Learning Cycle One

The Right Fit

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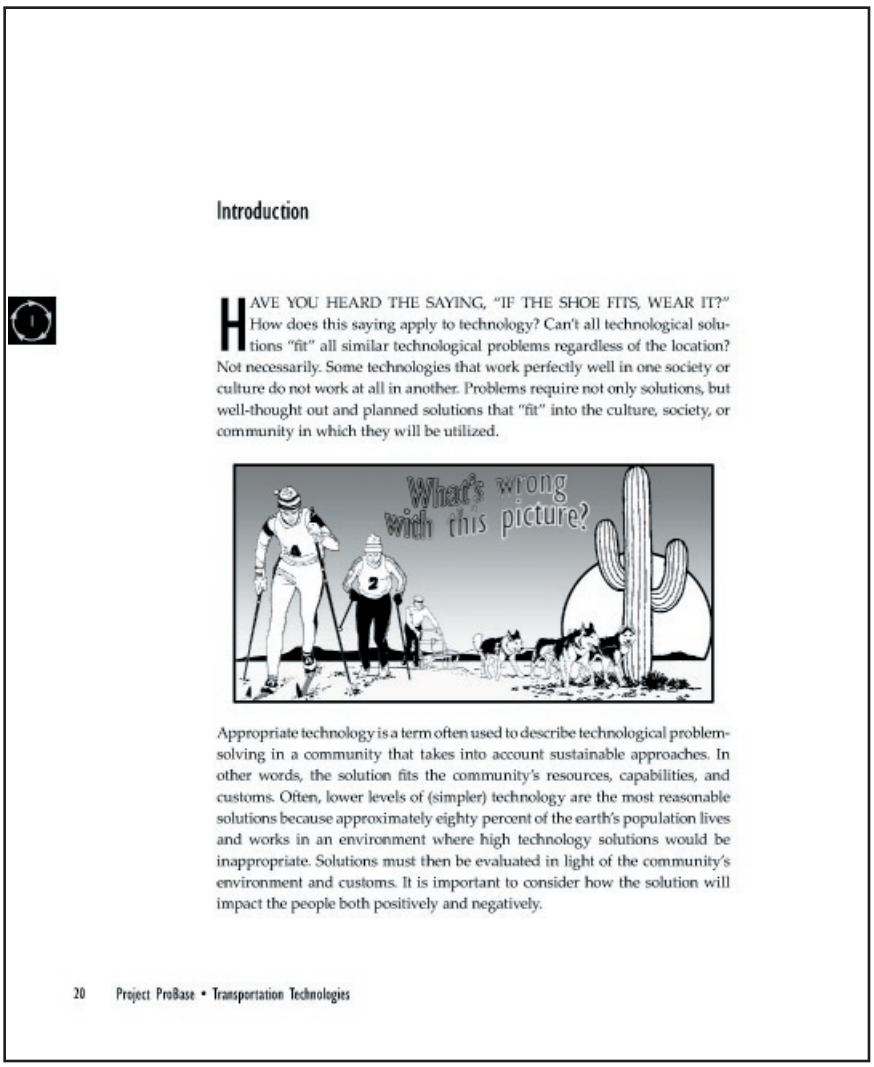
The Right Fit

Introduction

The goal for this learning cycle is to introduce students to the concept of appropriate technology. Appropriate technology is technological problem-solving that considers the needs of the community. In fact, appropriate technology takes into account sustainable approaches that fit the community's resources, capabilities, and customs. In this learning cycle, students will continue conducting research on the country that was assigned to their design team for the *Primary Challenge.*

Students should begin to understand the importance of conducting research and understanding their assigned nation's culture and environment in designing their *Primary Challenge* solution and in solving the challenges faced in this learning cycle. While working through this learning cycle, students should be continually reminded that their solution to the *Primary Challenge* should be designed and constructed so that it will be appropriate and sustainable for their assigned nation. The activities included in this learning cycle are designed to stimulate that thought process.



Introduction

HAVE YOU HEARD THE SAYING, "IF THE SHOE FITS, WEAR IT?" How does this saying apply to technology? Can't all technological solutions "fit" all similar technological problems regardless of the location? Not necessarily. Some technologies that work perfectly well in one society or culture do not work at all in another. Problems require not only solutions, but well-thought out and planned solutions that "fit" into the culture, society, or community in which they will be utilized.

Appropriate technology is a term often used to describe technological problem-solving in a community that takes into account sustainable approaches. In other words, the solution fits the community's resources, capabilities, and customs. Often, lower levels of (simpler) technology are the most reasonable solutions because approximately eighty percent of the earth's population lives and works in an environment where high technology solutions would be inappropriate. Solutions must then be evaluated in light of the community's environment and customs. It is important to consider how the solution will impact the people both positively and negatively.

