuasive and expository writing and create research reports. Of course, all of this would require edits and revisions. And finally, students would need to make presentations, both oral and written, about their project. Ed reviewed the Visual and Performing Arts Standards to help prepare his students for their presentation.

Ed's "jump start" was starting to evolve into a plan for a Class Project that would make standards-based learning come alive for his students and could make a difference in the community. Ed quickly realized that his decision to research his state standards was going to become the best way to integrate the core content areas with project-based learning.

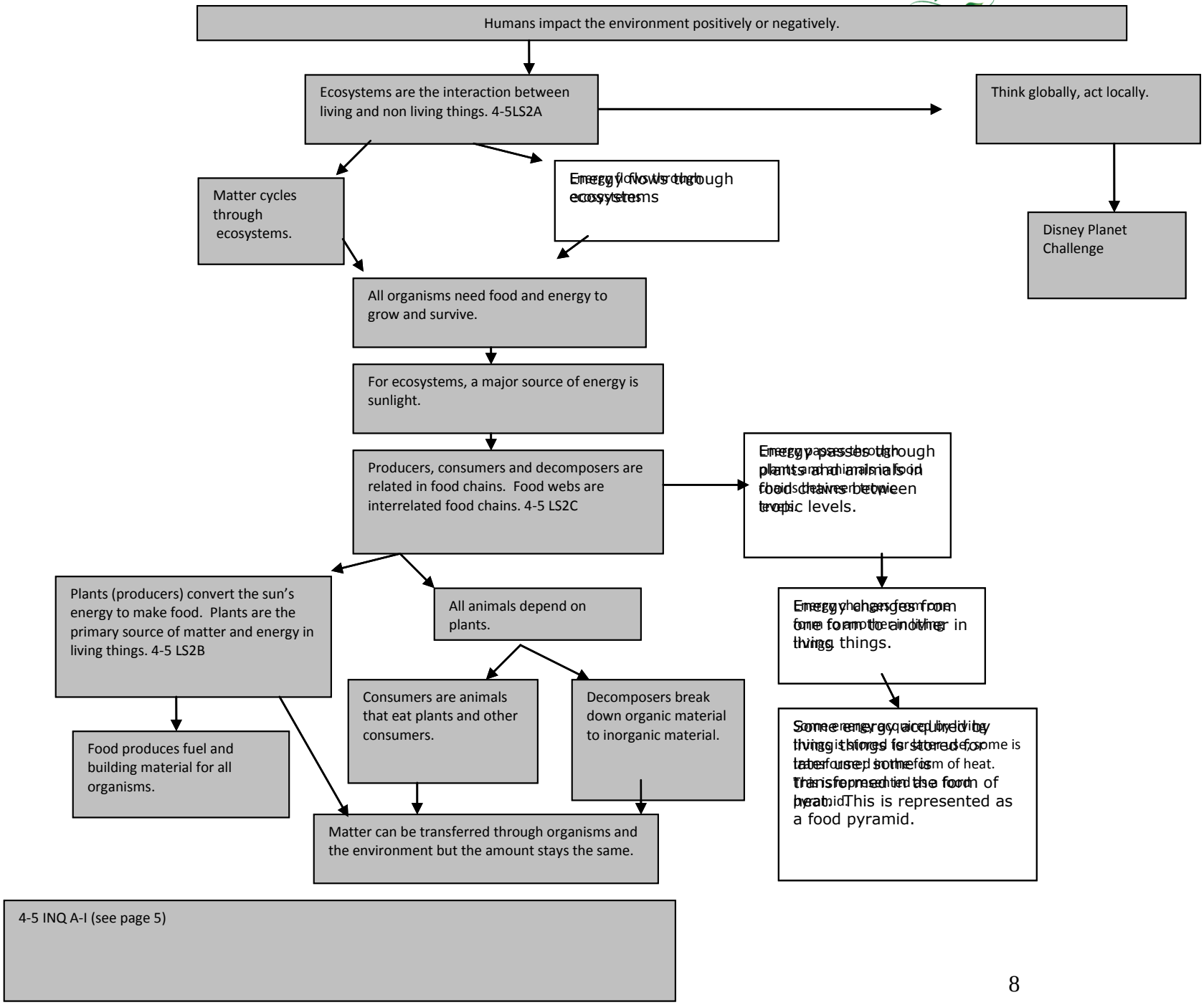
Ed was now ready to prepare for teaching and facilitating the students' thinking and selection of a topic for their project. He used Lesson 1 to help students brainstorm possible topics. The students selected the broad topic of the effect pollution on a food chain/web. PLEASE SEE Burrowing Owl portfolio page 2.

With the students' topic as a foundation, Ed identified the appropriate Science Content Standards for the topic. These standards include:

4-5 LS2A An *ecosystem* includes all of the plant and animal *populations* and nonliving resources in a given area. Plants and animals depend on one another and the nonliving resources in their *ecosystem* to help them survive.

4-5 LS2B	Plants make their own food using energy from the sun. Animals get food by eating plants and/or other animals that eat plants. Plants make it possible for animals to use the energy of sunlight.
4-5 LS2C	Plants and animals are related in *food webs* with *producers* (plants that make their own food), *consumers* (animals that eat *producers* and/or other animals), and *decomposers* (primarily bacteria and fungi) that break down wastes and dead *organisms*, and return *nutrients* to the soil.
4-5 LS2D	*Ecosystems* can change slowly or rapidly. Big changes over a short period of time can have a major impact on the *ecosystem* and the *populations* of plants and animals living there in the *ecosystem* might affect the *population* of that plant or animal.
4-5 LS2E	All plants and animals change the *ecosystem* where they live. If this change reduces another organism's access to resources, that *organism* may move to another location or die.

He used these standards to develop a conceptual flow shown below. The grey-shaded boxes represent the science content embedded in the students' topic. The language arts, math, and science processes will be addressed throughout the project.


Humans impact the environment positively or negatively.
Ecosystems are the interaction between living and non living things. 4-5LS2A
Think globally, act locally.
Matter cycles through ecosystems.
Energy flows through ecosystems
Disney Planet Challenge
All organisms need food and energy to grow and survive.
For ecosystems, a major source of energy is sunlight.
Producers, consumers and decomposers are related in food chains. Food webs are interrelated food chains. 4-5 LS2C
Energy passes through plants and animals in food chains between trophic levels.
Plants (producers) convert the sun's energy to make food. Plants are the primary source of matter and energy in living things. 4-5 LS2B
All animals depend on plants.
Energy changes from one form to another in living things.
Food produces fuel and building material for all organisms.
Consumers are animals that eat plants and other consumers.
Decomposers break down organic material to inorganic material.
Some energy acquired by living things is stored for later use or some is released as heat. This is represented as a food pyramid.
Matter can be transferred through organisms and the environment but the amount stays the same.
4-5 INQ A-I (see page 5)

Knowing what science concepts have to be reviewed or explored, Ed is ready for Lesson 2 (which may be many lessons, depending on the science concepts necessary to build student understanding). An outcome of the class project is for students to understand how energy flows through an ecosystem and to recognize how habitat destruction interrupts food chains and the flow of energy. In the sample lessons that follow this vignette, Lesson 2 addresses the following ideas from Ed's conceptual flow: energy flows through ecosystems, and is transformed in living things. This can be represented as a food pyramid.

Ed continues to facilitate his class as they use their language arts skills and understanding to research and refine their questions in Lesson 3. Ed's class studied various food pyramids to understand how energy flows through ecosystems. The students learned how changing habitats disrupted the food chains. They discovered that the new housing tracks were shrinking the habitats for local animals, particularly the owls. They also discovered their community was unaware of how these changes could impact their area. They refined their questions to include: What impact has our community's growth had on the owl population? How can we protect the owls? What can we do to help them reproduce? What will happen if the owls are not protected?

