What Makes A Building Green?

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INTRODUCTION

This lesson unit will introduce and examine the concepts of green building and green jobs by researching terms, methodologies and benefits of green construction and renovation.

LESSON OVERVIEW

Grade Level & Subject: 9-12: Science (Art and Mathematics)

Length: One to Two Weeks (may be divided between in-class activities and homework)

Objectives:
After completing this lesson, students will be able to:

1. Compare and contrast the terms "traditional building" and "green building".
2. Compare and contrast the methodologies between traditional building and green building.
3. Compare and contrast the definitions of green building design and sustainable building design.
4. List factors that are consistent of green building.
5. Predict the economic benefits of a green building.
6. Discuss the not quantifiable benefits of a green building.
7. Locate websites and companies that sell green building products.
8. Interview a person who is associated with green building.
9. Create a blueprint for a green building
10. Construct a model of a green building
11. Facilitate a group discussion on the various aspects of their green building
12. Evaluate peer green building designs and model construction

National Standards Addressed:
This lesson addresses the following National Education Standards[1]

- **Content Standard: NS.9-12.5 Science and Technology**
  As a result of activities in grades 9-12, all students should develop
  - Abilities of technological design
  - Understandings about science and technology
- **Content Standard: NS.9-12.6 Science in Personal and Social Perspectives**
  As a result of activities in grades 9-12, all students should develop understanding of
  - Personal and community health

[1] http://www.education-world.com/standards/

- Population growth
- Natural resources
- Environmental quality
- Natural and human-induced hazards
- Science and technology in local, national, and global challenges

Materials Needed:

- Internet connection
- Reproducible #1- **Brainstorming Session**
- Reproducible #2 (3 pages)- **What Makes a Building Green?**
- Reproducible #3- **Guide for Your Green Building**.
- Reproducible #4- **Peer Evaluation of Green Buildings** (copies for each group)

Assessment: Students will be assessed through the following activities:

- Completion to questions provided on handouts.
- Creation, execution and presentation of green building model
- Peer evaluation
- Contribution in class discussion

LESSON BACKGROUND

Relevant Vocabulary:

- **Salvaged products**
- **Pre-consumer recycled content**
- **Post-consumer recycled content**
- **Agricultural waste material**
- **Rapidly renewable products**
- **Certified wood products**
- **Storm water pollution**
- **Ozone depleting substances**
- **Indoor contaminants**
- **Fuel cell equipment**

Information:

Teachers can copy the relevant vocabulary and either provide definitions to the class, or research the words and discuss their definitions in a class setting. This will provide the starting knowledge for students to begin an inquiry to green building and examining the concept relating to it.

Resources:

- Interview with a green builder. This link can be used as an example for one of the activities. http://www.earthday.net/~earthday/lesson%20plans/MonicaInterviewfinal.pdf
- The Whole Building Design Guide: http://www.wbdg.org/design/sustainable.php

- Smart Communities Network: http://www.smartcommunities.ncat.org/buildings/gbintro.shtml
- Natural Resource Defense Council: http://www.nrdc.org/buildinggreen/default.asp
- City of Seattle: http://www2.ci.seattle.wa.us/implement/default.asp
- City of Oakland Public Works Department: http://www.oaklandpw.com/Page29.aspx
- Environmental Building News: http://www.greenerhomes.ca/storage/file/greenproducts.pdf
- U.S. Green Building Council: http://www.usgbc.org/

LESSON STEPS

Warm-up: *Brainstorming Session*

1. Students should be divided into a brainstorming group of two or three.
2. Provide each group **with Reproducible #1-Brainstorming Session** and the following websites, to facilitate a discussion on green building.
   The websites to be used are:
   - The Whole Building Design Guide: http://www.wbdg.org/design/sustainable.php
   - Smart Communities Network: http://www.smartcommunities.ncat.org/buildings/gbintro.shtml
   - Natural Resources Defense Council: http://www.nrdc.org/buildinggreen/default.asp
   - City of Seattle http://www2.ci.seattle.wa.us/implement/default.asp

   The questions that need to be answered are:
   - What are the differences between traditional building and green building?
   - What are the differences between traditional building and green building methodology?
   - Is there a difference in meaning between the terms "green building" design and "sustainable building" design or are they interchangeable?