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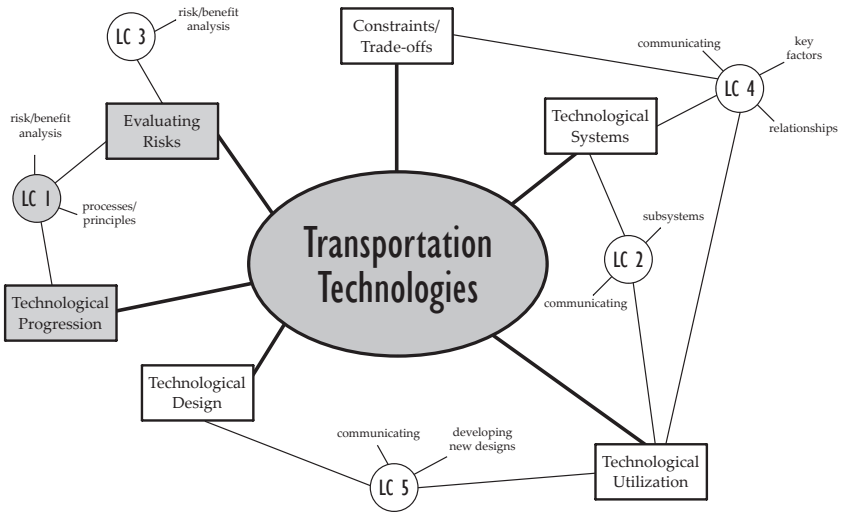
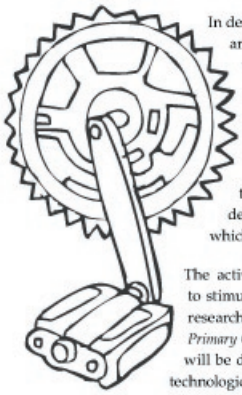
Transportation Technologies
Learning Cycle One Concept Map





In designing your *Primary Challenge* solution, you are required to research the nation that will use your completed transportation device. This research should be focused by the principles of appropriate technology. Your solution should fit into the nation's resources, capabilities, and customs. As you work through this learning cycle, try to determine how your transportation device will be sustainable to the nation in which it is implemented.

The activities in this learning cycle are designed to stimulate that thought process. You will first be researching the nation you were assigned in the *Primary Challenge*. During the *Engagement* phase, you will be designing and constructing a device that is technologically appropriate for a developing nation.

Objectives

After completing this learning cycle, you will be able to:

1. Explain the principles of appropriate technology.
2. Determine how to analyze the risks and benefits of a design.

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During the *Exploration* activity students will be researching one of the nations they were assigned for the *Primary Challenge*. This will provide them an opportunity to learn about their nation in a structured way. During the *Engagement* phase, students will be examining pedal power in designing a device to complete a domestic chore. Although the activity is not directly connected to the *Primary Challenge* problem, pedal power is a potential component that can be incorporated into their solutions.

Objectives and Essential Questions

After completing this learning cycle, students will be able to:

1. Explain the principles of appropriate technology.

Essential Question 1e: What are the fundamental processes/principles used to develop new technologies?

2. Determine how to analyze the risks and benefits of a design.

Essential Question 8a: How does a risk/benefit analysis aid the designer in addressing potential harmful effects prior to development?

Facility Requirements

This learning cycle can be completed in a regular classroom. Students will need to use computers that have Internet access to conduct their research. They will also need enough space to construct their devices.