In Lesson 4, Ed's class determines their project goals and action plan. PLEASE SEE Battery Recycling portfolio page 1. The class wants to build community awareness of the decrease in owl population and wants to see if establishing artificial habitats for the owls will increase their numbers.

In Lesson 5 and 6 students combine their science process, math, and language skills as they investigate their selected project through research and experimentation. Ed's class used the library, Internet and local environmental agencies to determine the impact. Students worked with local agencies to monitor the owl population and collect data on the impact on the food webs. The students charted and graphed the data, comparing it with other data released by the agency. PLEASE SEE Battery Recycling portfolio page 15.

The class invited a local environmental agency to share their work in trying to increase other wildlife in the area. They even had a councilman explain how the city council was trying to balance human population growth while maintaining the owl population. PLEASE SEE Our Starfish portfolio page 6.

In Lesson 7 and 8 the students synthesize their learning and think about ways in which to communicate what they have learned. Ed's class prepared their findings, backed with evidence from their research and experimentation, and made a portfolio to submit as their Disney Planet Challenge Class Project. They practiced their presentation, and shared their learning with other classes and at a PTA meeting. Ed made sure that they also sent a copy of their findings to the city council. And, lastly, they celebrated their hard work!

SAMPLE LESSONS

Use in conjunction with

the

Disney Planet Challenge Handbook

Lesson 1: Choosing the Project
Brainstorming Issues/Topics

Purpose: To brainstorm local environmental issues as possible topics to research for the Disney Planet Challenge Class Project.

Outcome: Students will select a topic to research for the Disney Planet Challenge Class Project.

Reference: Please see Burrowing Owl portfolio page 2.

Time: 40-60 minutes

Materials: Chart paper
Marking pens
Disney Planet Challenge Handbook:
Page 4, Teacher Page--Brainstorming Issues/Topics,
Page 5, Student Page--Carousel Brainstorming Issues/Topics

Standards: Language Arts Standards that help students clarify and support spoken ideas with evidence and examples.

Advanced Preparation:

1. Review the newspaper for articles that might suggest local environmental issues.
2. Contact one of the state and/or federal agencies about a project they might be conducting in your area.
3. Call local environmental agencies for ideas for local environmental issues.
4. Review Disney Planet Challenge website for ideas from previously completed projects.
5. Have students check with their parents regarding any local environmental issues.

Procedure:

1. Explain to students that the Disney Planet Challenge is an opportunity for 4^{th} - 6^{th} grade students from throughout the country to make a difference in their community by researching and developing a project based on a local environmental issue.

2. Have students think about their answer to the following prompt: "What do we mean by an environmental issue?" Have students share their response with a partner. Have partner groups share their responses with the entire class. Chart student responses. Facilitate a discussion to help students decide which environmental issues are local or global. Allow 10 minutes.

Teacher Note: Possible student responses may include: habitat destruction, soil contamination, invasive species, E-waste, reduce human impact, efficient energy use, over fishing, landfill, smog, water pollution, endangered species, recycling, toxins in the food chain.

3. Prior to the brainstorm of a specific issue/topic, "seed" the brainstorm by completing the following:
   - Have students do a think-pair-share of possible environmental problems in their community.
   - Ask students to do a quick-write on an environmental topic of their choice. Ask students to include a rationale for their choice.
   - Have students interview a parent, school official, and/or community members to get ideas.
   - Contact one of the state and/or federal agencies provided on the Disney Planet Challenge Resource Center about a project they may be conducting in the area.

4. Refer to the **Disney Planet Challenge Handbook**, p**age 4, Teacher Page--Brainstorming Issues/Topics**. Jot notes on this page as you facilitate the brainstorm process with your students.

5. Divide the class into small working groups. Have students refer to the **Disney Planet Challenge Handbook, page 5, Student Page--Carousel Brainstorming Issues/Topics.** Have students use page 5 for their group carousel brainstorm. Ask students to think about possible local environmental issues. Have each student in the small group add their idea to page 5. After the first student has added his/her issue, he/she passes the paper to the next student to add another idea. Have students continue to pass the paper and record ideas until the groups have exhausted their ideas. Remind students that in a brainstorm all ideas are important.

6. Ask the small groups to review their list and star their top two choices. Ask groups to share their top two choices with the whole class. Tally student choices.

7. Have the class vote for their top choice from the list of topics.

Teacher Note :If the votes are close, choose the top 3 or 4 ideas and have students vote again.

8. Once a topic is chosen, have students discuss in table groups how the class might gather more information about the topic: Who can be called to come and give a talk? What local agencies should be contacted? Who might be an expert in this area? What books might be helpful?

9. Make a class list of the suggestions.

10. For homework, direct students to share the topic with their parents and get suggestions from them regarding a possible project, information needed, and possible contacts. Add these suggestions to the class list.

Teacher Note: Retain the list of suggestions to use in Lesson 3.

Lesson 2: Background Science Lesson(s) Based on Learning Goals

Teacher Note: This is a sample lesson that a teacher might use to build science background for students before they get too far into the project. The actual lesson(s) will be dependent on the topic the students select, science standards the teacher has selected, and the amount of science background students will need to refine their project and questions in Lesson 3.

We provide one example of a background science lesson; however, it may be necessary to provide additional background science lessons to help students to fully understand the science learning to be gained through the Class Project.

This example is based on Ed West's vignette. Ed's students selected the effect of habitat destruction on food chains/webs and the flow of energy in their local environment. Ed then selected science standards that addressed the importance of understanding the relationship between food chains and the flow of energy.

Purpose: To connect students' prior experiences with the components of a food chain and link it to energy flow.

Outcome: Students will identify how energy flows through a food chain.

Time: 1 class period

Materials: Science notebooks (1 per student)
1 whiteboard and markers/ group of 4 students
Copies of the student reading: 1/student

Standards:

4-5 LS2A An *ecosystem* includes all of the plant and animal *populations* and nonliving resources in a given area. Plants and animals depend on one another and the nonliving resources in their *ecosystem* to help them survive.

4-5 LS2B Plants make their own food using energy from the sun. Animals get food by eating plants and/or other animals that eat plants. Plants make it possible for animals to use the energy of sunlight.

4-5 LS2C Plants and animals are related in *food webs* with *producers* (plants that make their own food), *consumers* (animals that eat *producers* and/or other animals), and *decomposers* (primarily bacteria and fungi) that break down wastes and dead *organisms*, and return *nutrients* to the soil.

4-5 LS2D *Ecosystems* can change slowly or rapidly. Big changes over a short period of time can have a major impact on the *ecosystem* and the *populations* of plants and animals living there in the *ecosystem* might affect the *population* of that plant or animal.

4-5 LS2E All plants and animals change the *ecosystem* where they live. If this change reduces another organism's access to resources, that *organism* may move to another location or die.

Advanced
Preparation: 1. Gather materials

Procedure:

1. Ask students, in a think-pair-share to recall what they remember about food chains. List the various roles on the board and ask students to explain the relationship among them.

2. Ask partners to recall examples of food chains. Write one or two on the board, and have students identify the producers, consumers, and decomposers.

3. Explain that today the students will learn about how energy flows through an ecosystem.

4. Describe the following scenario: Biologist in the year 2014 observes a food chain which is part of an ecosystem on a distant planet. They find that it has many characteristics of food chains on Earth. Here is what they discover: On a particular are of land, a small, plant-like organism capable of photosynthesis, called a vortek, serves as a source of food for an animal called a snive. The snive, in turn, is preyed upon by a kluke. There are 100 vorteks, 50 snives, and 25 klukes. .