Activity One*: What Makes a Building Green?*

1. Provide each group with **Reproducible #2-What Makes a Building Green?** (3 pages)

2. A green building is defined by the City of Oakland's Public Works Department as: "a 'Whole-Systems' approach for designing and constructing buildings that conserve energy, water and material resources and are healthier, safer, and more comfortable."

3. Using this definition as a foundation, have student groups list 7 factors that are consistent of a green building.

4. Groups should compare their lists to the City of Oakland's Public Works Department list:
   - Using sun and wind to the building's advantage for natural heating, cooling, and day

lighting
- Landscaping with native plants and using water efficiently
- Building quality, durable structures
- Insulating well and ventilating appropriately
- Incorporating salvaged, recycled, and sustainably harvested materials
- Using energy-efficient and water-saving appliances and fixtures
- Reducing and recycling construction waste

5. Continue the discussion about the principles of green building by having the students visit the Smart Communities Network site and list the principles found there:
   http://www.smartcommunities.ncat.org/buildings/gbprinc.shtml
   Green Building Principles:
   - Energy efficiency and renewable energy resources
   - Environmental Impact
   - Resource conservation
   - Indoor Air Quality
   - Resource conservation
   - Community Issues

6. The student groups should discuss the economic benefits of green building. Include in the discussion what factors are not quantifiable. For example: occupant health, comfort, productivity, reducing pollution and landfill waste.

Activity Two: *What Makes a Green Building Product?*

1. In student groups, students should read and discuss "Building Materials: What Make a Product Green?" by visiting the site Environmental Building News or printing and distributing a copy of the article.
   http://www.greenerhomes.ca/storage/file/greenproducts.pdf
   The following information was obtained from this site:
   1. Products Made with Salvaged, Recycled, or Agricultural Waste Content
      1a. Salvaged products
      1b. Products with post-consumer recycled content
      1c. Products with pre-consumer recycled content
      1d. Products made with agricultural waste material

   2. Products That Conserve Natural Resources
      2a. Products that reduce material use
      2b. Products with exceptional durability or low maintenance requirements
      2c. Certified wood products
      2d. Rapidly renewable products

   3. Products That Avoid Toxic or Other Emissions
      3a. Natural or minimally processed products
      3b. Alternatives to ozone-depleting substances
      3c. Alternatives to hazardous products
      3d. Products that reduce or eliminate pesticide treatments

3e. Products that reduce stormwater pollution
3f. Products that reduce impacts from construction or demolition activities
3g. Products that reduce pollution or waste from operations

4. Products That Save Energy or Water
   4a. Building components that reduce heating and cooling loads
   4b. Equipment that conserves energy and manages loads
   4c. Renewable energy and fuel cell equipment
   4d. Fixtures and equipment that conserve water

5. Products That Contribute to a Safe, Healthy Built Environment
   5a. Products that do not release significant pollutants into the building
   5b. Products that block the introduction, development, or spread of indoor contaminants
   5c. Products that remove indoor pollutants
   5d. Products that warn occupants of health hazards in the building
   5e. Products that improve light quality
   5f. Products that help noise control
   5g. Products that enhance community well-being

2. Use an internet search engine to locate green building products.

3. Begin a class discussion regarding the sites located by student groups. Which ones are the best? Why? What products are the best? Why?

Activity Three*: Interview*

1. Individual students will conduct an interview with someone who sells green materials, or designs or implements green building plans. This interview can be held in person, by telephone or through a written medium such as email or internet. Questions for the interview should be created by the student and a formal write-up should be handed in for assessment.

Activity Four: *Green Building Programs*

1. Using the internet, individual students will research green building community programs. Students will focus on one program and describe it in detail.