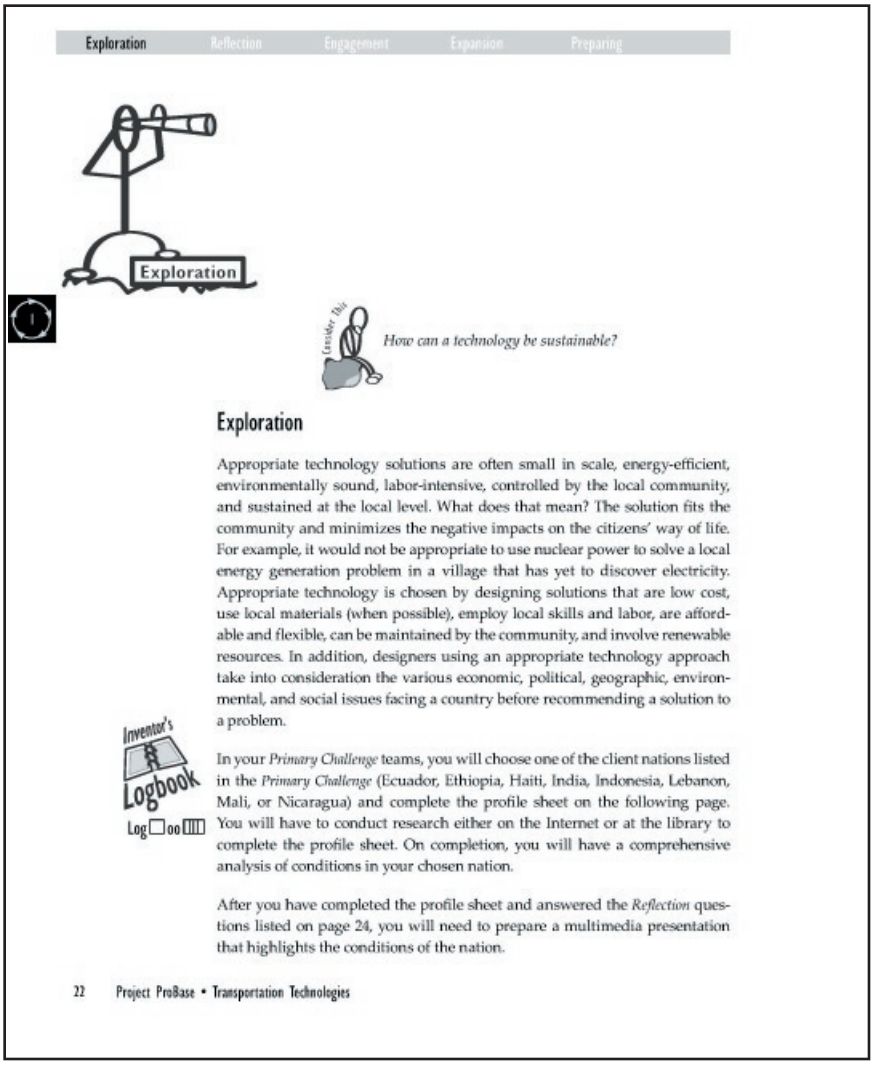
Equipment and Materials

Based on a class of 28 students:

Engagement materials will vary and may include recyclable materials or discarded objects

Optional:

Plastic buckets
Used bicycles
Wood slats
Nuts and bolts
Nails
Hammers



Exploration Reflection Engagement Expansion Preparing

Exploration

Consider This

How can a technology be sustainable?

Exploration

Appropriate technology solutions are often small in scale, energy-efficient, environmentally sound, labor-intensive, controlled by the local community, and sustained at the local level. What does that mean? The solution fits the community and minimizes the negative impacts on the citizens' way of life. For example, it would not be appropriate to use nuclear power to solve a local energy generation problem in a village that has yet to discover electricity. Appropriate technology is chosen by designing solutions that are low cost, use local materials (when possible), employ local skills and labor, are affordable and flexible, can be maintained by the community, and involve renewable resources. In addition, designers using an appropriate technology approach take into consideration the various economic, political, geographic, environmental, and social issues facing a country before recommending a solution to a problem.

Inventor's Logbook

In your *Primary Challenge* teams, you will choose one of the client nations listed in the *Primary Challenge* (Ecuador, Ethiopia, Haiti, India, Indonesia, Lebanon, Mali, or Nicaragua) and complete the profile sheet on the following page. You will have to conduct research either on the Internet or at the library to complete the profile sheet. On completion, you will have a comprehensive analysis of conditions in your chosen nation.

After you have completed the profile sheet and answered the *Reflection* questions listed on page 24, you will need to prepare a multimedia presentation that highlights the conditions of the nation.

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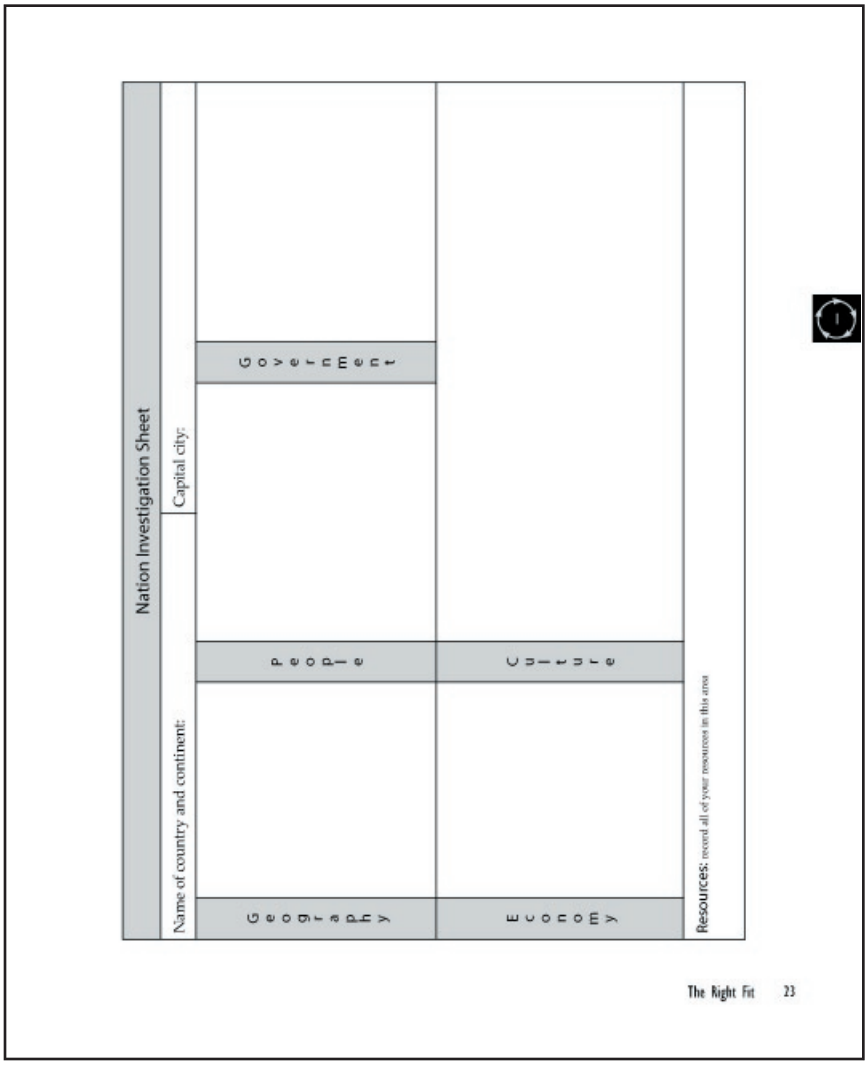
Suggested Daily Outline