5. Ask students to list the members of this food chain by:

    a. Placing them in order, with the members at the bottom of the food chain near the bottom of the page; and

    b. Spacing them 5 cm apart

6. Have students, for each animal beginning with the bottom one, draw a horizontal block around it to represent the numbers of each member inside the block following these guidelines:
    a. Height: each block should be 5 cm tall, so that it touches the bottom of the block above it
    b. Width: make the width to scale according to the numbers of each organism in the food chain—10 organisms in 1 cm. The block around the vorteks, for example, will be 10 cm wide.
    c. Centering: center each block on the page.

7. Ask students to draw line to connect the edges of the blocks. What shape is formed?

8. Ask students to label which organisms are the producer, primary consumer and secondary consumer.

9. Assign students to groups of 4 and distribute a whiteboard to each group.

    a. Assign each group two of the situations in following prompt: How would the numbers of each member of the food chain—vorteks, snives, and klukes—change over the course of time in these situations:

        - the biologists visiting the planet consume all of the vorteks for food
        - a deadly disease wipes our all of the klukes
        - animals called skunkolas travel to the area being studied from another region of the planet. The skunkolas prey upon the vorteks; the klukes, however, dislike the taste of the skunkolas and refuse to eat them.
        - The biologists remove all of the snives for study
        - More vorteks are planted
        - A tertiary consumer called a joon is introduced

    b. Ask groups to think about the situation and draw on their board how the situation changes the food chain.

    c. Ask groups to assign numbers to the number of organisms still in their food chain and then to draw boxes around those numbers. How does the pyramid change?

10. Have groups with the same situations visit each other's drawings. How are they similar? How are they different?

11. Ask a couple of groups to share their drawings with the whole class. What can the students summarize about changes in the food chains? How do the pyramid drawings change?

12. In partners, have students read the article (student reading). As a class, discuss the following:

    - Where does energy enter a food chain?
    - How is energy transformed in a food chain?
    - Why are there few consumers at the top of the pyramid?
    - Why are producers essential to a food chain?

- What is a trophic level?
- Why can't 400 pounds of corn be converted to 400 pounds of cow?

13. After the class discussion, have students in partners answer the following question in their notebook: It has been stated that it is more energy efficient to eat "lower on the food chain." Look at the shape of the food chain you originally drew and explain why this statement is true.

14. Ask a couple of partners to share their answers.

Teacher Note:
Before teaching this lesson, Ed West taught a lesson in which students reviewed what they knew about the components of a food chain. He followed this lesson with investigations of "real" food chains in various ecosystems and had students compare the various pyramids. He now felt that students had science background on which he could build to help them narrow their topic and refine their questions in Lesson 3.

Student Reading

Energy flows through ecosystems. Plants collect the sun's energy with their leaves and use it to transform water and carbon dioxide into high-energy carbohydrate molecules. When an animal consumes these molecules (such as when a rabbit eats a carrot), the stored energy is released and helps to fuel the animal's cellular activities, including the production of new molecules, cells, and tissues. If a secondary consumer then eats primary consumer (for example, if a wolf eats the rabbit), the secondary consumer will in turn be fueled by the energy stored in the primary consumer's tissues. In this way the solar energy originally collected by plants is transferred from one organism to another.

The passage of energy through an ecosystem is anything but tidy, however. At every step of the food chain a tremendous amount of energy is used up or converted to heat, which makes it unavailable to the next level of consumers. The most efficient plants, for example, convert less than 3 percent of the solar energy available to them into plant tissue, and much of this tissue is never eaten. And of that which is eaten, only 10 percent on average is converted into primary consumer tissue; the other 90 percent of the energy goes toward maintaining normal life functions or is passed on as waste. And so it goes until, at the top of the food chain, only a tiny fraction of the energy once absorbed during plant photosynthesis has been maintained and stored in the tissues of top-level carnivores.

A pyramid represents the amount of energy that gets transferred from one level of the food chain to the next, with plants at the base and secondary/tertiary consumers at the peak. In general, the shape of the energy pyramid reflects the relative numbers of individuals at each feeding level. But more accurately, it reflects the amount of tissue, called biomass, that each type of organism contributes to the ecosystem. For instance, if biologists weighed all of the organisms living on 100 acres of wilderness, they would find that the sum of all plants weighed the most, followed by all of the primary consumers, and then the secondary consumers.

Because of the energy loss that occurs at each step of a food chain, there is a limit to the number of feeding levels, called trophic levels, a given ecosystem can have. In fact, most food chains are made up of only three or four feeding levels. An ocean ecosystem, for example, may have shrimp that feed on plankton, small fish that eat the shrimp, and larger fish and mammals that eat the fish. Each trophic level has in it fewer animals than the level below. In fact, there are simply too few animals at the top of the food chain to sustain a group of animals one level higher that feeds only on them

Lesson 3: Select Project
Refine Investigation Questions

Purpose: To select and refine investigation questions to help determine the final project goals.

Outcome: Students will narrow the class project topic and will determine investigable questions appropriate for their grade and time for the project.

Reference: Please see Burrowing Owl portfolio page 4.

Time: Varies and is dependent on how much preliminary research students have to do to narrow the project focus and refine the questions. Suggested time frame: 2-5 class periods.

Materials: Sentence strips
Marking pens
Disney Planet Challenge Handbook:
Page 6, Teacher Page--Selecting Questions to Investigate, Choosing the Project
Page 7, Student Page--Selecting Questions for Our Project

Standards: *English Language Arts*
(Speaking and Listening)
Clarify and support spoken ideas with evidence and examples.
(Reading Comprehension)
Discern main ideas and concepts presented in texts; identify and assess evidence that supports those ideas. Draw inferences, conclusions, or generalizations about text and support them with textual evidence and prior knowledge.
(Writing Strategies)
Establish a topic, important ideas, or events in chronological order. Provide details and transitional expressions that link one paragraph to another in a clear line of thought. Offer a concluding paragraph that summarizes important ideas and details.
Science, Mathematics and History Social Science
Depends on the content of the research

Advanced Preparation:

1. Gather the list of possible topics and people to contact from Lesson 1 that was generated in class.

2. Make a large K-W-L chart.

Procedure:

1. Explain to students that they will narrow their topic and generate possible questions they want to investigate. Explain that the goal for the project should represent something the class can do that will have a lasting impact on the school/community, should be something the class can participate in over a period of time, and should address an important environmental issue or concern in the school/community.

2. Re-introduce the chart from Lesson 1 that contained possible ideas to investigate and people to contact. Ask students to review their ideas, think about what they learned in Lesson 2 about the science in their topic, and identify 4-6 ideas that they think will help them narrow the topic and help them develop questions to investigate.

Teacher Note: Guide the selection by facilitating the conversation so that the students' ideas for preliminary research/gathering of information are doable and reasonable.

3. Structure a limited time and effort for the students to learn more about the topic (for example, see the Burrowing Owl Portfolio Link above).

4. Use a K-W-L Chart and ask students to complete the "W" section of the chart by having students respond to the following prompt: "What do we already know now about this topic?" Record student responses in the "W" section of the K-W-L chart.

5. Refer to the Disney Planet Challenge Handbook, page 6, Teacher Page Choosing the Project, Selecting Questions to Investigate. Use page 4 to jot notes as students choose their project and questions.

*Teacher Note: A K-W-L chart displays information students already **K**now about a topic; what they **W**ant to Know; and what they **L**earned throughout the lesson or unit of study. The K-W-L chart will be referenced in Lesson 7 when students summarize their learning and record it in the "L" column.*

6. Distribute the **Disney Planet Challenge Handbook**, **page 7, Student Page, Selecting Questions for Our Project**. Have groups of students generate questions they want to explore. Prompt students to record their questions on the top of page 7.

7. Use the following process to help students select questions to investigate.

    - Distribute two sentence strips and a marker to each group. Ask the groups to transfer their two best questions to two sentence strips (one question per strip).