Wrap Up*: Green Building Construction*

1. Provide students with **Handout #3-Guide To Your Green Building and Handout #4-Peer Evaluation of Green Building**

2. Students will work in teams to develop a plan and construct a model of a building using green materials. Students need to be able to discuss with the class:
   - The function of the building
   - Why they chose particular materials in the design of the building
   - What makes a green building

- The layout of the interior of the building
- Where the building would be placed in the community
- What will become of the building materials if the building is upgraded or demolished
- What will be the impact on the environment if the building is upgraded or demolished

3. Students will submit a written plan for their building which include blueprints, materials used and answers to the discussion questions found on the handout all in addition to their constructed model.

Extension: *Green Building Budget*
Students will be given a budget to build a green building. Students will research the cost of materials to determine which materials will be included in the building process, prioritizing materials for inclusion due to budgetary factors.

CONCLUSION

The previous activities will provide an opportunity for students to examine what constitutes a green building. Students will be able to demonstrate their newfound knowledge through constructing a model of a green building and facilitating a class discussion on its components. Demonstration of knowledge will also be found in individual answers to provided questions in handouts. Peer evaluation sheets will provide additional feedback to students' communications skills and knowledge of topic.

Brainstorming Session

Name:

Answer the following questions during your group discussion on green building:

1. What are the differences between traditional building and green building?

2. What are the differences between the traditional building and green building methodologies?

3. Is there a difference in meaning between the terms "green building" design and "sustainable building" design or are they interchangeable?

Use the following websites to gather information for your brainstorming session:
The Whole Building Design Guide:
http://www.wbdg.org/design/sustainable.php
Smart Communities Network:
http://www.smartcommunities.ncat.org/buildings/gbintro.shtml
Natural Resources Defense Council:
http://www.nrdc.org/buildinggreen.default.asp
City of Seattle
http://www2.ci.seattle.wa.us/implement/default.asp
U.S. Green Building Council
http://www.usgbc.org/

What Makes a Building Green?

Name:

A green building is defined by the City of Oakland's Public Works Department as: "a 'Whole-Systems' approach for designing and constructing buildings that conserve energy, water and material resources and are healthier, safer, and more comfortable."

Using this definition as a foundation, brainstorm and list 7 factors that are consistent of a green building.

1.

2.

3.

4.

5.

6.

7.

Visit the City of Oakland's Public Works Department and list the factors that they suggest makes a building green.
http://www.oaklandpw.com/Page29.aspx

1.

2.

3.

4.

What Makes a Building Green?

5.

6.

7.

Did you have any similarities to the City of Oakland's site? Differences? List them here:

Visit the Smart Communities Network site:
http://www.smartcommunities.ncat.org/buildings/gbprinc.shtml
List their Green Building Principles and in your own words provide a one or two sentence summary for each one.

1.

2.

3.

4.

5.

What Makes a Building Green?

Conclusion Discussion: Answer the following questions in your closing discussion.

Predict the economic benefits of a green building?

Are there any factors to green building that are not quantifiable? If so, list them here:

Guide for Your Green Building

You will be working in teams develop a plan and construct a model of a building using green materials.

You will be required to submit a written plan for your building including blueprints and materials used.

Your final assessment will consist of a presentation of your model and plan to the class. Answer the following question on separate paper and be prepared to discuss your answers with the class.

1. What is the function of the building?
2. Why did you choose particular materials in the design of the building?
3. What makes a green building?
4. Explain the layout of the interior of the building. (Attach the blueprints to your explanation on separate paper)
5. Where the building would be placed in the community?
6. What will become of the building materials if the building is upgraded or demolished?
7. What will be the impact on the environment if the building is upgraded or demolished?

Peer Evaluation of Green Buildings

Group Name:
Members of Group:

What was the function of the building?

Where will the building be placed in the community?

What aspects of this building do you agree with?

What recommendations would you make for this particular green building? Explain.

What is your overall opinion of the green building?