Day One	Day Two	Day Three
Introduction, *Exploration*	*Exploration* *Reflection*	*Engagement*
Day Four	**Day Five**	
Engagement	*Engagement* *Preparing for the Challenge*	

Estimated number of 50-minute class periods: **5**



Nation Investigation Sheet

Name of country and continent:

Capital city:

Geography	People	Government
Economy	Culture	

Resources: record all of your resources in this area

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Exploration

In their *Primary Challenge* teams, students are asked to research their team's client nation and complete the profile sheet. This research will help the students design technologically appropriate solutions for the *Primary Challenge*. You may decide to use each team's completed profile sheet to evaluate their *Primary Challenge* solutions to determine how "appropriate" they are.

Before students can begin to make judgments on the appropriateness of technology, they must have an understanding of the region or nation in question. There are twelve common characteristics for determining the appropriateness of a given technology. These characteristics can be shared with the class to help guide each team's research. The twelve common characteristics are listed to the right.

Teaching tips

You may want to direct students to the CIA World Factbook. The Factbook is an excellent resource available online that can help the students complete their profile sheet. The site is located at http://www.odci.gov/cia/publications/factbook/index.html

An appropriate technology:

- Adresses the well-being of the indigenous population.
- Takes into account environmental issues.
- Benefits society.
- Solves problems and satisfies particular needs of the community.
- Takes into account the culture of the indigenous population.
- Includes a collective effort in its creation, implementation, and maintenance.
- Is cost effective for the end user.
- Is sustainable by the user.
- Utilizes local and renewable resources whenever possible.
- Has multiple benefits.
- Allows for the continuation of development.
- Has an "image of modernity," whenever possible.

Reflection

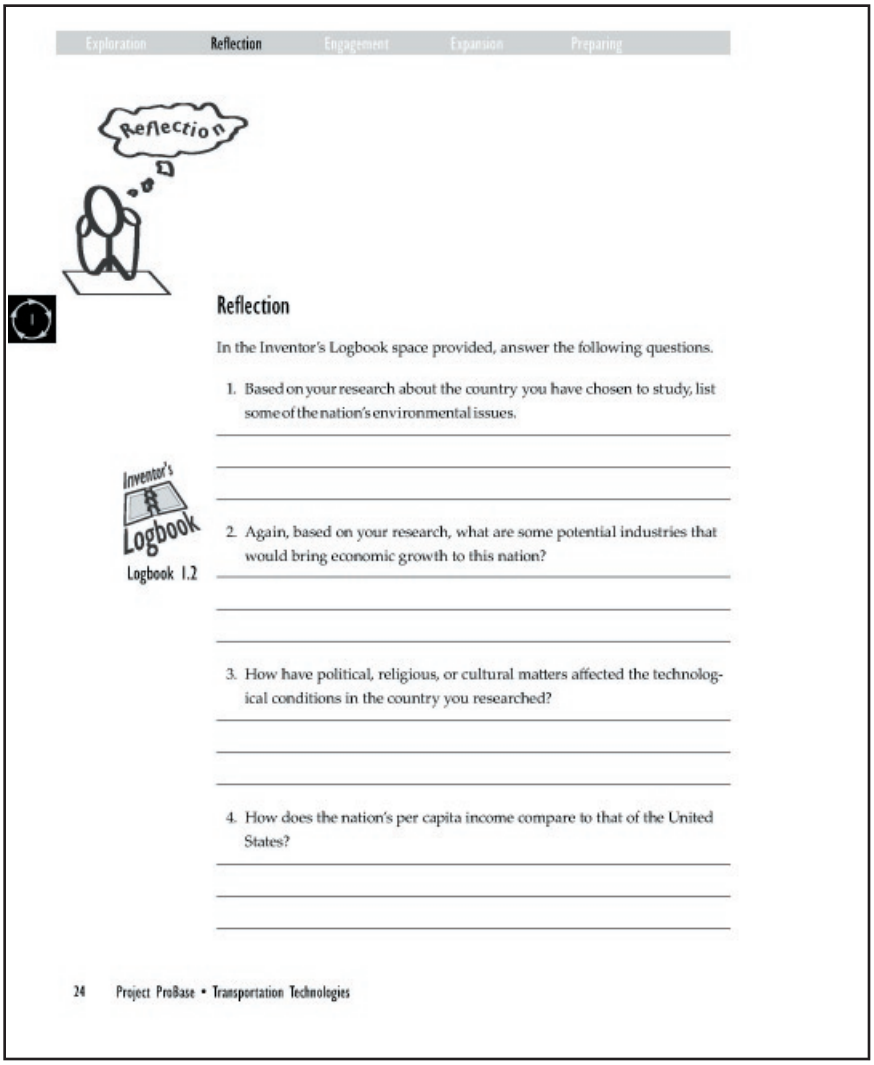
Students are asked to answer the following questions in their Inventor's Logbook.

1. Based on your research about the country you have chosen to study, list some of the nation's environmental issues.

   Answers will vary. Students should explore some of the environmental concerns plaguing the nation, along with the natural resources that may either be endangered or that should be protected.