- Have each group share their two sentence strips. Post the strips so that the class can see them. Facilitate a discussion to clump questions that are alike, and then ask the class to select the final questions to use for the investigation.

Teacher Note: The project should consist of several questions that the class wants to answer about the topic. Help students choose questions that provide an opportunity for them to "go deep" in their understanding of the topic. If appropriate, include questions that can be explored through a scientific experiment. (See Lesson 6).

8. Ask students to write the final questions on the bottom of student page 7. Record the questions under the "W" part of the K-W-L chart.

Teacher Note:

See an example of narrowing questions in the Burrowing Owls Portfolio. PLEASE SEE Burrowing Owl portfolio page 4.
From their initial research, the students came up with the following questions:
•How can we protect the burrowing owls and other raptors in the Sacramento watershed area?
•How can we build a burrowing owl habitat?
•What does the government data say about the burrowing owl population?
•How has the population of Elk Grove changed over the years?
•Has human population change hurt the owls?
•What else can we do to save the burrowing owl?
•Do any other raptors need our help?

It is important to keep the project focused. A successful project focuses on one purpose and the students put their energy and time into attaining that purpose. The students focused their questions on the following:

•What does the government data say about the burrowing owl population?
•Has development in Elk Grove hurt the burrowing owl?
•What can we do to protect the burrowing owls
•How can we increase the burrowing owl population in the Sacramento watershed area?
•How can artificial habitats be built that will attract the burrowing owls and help them reproduce?

From these questions, the students were able to define the goal of their project and set up an action plan.

Lesson 4: Determine Project Goals and Action Plan

Purpose: To determine the goals for the Disney Planet Challenge Class Project and develop an Action Plan for the selected topic.

Outcome:
1. Students will determine the goal for the project, the evidence they will use to know if the goal was met, and explain how meeting the goal can make a difference in their school or community.
2. Students will develop an action plan and timeline to meet the goals of the project.

Reference: Please see Our Starfish portfolio page 4.

Time:

Part I:	Goals of the Project	35 minutes
Part II:	Action Plan	45 minutes

Complete all at once or on two different class periods.

Materials:
Chart Paper
Markers
Disney Planet Challenge Handbook:
Page 8, Teacher Page--Determining a Goal,
Page 9, Student Page--Determining Our Goal
Page 10, Teacher Page--Planning the Project
Page 11, Student Page--Planning the Project
Page 12, Student Page--Planning the Project
Page 13, Student Page--Planning the Project (Personal, Group or Class Timeline)

Standards: Review standards for English-language arts, science, social studies and mathematics to align with actions for this part of the project. See Foreword for suggestions.

Advanced Preparation:
1. Consider the local, state, or federal resources that are related to this project and be ready to share information with students.
2. Have the K-W-L chart from Lesson 3 available for review.

Procedure

Part I: Goals of the Project 35 minutes

1. Explain to students that they will now determine a clear goal for the project.

2. Remind students that the goal for the project should represent something the class can do that will have a lasting impact on the school/community, should be something the class can participate in over a period of time, and should address an important environmental issue or concern in the school/community.

3. Review the top choice the class selected for the project and the selected questions generated in Lesson 3.

4. Refer to the **Disney Planet Challenge Handbook, page 8, Teacher Page--Determining a Goal**. Ask students what they would like to accomplish in the project. Why is this project important? What evidence will students use to analyze the impact of the project? How will this goal impact the students, school, parents and/or community? What are the benefits of this project? Jot notes on this page as you facilitate a discussion with your students.

Teacher Note: Keep the goal realistic, meaningful, and relevant to the project. An example of a goal is, "Our environmental goal is to create a wetlands education program that would be used to teach other kids about wetlands and their importance in our community." The project needs a specific focus and long term impact. The project should be more than a one- time event. Involve others in the project. Make sure the project is doable in a reasonable amount of time.

5. Refer students to the **Disney Planet Challenge Handbook, page 9, Student Page--Determining Our Goals.** Ask students if there are additional support goals that are part of their big goal. (*e.g. train 5th graders to be docents to lead student tours of the wetlands and conduct science investigations with students on the tours).* Ask students to also record these goals on page 9.

6. Ask students to consider what it would "look like" if their goals were accomplished. Allow students to share with their partner or table group what they envision. What evidence will they use to analyze the impact of the project?

7. Ask students to record their "evidence" ideas on page 9 by completing the prompt: "The evidence we will use to know that we met our goal is…"

Teacher Note: Make sure the project is doable in a reasonable amount of time. Evidence should relate to concrete actions so that students will be able to measure completion. For example: "The evidence we will use to know that we met our goal: 1) the production of an information booklet; 2) trained 5th grade tour leaders; and, 3) tours offered to school and community members.

PLEASE SEE Burrowing Owl portfolio page 5.

8. Discuss with students how this goal will make a difference and will last over time and have long-term impact. Ask students to record these ideas on page 9.

Teacher Note: Consider how the class might involve others in the project (speakers, local or regional organizations and resources, other classes and teachers, etc.).

Part II: Action Plan 45 minutes

Teacher Note: The Action Plan should be a set of concrete activities students will do to accomplish goals. Use the Disney Planet Challenge, teacher page 10 and student pages 11, 12, and 13 to guide students to develop a concrete plan.

9. Refer to the **Disney Planet Challenge Handbook, page 10, Teacher Page--Planning the Project**. Review the goals and evidence to analyze impact of the project with students. Explain that students will now determine the action plan.

10. Distribute **Disney Planet Challenge Handbook, page 11, Student Page--Planning the Project.** Discuss with students the various actions that need to be done in order to accomplish their goals. Ask students to consider things to do, resources to use, equipment needed, people to contact, etc., and list them on page 11.

11. Brainstorm a list of actions and activities students will do for each of the goals. Brainstorm all the possible things that could be done and prioritize and "clump" items that go together.

12. Distribute **Disney Planet Challenge Handbook, page 12, Student Page--Planning the Project.** Ask students to complete page 12 to help them plan the activities for the project. Organize their Action Plan into the following categories: Activity, Person Responsible, Materials Needed, Due Date.

13. Distribute **Disney Planet Challenge Handbook, page 13, Student Page--Planning the Project (Personal, Group or Class Timeline).** Have students use the monthly calendar to develop a timeline of when activities will be conducted and completed. Use multiple copies of student page 13.

Teacher Note: Consider forming student Action Committees such as publicity, funding, research, historian, materials, etc., to divide the work.

Decide when in the course of the Class Project students should stop and reflect on their progress. Have students do quick writes throughout to help them with their final reflection. Record reflections in student journal or as a class on chart paper.

Activities to Complete the Project (Example)

Activity	Persons Responsible	Materials Needed	Due Date
Research facts about the wetlands and write fact sheets. Read, watch videos, listen to speakers.	Teacher will help collect materials. Contact expert for additional information. All students will write fact sheets.	Books, brochures, videos on wetlands. Internet information on wetlands.	October 30, 2009
Make a personal wetlands vocabulary picture dictionary. Look for word meaning and pictures on the Internet.	All students Teacher will review for accuracy.	List of vocabulary	October 30, 2009
Take a tour of the wetlands with a local people that have background in wetlands and review their materials. Invite them to partner with our class on project.	Students will contact speaker and with the help of the teacher, set up field trip and bus.	None	Fall 2009
Conduct science investigations: 1. Properties of water 2. Test water samples from different parts of the wetlands.	Teacher gathers materials and teaches lessons. All students will do investigations	Wax paper, eye droppers, cups with water, straws, etc.	Fall 2009
Create program to teach other students about the wetlands, (e.g., go over fact sheets, show videos about wetlands, do science investigations with students, and have them take a test to see if they know important information.) Take students on a tour so they can see what a tour is about before becoming docents.	Teacher Make committees with class: Science Committee Tour Committee Presentation Committee	Materials created from above activities.	December 2009-January 2010
Have the students take other classes on tours. Conduct at least 10 tours.	Student committees	Wetland program materials	February 2010
Revise materials that we created for the program and publish for future classes.	Teacher and students	Wetland program materials Computers	March 2010

Lesson 5: Investigate the Project--Research

Purpose: To conduct additional research on the selected topic for the Disney Planet Challenge project. Research is used to gather information from any reliable source (e.g., books, Internet, newspapers/magazines, field trips, interviews, local, state, and federal agencies). Research is also used to implement the action plan.

Outcome: Students will read, research, and record information related to the project; they will implement the action plan.

Reference: Please see Recycling Batteries portfolio page 3.

Time: This portion of the project will take place over time and during multiple class periods.

Materials: Books, newspapers, magazines, Internet resources, local speakers, and materials from organizations related to topic.
Disney Planet Challenge Handbook:
Page 14, Teacher Page--Implementing the Project
Page 15, Student Page--Implementing the Project, Activity Record Log
Page 16, Student Page--Implementing the Project, Pre-project Observations
Page 17, Student Page--Implementing the Project, Information You Want to Remember

Standards: Review standards for English-language arts, science, social studies and mathematics to align with actions for this part of the project. See Foreword for suggestions.

Advanced Preparation:

1. Collect materials from local, state, or federal resources that are related to this project and have available for students.

2. Review Teacher Resource and decide if any of the strategies are appropriate for students.

Procedure

1. Refer to the **Disney Planet Challenge Handbook, page 14, Teacher Page--Implementing the Project.** Review with students the Goals and Action Plan for the project. Explain to the students that they will now begin their action plan. What are the activities noted on the Action Plan? Are there multiple things that need to be done during the same period to

complete activities? What additional information do they need to find out? Use page 14 to guide the implementation of the class project.

2. Distribute **Disney Planet Challenge Handbook, page 15, Student Page--Implementing the Project, Activity Record Log.** Remind students to record the activities as they do them and complete the chart. Have students enter their projected outcomes. As students complete activities have students enter the actual outcomes.

3. Teacher Note: Rather than having every student complete student page 15, consider having different groups monitor different activities, or completing a large class chart of the activities.

4. Distribute **Disney Planet Challenge Handbook, page 16, Student Page--Implementing the Project, Pre-Project Observations.** Explain that students will be spending several class periods conducting additional research on their project and implementing their action plan. Have students conduct a pre-project observation to collect base-line data. Encourage students to sketch/write about the issue before it is addressed in the project.

5. Teacher Note: See Lesson 6 for ideas about making quality observations.

6. Begin the action plan by displaying the collected resources for the students. Review what is available for students to read or view. Decide the best way to divide the information for students to research. Distribute **Disney Planet Challenge Handbook, page 17--Student Page, Implementing the Project, Information You Want to Remember.** Encourage students to record the information they are learning.

Teacher's Note: If necessary, use strategies from Teacher Resource to help students make sense of the content readings.

7. If the class has not already decided on work groups, facilitate a discussion to group students into appropriate work groups. For example, in the wetland project, some students might be grouped as tour leaders; some may work on a publicity committee; some might work on the letter writing campaigns. PLEASE SEE Our Starfish portfolio page 12.

8. Continue to have students use the **Disney Planet Challenge Handbook, page 15--Student Page, Implementing the Project, Activity Record Log.** Periodically provide time for students or groups to share information with the class. Display information for others to see and to have available during the course of implementing the project.

Teacher Note: If the project lends itself to scientific experimentation, incorporate Lesson 6 as part of the project's activities.

Teacher Resource
Strategies to Help Students Make Sense of Content Readings

1. Before reading, select 10 –15 words that students will need to know before reading. Give each student a piece of paper and ask him/her to fold it into fourths. Review each word with students and ask them to record the following information in each box:
   a. Write the word and any appropriate prefix or root word definitions.
   b. Define the word in as many ways as possible.
   c. Illustrate what the word means and/or draw an example of how the word is used in context.
   d. Write a number 1-4 (4 is the highest) to rate student understanding of the word.
   e. Review student papers and provide further instruction on vocabulary for students before reading.
   f. Create a word wall with appropriate vocabulary.

2. Introduce the concept to students, writing the word on the chalkboard. Ask students to generate a list of other words or phrases that come to mind when they think of the target word. The words may come from the Word Wall.
   a. Lead a class discussion on students' responses.
   b. Write a list of words from their responses that fit appropriately with the target word on the chalkboard.
   c. Direct students to find a definition of the word in the textbook, glossary, or dictionary.
   d. Read the definition of the target word and direct students to compare their generated list of words with the definition.
   e. Direct students to look over the words on the board very carefully and with the definition in mind to decide on at least three words from the list that will help them remember the target word.
   f. Tell students to write their selected words in the concept wheel (a circle with four sections) to help them remember the concept
   g. Ask students to write a sentence using the words in the concept wheel.
   h. Give students 4x6 sticky-notes. As students read, ask them to record ideas they are learning from their readings. Each Post-It should contain one idea. After reading ask students to share their sticky-notes. Clump or group ideas that go together and order the sticky-notes into a sequence that best describes the content they read. Ask students to re-write the information into paragraphs that go together.

3. Ask students to use the following frames to record what they are thinking and learning as they read.

   "I know something about this from _____ ."
   "Two questions I have about this section are ___ ."
   "I'm not sure what this is about, but I think it may mean ____ ."
   "These pictures help me understand because ___ ."

"The big idea here is ___ ."
"I'm confused about ___ ."
"Now I understand ___ ."
"I learned ____ ."

4. Ask students to fold a paper into fourths and give these headings to the sections: Predict, Clarify, Summarize, Questions

   a. Explain to students that as they read, they are to record related ideas in each box (written or illustrations).

   b. Predict--What do they predict the section will be about? How do they think this information will help them understand more about the topic?
   "I predict that ___ because ___ ."
   "This is like ____ ."
   "This is going to be about ___ ."

   c. Clarify--What information did they read about that helped clarify what they didn't quite understand?
   "I'll reread this because ___ ."
   "This is the same as ___ ."
   "This is different because ___ ."
   "I'd like to talk to someone about ___ ."
   "I thought I knew this, but now I understand ____ ."

   d. Summarize--After reading a "chunk" of material, what are the key ideas in that section?
   "I learned that ___ ."
   "I can picture ___ ."
   "What I understand about this reading so far is ___ ."

   e. Questions--What questions do students still have about the topic?
   "A question I have about this is ___ ."
   "I wonder if ___ ."
   "Two questions I have about this section are ___ ."

5. As students read, ask them to create a visual map with words and pictures of what they are learning. Connect ideas that go together. Share maps with other students and add to maps with new information learned from others.

6. Explain to students that as they read a selection they are to think about words, phrases, or sentences that "jump out" at them and help them make meaning or understand the text.

a. Provide each student with a highlighter pen and ask him/her to highlight the parts that were significant in helping him/her learn more about the topic.
b. Ask students to share their ‘golden lines” and explain how the golden lines helped them understand.
c. Summarize the text using the golden lines.

Lesson 6:
Investigate the Project: Conduct an Experiment

Teacher Note: *Remember that the Disney Planet Challenge Project includes an action project appropriate to the content of the goal. One of the activities related to the project may include an experiment with variables and controls. If the Class Project has a question(s) that can be answered by an experiment, use this lesson to build students' experimental design skills.*

Purpose: To provide a series of activities to help students understand each stage of the experimental design process.

Outcome: Students will be able to conduct an experiment related to their Disney Planet Challenge Class Project.

Reference: Please see Recycling Batteries portfolio page 4.

Time: This lesson will be taught over several days.