2. Again, based on your research, what are some potential industries that would bring economic growth to this nation?

   Answers will vary. Economic growth is most likely a major concern of many of the client nations. Students can explore some of the initiatives that have been used or are currently being attempted to stimulate growth. Students may have ideas of their own based on their findings and answers to the first question. Some nation's natural resources may be exploited for economic growth.



Exploration Reflection Engagement Expansion Preparing

Reflection

Reflection

In the Inventor's Logbook space provided, answer the following questions.

1. Based on your research about the country you have chosen to study, list some of the nation's environmental issues.

2. Again, based on your research, what are some potential industries that would bring economic growth to this nation?

3. How have political, religious, or cultural matters affected the technological conditions in the country you researched?

4. How does the nation's per capita income compare to that of the United States?

Inventor's Logbook

Logbook 1.2

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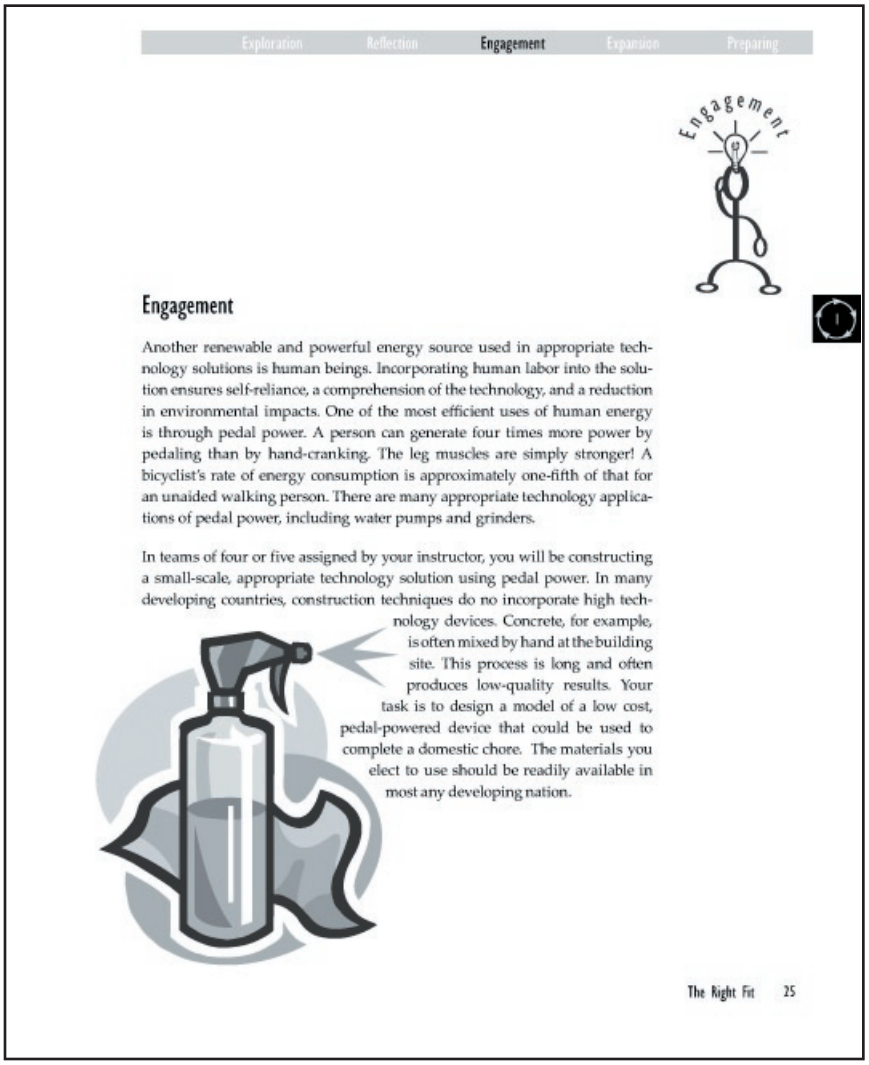
3. How have political, religious, or cultural matters affected the technological conditions in the country?

   Answers will vary. A region's beliefs can affect the technological conditions of the region. Students should explore this concept and analyze how their Primary Challenge solution should adapt to their findings.

4. How does the nation's per capita income compare to that of the United States?

   Answers will vary.



Exploration Reflection Engagement Expansion Preparing

Engagement

Engagement

Another renewable and powerful energy source used in appropriate technology solutions is human beings. Incorporating human labor into the solution ensures self-reliance, a comprehension of the technology, and a reduction in environmental impacts. One of the most efficient uses of human energy is through pedal power. A person can generate four times more power by pedaling than by hand-cranking. The leg muscles are simply stronger! A bicyclist's rate of energy consumption is approximately one-fifth of that for an unaided walking person. There are many appropriate technology applications of pedal power, including water pumps and grinders.

In teams of four or five assigned by your instructor, you will be constructing a small-scale, appropriate technology solution using pedal power. In many developing countries, construction techniques do no incorporate high technology devices. Concrete, for example, is often mixed by hand at the building site. This process is long and often produces low-quality results. Your task is to design a model of a low cost, pedal-powered device that could be used to complete a domestic chore. The materials you elect to use should be readily available in most any developing nation.

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Engagement

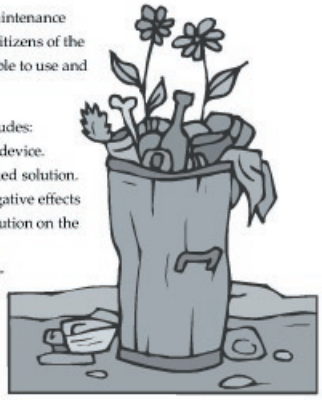
In teams of four or five assigned by you, students will be constructing an appropriate technology device using pedal power. Pedal power is an important resource for appropriate technology and may be an option for students' *Primary Challenge* solutions. Their task for the *Engagement* activity is to design a low-cost device to complete a domestic chore that can be constructed using materials available in most any developing nation.

Students should first identify a domestic chore that could be improved with a technological device. Students can use their research findings to target a device for their *Primary Challenge* nation. Some examples of pedal-powered devices include concrete mixers, generators, corn grinders, and water pumps.

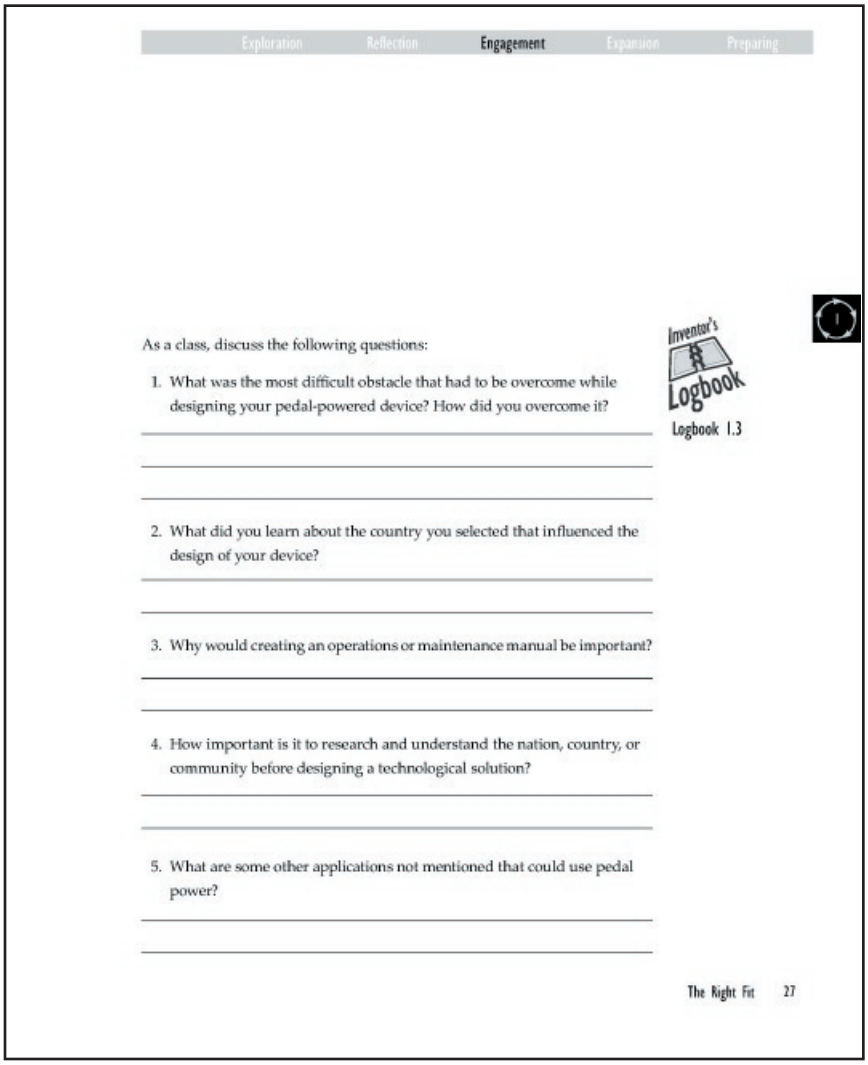
Students are asked to use only recyclable or freely obtained resources for their device. Each team should submit a materials list prior to construction so you can help them locate the necessary materials. Students should be encouraged to bring in materials from their homes. In addition, you may decide to provide them with wood, nuts, bolts, screws, nails, and hand tools.

Follow the directions below to design and construct your device:

1. Select a country where your solution will be implemented and identify the available materials, equipment, and resources.
2. Use only recycled or freely obtainable materials.
3. Submit a list of materials to your instructor and, with your instructor's help, gather the materials.
4. Develop a device that will complete a domestic task. Think about a task that really needs to be accomplished in this nation.
5. Develop an operations and maintenance manual that ensures that the citizens of the country you selected will be able to use and repair the device.
6. Create a presentation that includes:
   a. A demonstration of your device.
   b. The merits of your designed solution.
   c. Potential positive and negative effects of implementing your solution on the country.
   d. A discussion of the operations and maintenance manual.



Notes:



Exploration Reflection **Engagement** Expansion Preparing

As a class, discuss the following questions:

1. What was the most difficult obstacle that had to be overcome while designing your pedal-powered device? How did you overcome it?