Teacher Note: The activities in this lesson will guide your students in doing their experiment. Only the observation piece is "generic" as written; the rest should be tied directly to your project. If you wish, you can preview the observation piece and apply those skills directly to the project. The amount of time needed to plan, conduct, and summarize the experiment will depend on the complexity of the experiment(s).

Part I:	Observations (if done as a generic lesson)	45 minutes
Part II:	Developing a Testable Question	
Part III:	The Experimental Design	
Part IV	Data Collection	
Part V:	Graphing Results	
Part VI:	Making Summary Statements	
Part VII:	Drawing Conclusions	

Materials:
Chart paper
Markers
Objects to observe (e.g., leaves, pictures, rocks)
Hand lenses
Measuring tools (e.g., ruler, graduated cylinder, thermometer)
Other science materials related to the project
Disney Planet Challenge Handbook:
Page 18, Teacher Page--Implementing the Project, Conducting the Experiments
Page 19, Student Page--Conducting Experiments
Page 20, Student Page--Conducting Experiments

Sentence Strips

Standards:

4-5 INQA
Question Scientific *investigation*s involve asking and answering *questions* and comparing the answers with *evidence* from the real world.
4-5 INQB
Investigate Scientists plan and conduct different kinds of *investigation*s, depending on the *questions* they are trying to answer. Types of *investigation*s include systematic *observations* and descriptions, *field studies*, *models*, and *open-ended explorations* as well as *controlled experiments*.
4-5 INQC
Investigate An *experiment* involves a *comparison*. For an *experiment* to be valid and fair, all of the things that can possibly change the outcome of the *experiment* should be kept the same, if possible.
4-5 INQD
Investigate *Investigation*s involve systematic collection and recording of relevant *observations* and data.
4-5 INQE
Investigate Repeated *trials* are necessary for *reliability*.
4-5 INQF
Models A scientific *model* is a simplified representation of an object, event, *system*, or process created to understand some aspect of the *natural world*. When learning from a *model,* it is important to realize that the *model* is not exactly the same as the thing being modeled.
4-5 INQG
Explain Scientific explanations emphasize *evidence*, have logically consistent arguments, and use known scientific *principles*, *model*s, and *theories*. *Generate* a conclusion from a scientific *investigation* and show how the conclusion is supported by *evidence* and other scientific *principles*.*c
4-5 INQH
Communicate Scientists communicate the results of their *investigation*s verbally and in writing. They review and ask *questions* about the results of other scientists' work.
4-5 INQI
Intellectual Honesty Scientists report the results of their *investigation*s honestly, even when those results show their predictions were wrong or when they cannot *explain* the results**.**

Advanced Preparation: Collect all hands-on materials related to investigation.

Procedure

Part I: Observations (45 minutes)

1. Explain to students that they will participate in a series of activities to experience the experimental design process, or "work like a scientist." These activities will help them with collecting additional information related to their project.

2. Ask students to tell you what they think a scientist does. Chart responses. Responses will probably include ideas such as do research, conduct experiments, work with chemicals, etc. Explain to students that scientists often try to answer a question with an experiment.

3. Explain that scientists often begin their understanding of a topic by making observations and that as good "student scientists," students need to develop their skills of observation.

4. Distribute an assortment of objects for observations (e.g., leaves, rocks, or shells) and hand lenses to students. Make available measuring tools for students to use as they observe their object. Ask students to work with a partner and make as many observations as they can about their object and record what they observed.

Teacher Note: If possible, ask students to make observations on something related to the project, e.g., water that was collected from a local river they are considering for protection. Otherwise, this activity will teach students how to make scientific observations for future use in their Disney Planet Challenge project.

5. Ask students to share their observations and chart their responses. Clump responses into these groups, without labeling why they were clumped: those observations made with sight (color, shape, etc.), those made with other senses (texture, smell, taste--if appropriate-- sound), those that include a quantitative descriptor (words related to size, measurement, mass, quantity, etc.) and those that contain inferences. (e.g., it was eroded).

6. Ask students to discuss why the clumping was done as it was. Elicit from the students the "labels" for the clumps. Explain to students that a quality scientific observation is:

   - qualitative (i.e., the qualities or characteristics of what's being observed, made through any of the five senses--touch, sight, hear, taste, smell);
   - quantitative (i.e., use of tools to measure, rulers, scales, thermometer); and,
   - does not include inferences, opinions, or explanations.

7. Explain to students that observational writing, when precise and accurate, helps scientists describe the world around them and build on the work of others. Accurate observational writing represents the observations in the most direct way possible using words and phrases that are not subject to interpretation or explanation.

Teacher Note: If the above activity was conducted out of context of the project, before going on to the next step, students should make observations related to the project and the remainder of the investigation should focus on the content of the project. Have students use the Disney Planet Challenge Handbook, Student page 16, to record their observations. If they already recorded their observations in Lesson 5, ask the students to review what they wrote/drew and determine if it needs revision based on their new understanding of what makes a quality observation.

Part II: Developing a Testable Question

8. Display the class project questions. Ask the class to discuss which could be answered by conducting an experiment. Choose those that are testable and indicate a cause-and-effect relationship. For example, what is the effect of pollution on the number of primary consumers in the food chain?

9. Explain to students they will use these questions as the basis of their scientific experiment(s). The first thing that they need to do is to narrow the focus of their question by identifying factors that can be changed (variables).

10. Based on the observations (see note below), ask students to brainstorm things they could change or vary in an experiment (e.g., different levels of pollution; different area where they collect their data). Record ideas on a class chart.

Teacher Note: If students made observations about their project, they can review these observations to determine ideas for step 10 and 11. If they have NOT made observations of their project, they need to do so before they can refine the question(s) for the experiment(s).

11. Based on the observations (see note above), ask students to brainstorm things they could measure or observe in an experiment (e.g., students measure the dissolved oxygen in the water, measure temperature of the water at different intervals). Record ideas on a class chart.

12. As a class, choose one thing from the list of things to change and one thing from the list to measure. The other ideas could be used for additional experiments if time permits.

13. Ask students to now develop a testable question by completing this prompt: “How will changing the amount of pollution affect the number of primary consumers)?”

14. Distribute the **Disney Planet Challenge Handbook, Student Page 19--Conducting the Experiment.** Have students record their testable question on page 19.

Teacher Note: If there are several questions with which students will experiment, use additional pages 19 and 20 for each question.

15. Help students develop a hypothesis (a cause-and-effect relationship) by changing their testable question into an "if/then" statement. For example: if the amount of pollution is decreased, the number of primary consumers will increase.

Teacher Note: A guess is not the same a prediction or a hypothesis. A guess does not have a basis in prior experience. A prediction is based on prior experiences and repeated observations. A hypothesis is a specific prediction expressed as an "if/then" statement. A hypothesis indicates the variable to be tested.

Part III: The Experimental Design

16. Explain to students that they will design a plan to test the hypothesis. Note that the various steps for the plan include materials, steps for the experiment, what will be measured, and how data is collected and recorded.

Teacher Note: In a fair test, only one variable is tested at a time. All other factors are held constant or controlled. In this example, the location of water testing is kept constant.

The variable that is changed is called the manipulated variable (or the independent variable); the effect that is measured is called the responding variable (or the dependent variable). In this example, amount of pollution *is the manipulated variable and the number of primary consumers is the responding variable*.

17. In small groups ask students to decide on a procedure for the experiment: What sequential steps do they need to do? What will they control? What will they test? How will they measure the results?

Teacher Note: If students are having difficulty writing a plan for the experiment provide additional opportunities to write sequential procedures, e.g., steps to making a peanut butter and jelly sandwich, or directions to the lunch room, etc.

18. Have groups share their ideas and decide on a sequential plan that they will follow for the experiment. Chart the steps.