2. What did you learn about the country you selected that influenced the design of your device?

3. Why would creating an operations or maintenance manual be important?

4. How important is it to research and understand the nation, country, or community before designing a technological solution?

5. What are some other applications not mentioned that could use pedal power?

Inventor's Logbook

Logbook 1.3

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After students have presented their devices, lead a class discussion using the following questions:

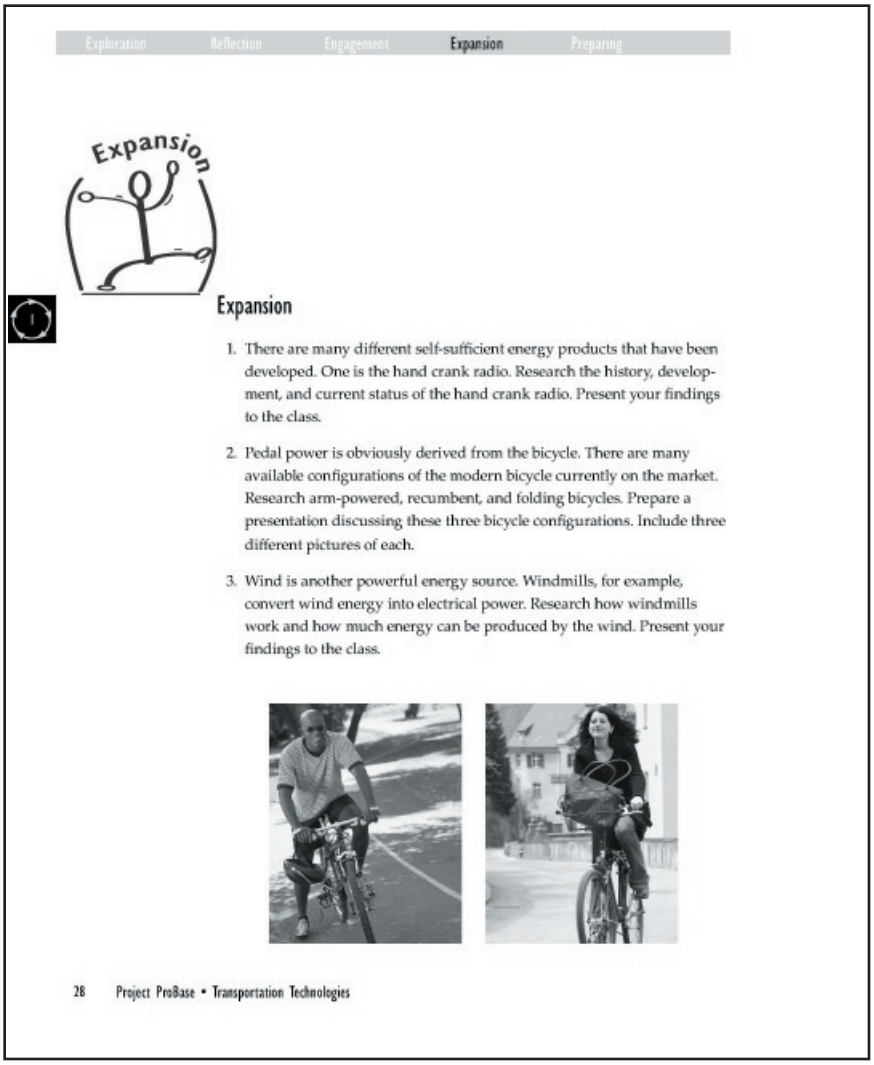
1. What was the most difficult obstacle that had to be overcome while designing your pedal-powered device? How did you overcome it?
   Answers may vary.

2. What did you learn about the country you selected that influenced the design of your device?
   Answers may vary. Students should provide at least one example of how an aspect of the country impacted the design. For example, the materials they chose.

3. Why would creating an operations and maintenance manual be important?
   The manual will ensure sustainability. Technologies implemented without some kind of manual will not last, because once they fail or break and the local population does not know how or have the materials available to fix them, they may be abandoned.

4. How important is it to research and understand the nation, country, or community before designing a technological solution?
   Students should now recognize the importance of understanding a community's culture and environment when designing solutions to problems.

5. What are some other applications not mentioned that could use pedal power?
   Mills, extractors, air compressors, transportation devices, etc.



Exploration Reflection Engagement Expansion Preparing

Expansion

Expansion

1. There are many different self-sufficient energy products that have been developed. One is the hand crank radio. Research the history, development, and current status of the hand crank radio. Present your findings to the class.
2. Pedal power is obviously derived from the bicycle. There are many available configurations of the modern bicycle currently on the market. Research arm-powered, recumbent, and folding bicycles. Prepare a presentation discussing these three bicycle configurations. Include three different pictures of each.
3. Wind is another powerful energy source. Windmills, for example, convert wind energy into electrical power. Research how windmills work and how much energy can be produced by the wind. Present your findings to the class.

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Expansion

Although not required, these *Expansion* activities are designed to cause teams to delve deeper into the concepts explored in this learning cycle.

1. There are many different self-sufficient energy products that have been developed. One is the hand crank radio. Research the history, development, and current status of the hand crank radio. Present your findings to the class.
2. Pedal power is obviously derived from the bicycle. There are many available configurations of the modern bicycle currently on the market. Research arm-powered, recumbent, and folding bicycles. Prepare a presentation discussing these three bicycle configurations. Include three different pictures of each.
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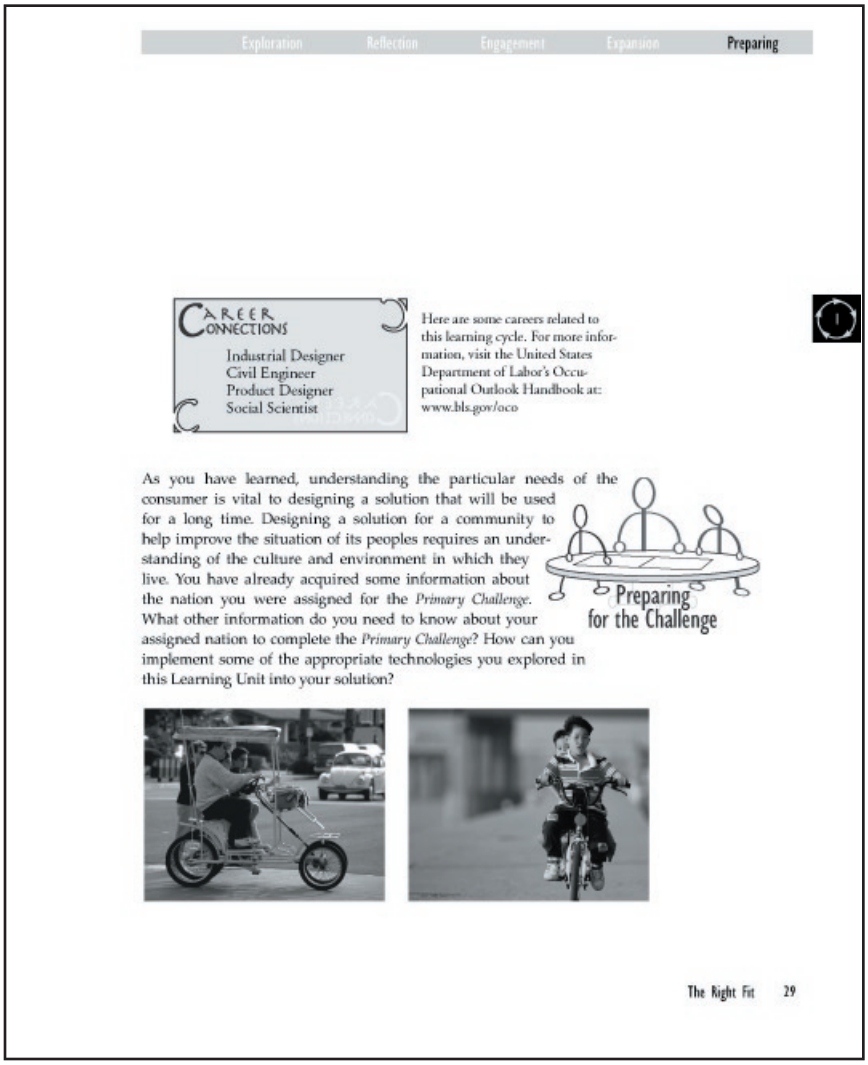

Exploration Reflection Engagement Expansion **Preparing**

CAREER CONNECTIONS

Industrial Designer
Civil Engineer
Product Designer
Social Scientist

Here are some careers related to this learning cycle. For more information, visit the United States Department of Labor's Occupational Outlook Handbook at: www.bls.gov/oco

As you have learned, understanding the particular needs of the consumer is vital to designing a solution that will be used for a long time. Designing a solution for a community to help improve the situation of its peoples requires an understanding of the culture and environment in which they live. You have already acquired some information about the nation you were assigned for the *Primary Challenge*. What other information do you need to know about your assigned nation to complete the *Primary Challenge*? How can you implement some of the appropriate technologies you explored in this Learning Unit into your solution?

Preparing for the Challenge

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Preparing for the Challenge

After students complete the *Expansion* activity, ask them to meet in their *Primary Challenge* teams and work through the questions in their student guides. Most teams will need to do additional research on their assigned nation in order to complete their solutions. You may decide to bring the whole class together and discuss how students may incorporate some of the appropriate technologies they explored in the learning cycle into their *Primary Challenge* solutions.

Student Assessment

An assessment rubric has been developed for the *Exploration* and *Engagement* activities. Feel free to change this rubric to better suit your particular needs.

The Right Fit

Name: Date:

Element	Criteria				Points
	4	3	2	1	
Exploration	Completed profile sheet with exceptional quality and delivered an excellent presentation.	Completed profile sheet with above average quality and delivered a very good presentation.	Completed profile sheet with average quality and delivered a good presentation.	Completed profile sheet with poor quality and delivered a poor presentation.	
Engagement	Completed a device and manual with exceptional quality and delivered an excellent presentation.	Completed a device and manual with above average quality and delivered a very good presentation.	Completed a device and manual with average quality and delivered a good presentation.	Completed a device and manual with poor quality and delivered a poor presentation.	
Inventor's Logbook Entries	Fully answered all entries and provided good examples.	Answered most of the entries and provided some examples.	Answered few entries and provided few examples.	Did not answer entries and did not provide examples.	
				Total Points	