19. Ask students to discuss what materials they will need for the experiment. Make a class list.

Part IV Data Collection

Teacher Note: At this point, students should be conducting the experiment and collecting real data. A recommendation is to help students understand the use of a T-chart for recording data before they begin to collect the data.

20. Explain to students that organizing data is an important science thinking skill. There are many ways to organize. A particularly helpful method for charting information from a scientific experiment is called the T-chart. Explain that in a T-chart (which looks like the letter "T"), is titled with the effect of the manipulated variable on the responding variable (e.g., The Effect of Pollution on the Number of Primary Consumers). The data is written so that the manipulated variable data is recorded in the left-hand column and the responding variable data is written in the right-hand column.

Teacher Note: Eventually students should be able to develop their own format for recording data. The T-chart is a good basic way to help them think about organizing their data.

21. Ask students to consider if they need to do several trials and calculate an average for their data. In this case their T-chart might look like this:

The Effect of Pollution on the Number of Primary Consumers

	Number of Primary Consumers		
Amount of Pollution (parts/million)	Animal Name	Animal Name	Animal Name

22. Ask students to record their data on Student Page 19 or to create a data chart of their own. If students are working in groups have them also record their data on a whiteboard to share with the class.

23. Display the charts or white boards and ask students to share their data. Compare and contrast the data collected. Ask students to discuss similarities and differences in the data; reasons and possible variables that might have caused differences in the data. PLEASE SEE Recycling Batteries portfolio page 5, and Burrowing Owl portfolio page 8.

Part IV: Graphing Results

24. Explain to students that data from the T-chart (or other data collection method) can be easily graphed. Tell students that graphing is a type of communication that shows the relationships between two variables in the experiment.

Teacher Note: Three major types of graphs are commonly used to indicate relationships:

Bar graphs are used to show the relationships between a discontinuous variable and a continuous variable. A discontinuous variable is one for which there is not intermediate values. A continuous variable has intermediate values. For example, if you were to graph the annual rainfall in several cities, the cities are discontinuous, while the annual time frame is continuous. Pictographs, using pictures to show the relationships, are types of bar graphs. Histograms, which show the frequency of how often something occurs, are also a type of bar graph.

Circle graphs are also called pie graphs. These types of graphs compare parts to the whole and thus are good for representing percentages. Like bar graphs, circle graphs also compare discontinuous variables and continuous variables. Circle graphs are based on a fraction of a circle. Assign each set of data a fraction and multiply by 360 degrees. This provides the total degrees for each data sector. The circle can be drawn with a compass and a protractor can be used to measure the angle for the sector line. If you have a computer program for pie charts, use it!

Line graphs, also called coordinate and plot graphs, show the relationship between two continuous variables. An example is a graph that shows the relationship between the height of a person and his/her age. For line graphs, the data points should be connected by a line. Sometimes this results in a line that is straight. Other times, the resultant line is curved. Sometimes the data points are such that one cannot draw a smooth line to connect all of the points. In this case, help students to learn to draw the "best fit" line.

25. Distribute the **Disney Planet Challenge Handbook, Student Page 20,** graph paper, graph chart paper or white boards to students. Explain to students that they will use the data collected in Part IV, choose an appropriate graph to display the data, and make the graph.

26. Use the following graphing rules to assist students with the appropriate way to graph data. *If necessary make the graph together as a whole class, modeling each step.*

a. The manipulated variable or independent variable is on the x axis with the numbers increasing from left to right.
b. The responding variable or dependent variable is on the y axis with the numbers increasing from bottom to top.
c. The graph is labeled with a descriptive name, which indicates the relationship of the variables.
d. Each axis is labeled with the name of the variable.
e. Units of measure are labeled on the axis and the intervals along each axis should be evenly spaced.
f. The scale for the two axes does not have to be the same—and the scale should be selected for clarity.
g. Numbers on the axis are positioned on the grid line.

27. Ask students to share why they chose a particular graph (e.g., we used a line graph because it showed change over time) and to share what the graph describes about the relationship

between the variables (e.g., as the amount of pesticide increases, the number of species decreases).

28. Post the graphs. Compare graphs if students have different representations or if groups have done different experiments. PLEASE SEE Burrowing Owl portfolio page9.

Part VI Summary Statements

Teacher Note: Writing summary statements is often a step left out of the experimental design process. Typically, students write a summary statement as if it were their conclusion, or do not adequately observe the relationships evident in the data before writing a conclusion.

Modeled writing is a "think aloud" demonstration of the writing process. The teacher demonstrates how a person goes about the process of writing through verbalization and a description of his/her process.

29. On chart paper, use a "think aloud" to model how students might write a summary statement. The summary statements should describe only what is evidenced by the graph, summarize the data without inferences or conclusions, and should provide results related to the hypothesis. A summary statement describes the relationship between variables on a graph. It should tell what happens to the responding variable as the manipulated variable changes.

30. Ask students to look at their graph and write several summary statements on their chart paper (or white board) and on Student Page 20.

Part VII: Drawing Conclusions

Teacher Note: The conclusion is a synthesis of the summary statements and is based on evidence and a logical argument. It should wrap up the cause-and-effect relationship, as well as discuss any unresolved questions or error analysis of the data. The conclusion should answer the original questions, or explain why it cannot be answered at this time.

Because the experiment(s) are PART of the project, consider having students develop draft conclusions that will be supported (or refuted) by other data that they collect from their research or other activities.

If groups did different experiments (for example, different variables that might affect the quality of the water), the conclusion should be a synthesis of the various experiments.

31. Explain to students that they are ready to draw preliminary conclusions based on the patterns and relationships found in the data from the summary statements.

32. Ask students to review their summary statements and write a preliminary conclusion on sentence strips. The conclusion should relate to their question.

Teacher Note: Determine if several experiments need to be synthesized for a more accurate conclusion. If so, have students link their preliminary conclusions into a coherent conclusion for the total findings.

33. Ask students to share their conclusion sentence strips. Ask them to think about the next question they might ask.

34. Have students add their findings to the K-W-L chart AND the Activity Log.

Teacher Note: Save the Conclusion Sentence Strips for Lesson 7 when students summarize findings from all parts of the project.

Teacher Resource
Experimental Design Processes Notes

Science Experiments are usually documented in a formal report that details the experiment. Often, the report makes references to "raw" notes that were kept in a science log. Although the steps of an experiment are not necessarily sequential, the report is usually written with these components:

Process	Activity
Observation	Observations may be qualitative and/or quantitative using a variety of tools to measure. Observational writing is objective and free of inference and opinion.
Question	Use observations to determine the question. The purpose of the experiment should be in the form a question that can be tested through experimentation. The question should arise from the observations as something that was a discrepant event, or something that sparked the interest/curiosity of the experimenter.
Hypothesis	Develop the hypothesis from the question. It is more than an "educated guess". It must be testable using variables and controls. The hypothesis should be stated in an if/then statement.
Procedure	The procedure is the detailed steps of the experiment and must be clear, without little or no interpretation of what to do next. The procedure should include the list of materials and how they were used. Discussion of Fair Test using control, manipulated (independent) variable, responding (dependent) variable.
Data Collection Graphing	Observations should be written using the criteria for observational writing. Measurements need to be part of the data collection. The data should be represented in charts or tables that are clearly labeled and contain relevant information. If variables are used in the experiment, a T-chart is the chart of choice. The data collected should also be represented in a pictorial form through a graph. The graph can be a bar graph, pie graph or point (coordinate) graph. The graph should clearly show the relationship between the variables.
Summary Statements	Summary statements should describe the data; only data can be included in a summary statement. This statement should also contain as much quantitative information as possible, identifying things like the average, mean, mode, or range, as well as the data that seems to lie outside of what was expected. The summary statements are based on evidence from the data.
Conclusion	The conclusion is based on the summary statements. It should wrap up the cause-and-effect relationship as well as discuss any unresolved questions or error analysis of the data. The conclusion should answer the Problem/Question or explain why it cannot be answered at this time. Synthesizing the evidence from all parts of the experiment go into a concluding statement. Concluding statements from the experiment(s) should be added to other concluding statements for the project.
Generalization/Application	Broadening the conclusion to other situations uses the conclusion to explain or apply to a new area. Generalizations are usually made after repeated trials and are based on expectations from these previous experiences.

Lesson 7:
Synthesizing Findings: Reflect On Process

Purpose: To summarize the findings from the project and reflect and evaluate the project's impact-and long-term benefit

Outcome: Students will summarize their findings and reflect and evaluate the goals at the completion of project.

Reference: Please see Recycling Batteries portfolio page 15, and Our Starfish portfolio page 16.

Time: Several class periods over a couple of weeks
Part I Drawing Conclusions
Part II Evaluating the Impact of the Project

Materials: Chart paper
Markers
Disney Planet Challenge Handbook:
Page 22, Teacher Page--Evaluate the Project
Page 23, Student Page--Evaluate the Project
Page 24, Teacher Page--Teacher Reflection
Page 25, Student Page--Reflections

Standards: Review standards for English-language arts, science, social studies and mathematics to align with actions for this part of the project.

Advanced Preparation: Have students gather their conclusions (e.g., sentence strips from Lesson 6; comments/learning from Lesson 5), as well as from their Activity Logs, previous reflections, and any other prompts that were used to synthesize information.

Procedure

Part I Drawing Conclusions

1. Congratulate students for their efforts and for their hard work. Explain to students that now that the investigation portion of the project is complete, they will now have an opportunity to synthesize what they learned from the various components of the project and determine their major findings and learning.

2. Refer to **Disney Planet Challenge Handbook, page 22, Teacher Page--Evaluate the Project.** Distribute **Disney Planet Challenge Handbook, page 23, Student Page--Evaluate the Project.** Help students review their information and data. Have students work in groups to

organize their findings in a manner that others can understand. Help students document their results, e.g., amount of money raised, energy saved, cans recycled. Use Activity Logs, notes from research, preliminary conclusion sentence strips, reflections etc.

Teacher Note: If students have worked in committees to gather information, have each committee report on its findings. If the class has worked as a whole group on each component, review each component and the findings.

3. When the class has had an opportunity to review the information from all groups, divide the class into small groups (preferably that worked on different parts of the project). Ask groups to brainstorm 3-5 major things you learned that you think others would want to know?

4. Have each group share their ideas, then build consensus for the 3-5 major findings that will be used in the portfolio.

Part II Evaluating the Impact of the Project

5. In small groups, have students reflect on the impact of the project. Use the following questions as discussion prompts:
   - What was the overall effect of the project?
   - What were some of the challenges and successes observed through this project?
   - What were some of the educational benefits of doing this project?
   - What is the long-term environmental benefit for students, parents, and/or the community as result of doing this project?
   - How have students grown/changed as a result of their participation? What responsible actions did they do, will continue to do now?
   - What are some possible next steps?

Teacher Note: Consider dividing these questions among the groups, and having groups report on their discussion. Also consider sharing your teacher reflections with the students ***Disney Planet Challenge Handbook page 24, Teacher Page--Teacher Reflection.***

6. Ask students refer to **Disney Planet Challenge Handbook, page 25, Student Page--Reflections.** Have each student complete his/her individual final reflection.

Lesson 8: Prepare Portfolio

Purpose: To provide information to guide student in putting the class project portfolio together; to generate other ideas for sharing their project.

Outcome: A completed portfolio

Reference: Please see Burrowing Owl portfolio, Our Starfish portfolio, and Recycling Batteries portfolio

Materials: Disney Planet Challenge Handbook:
Page 26, Teacher Page--Assemble the Class Portfolio
Page 27, Teacher Page--Portfolio Specification Checklist
Cover Sheet A
Cover Sheet B
Disney Planet Challenge Rubric
Chart paper, marking pens
11" x 17" white construction paper
Glue, tape, scissors
Several colors of construction paper
Optional--Stickers, scrapbooking materials; DVD or CD

Time: 4-6 class periods over several weeks

Standards: Review standards for English-language arts and visual and performing arts to align with actions for this part of the project.

Advanced Preparation:

1. Collect all pictures and artifacts taken/created during the project.
2. Student reflections completed; Disney Planet Challenge Handbook, page 25, Student Page--Reflections
3. Teacher reflection completed; Disney Planet Challenge Handbook, page 24, Teacher Page--Teacher Reflection.
4. Carefully review Disney Planet Challenge Handbook, page 27--Portfolio Specification Checklist.
5. Review the Presentation portion of the Disney Planet Challenge Rubric.
6. Make copies of the "10" column of the rubric for each work group of students.

7. Review the Grand Prize project portfolios on the Disney Planet Challenge website.

Teacher Note: The Class Project judges are classroom teachers, selected individuals from the different environmental agencies, and science professional development providers. They are trained to use the rubric to objectively score the projects. Thus it is important to help your students follow the rubric in assembling their portfolio.

Keep in mind that you and your students know your project best. Help your students tell their story clearly and concisely by making sure that all information included in the portfolio is linked to the project's goals and action plan.

Procedure:

1. Explain to students that now that the project is completed, it is time to put together a portfolio that shows the work that has been accomplished. Explain that it is important to tell the story of their project concisely and clearly so that it makes sense to someone else (the judges).

2. Make a large chart of the Portfolio Specification checklist (page 27 from the Handbook) and share with the students. Explain that the portfolio can only be 16 pages (excluding the cover). If possible, give student the opportunity to see portfolios from past winners that are on the Disney Planet Challenge web site.

3. Explain that the whole class will create the portfolio by working together in different work groups. Help the class decide on work groups for putting the portfolio together: Who will do the "write-up" and explanation of how the project was selected? Who will do the goal and what did the class hoped to accomplish? Who will summarize the findings?

4. Facilitate students selecting a work group.

5. Distribute the copy of the "10" column of the rubric to each work group. Ask students to review and discuss in their group what they think needs to be included in order to get a score of 10.

6. Distribute one sheet of chart paper and marking pens to each group. Have the groups chart what they think should be included in the portfolio and how it addresses one of the components on the rubric. Ask groups to share their charts.

   For Example: *Integration* *Use of Resources*
   List of books we read *Name of speakers and what they shared*
   Graphs we made *Names of local agencies who visited*
   Letters we wrote

7. Have groups use the ideas on the charts and gather the information for their portion of the portfolio: What photos, articles, and student communications would be important to include? Make sure students are aware of the guiding questions for their portion and make sure those questions are addressed in their information.

8. Have each work group share the information they have gathered and explain how each piece is important to be included in the portfolio. For example, how do the "artifacts" show that we accomplished our goal? Indicate changes from beginning to end? Demonstrate long-term impact?

9. Explain to students that the last section of the rubric is "Overall Quality of Presentation" and the rubric says "Overall presentation of portfolio is original, creative, and artistic, showing sustained effort and quality attention to detail." Ask students how they want to address this portion of the rubric-- do we want to address this portion of the rubric in our portfolio?" Chart students' ideas. Decide how the portfolio is going to be finalized.

10. Have work groups work on their portion of the portfolio and then assemble the whole portfolio. As a class, re-check the checklist to make sure that the portfolio is complete.

11. Make copies of the completed portfolio. Send one to Disney!

12. Ask students how they would like to publicize their results to the school and to the community.

Teacher Note: Spread the word about your project! Invite the local press and the media to share your class's accomplishments. Involve the entire school, family members, friends and the community. Consider sharing your project with another school, at a board meeting, or other district professional development events.