

Green Building

Certificate



Green building design, construction, materials, and economics to design a LEED Certified building

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Curriculum Matrix: Green Building Certificate

Total estimated time for the curriculum is 34.5 – 47 hours

Module		Lesson		Approx. Time	Description
1	Sustainability	1.1	Defining Sustainability	90 minutes	Students explore, discuss and write about the concept of sustainability. Students watch a brief film and examine their personal choices as consumers, then analyze the impact of their lifestyles using a personal ecological footprint calculator.
		1.2	Climate Change	225 minutes	Students are introduced to the topic of climate change and the impact of our energy choices. Students will learn about the causes and consequence of climate change, and learn ways they can reduce their carbon footprint.
2	Green Building	2.1	The Built Environment	90 minutes	Students gather data and draw sketches of buildings around the world to understand the variety of purpose as well as the role of climate, local environment and culture in the design and construction of buildings.
		2.2	Why Build it Green?	135 - 225 minutes	Students identify the impacts of buildings and explore the network of environmental, social and economic benefits resulting from green building features. Students then investigate their own school to identify green building features and practices.
		2.3	Building Design and Construction	180 - 225 minutes	Students are introduced to the fundamental aspects of the design and the construction of a building. Students draw a building floor plan of a part of the school and for their home. In small groups, students design and build three-dimensional structures based on specific budget, timeframe, materials and functionality criteria.
3	Green Building Features	3.1	Sustainable Sites	45 - 90 minutes	Students learn about the impact of site characteristics on the construction, durability, and performance of a building. Students will understand that site selection and appropriate use of a site are key components to green building. Students use a checklist to conduct a site assessment of their school campus, considering topography, terrain, climate, vegetation, soil, solar radiation, building orientation, regulations and regional infrastructure.
		3.2	Water Smart Buildings	135 – 180 minutes	This lesson focuses on the importance of water conservation in the design and performance of green buildings. Students conduct a water audit of the school, develop recommendations and identify potential water savings.
		3.3	Energy Smart Buildings	90 – 135 minutes	This lesson focuses on the importance of building energy use in the design and performance of green buildings. First, students quantify energy consumption, energy costs and greenhouse gas emissions associated with the generation of energy. Next, students benchmark their school to determine how energy efficient it is compared to other schools around the country. The lesson concludes with students developing strategies to improve the energy efficiency of the school.
		3.4	Building Material Pathways	90 minutes	Students map out the resource pathway of green and conventional building materials to understand that embodied energy, durability, performance, environmental and health concerns are criteria used in selecting green building materials.
		3.5	What is in the Air?	90 - 135 minutes	In this lesson, students understand the role of indoor air quality in the design and performance of green buildings. Students conduct an indoor air quality assessment of their school and come up with recommendations for improvement.
		3.6	Innovation	135 minutes	Green building design differs from conventional building methods in many ways, especially with regard to innovation. Due to user expectations, incorporation of new technologies and aesthetics, green building designers often have to be innovative in their approaches and strategies to building problems. In this lesson students learn about the importance innovation in green building design.

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4	Green Building Programs and Initiatives	4.1	How Green is your Building?	90 – 135 minutes	This lesson introduces the rating and analysis programs utilized in the construction of green buildings and to improve the performance of existing buildings. Students develop their own green building rating checklists and rate the school.
		4.2	Green Building Initiatives	90 – 135 minutes	Students learn about the California Green Building Code and then research, summarize and discuss a different policy, building code or incentive of their choosing. Students then consider the current environmental, social and economic context to critique and debate various green building programs.
5	Green Building Design	5.1	Green Building Economics	6 – 12 hours*	Green buildings may cost more to build compared to standard construction, but will cost less over the lifetime of the building. In this lesson students perform lifecycle cost analyses for green building practices and compare overall costs to conventional building practices. *Note: if adding computer drafting, add 225 minutes.
		5.2	Green Home Design	135 minutes	Students apply principles of green building learned in previous lessons to design and build a 2D rendering, poster, and three-dimensional green home model using recycled and re-purposed materials.
6	Green Collar Workforce	6.1	Green Jobs	90 minutes	Students research green job announcements and then complete and discuss assessments of their skills and green job interests. Students then interview or shadow a green building professional in their community.

Lesson 2.1: The Built Environment



Lesson 2.1 Overview

Estimated Time

2 lessons (90 Minutes)

Standards Covered

NGSS: HS-ETS1-1

CCSS ELA Literacy: Language Standards:
Vocabulary Acquisition and Use: 6
CTE Standards - Buildings Trades &
Construction Sector: D6.2

Objectives: Students will be able to:
Understand and communicate physical and natural phenomena affecting a building
Determine how environment, culture and purpose influence the form and function of buildings around the world

Prep Time

1 hour to collect materials and read lesson

Handouts

2.1.1 The Science of Buildings
2.1.2 Traditional Homes around the World

Materials

Computers with Internet

This lesson introduces students to the design, construction and use of buildings. Students will read about and discuss basic concepts of building science and then tour the school to identify design features. Students will then research and present on different building types from around the world to understand how the environmental and social context influences the form and function of our buildings.

KEY WORDS

Built Environment: Man-made structures and their surroundings that provide the setting for human activity, ranging in scale from individual homes to neighborhoods to entire cities

Building Science: The study and analysis of buildings, construction materials and building systems to optimize useful life, occupant health and resource efficiency

Infrastructure: Roads, pipes, bridges, power stations and other facilities and services needed for the functioning of a community

Architect: A professional who designs buildings, prepares, plans and oversees construction

Vernacular Architecture: Architectural design based on local needs, availability of materials, and climate. Originally, not designed by architects, instead relied on the design skills of local builders and tradesman

PREPARATION

- Review natural and social influences on building design using the websites listed in Optional Resources
- Reserve computer lab or computers for the Traditional Housing Handout
- Print the following handouts found at the end of the lesson:
 - 2.1.1 The Science of Buildings – one per student

2.1.2 Traditional Housing – one per student

Recommended Daily Lesson Breakdown:

- Day 1: The Built Environment and Culture
 - Setting the Stage: The Built Environment and Culture
 - Activity: The Science of Buildings
- Day 2: The Influence of Environment and Culture on Buildings
 - Activity: The Influence of Environment and Culture on Buildings
 - Handout: Traditional Homes around the World

SETTING THE STAGE: THE BUILT ENVIRONMENT AND CULTURE

- Buildings play diverse roles in our lives and perform a wide array of functions. They provide shelter and basic amenities as well as serve as gathering places for social activities. Since the earliest cave dwellings, building have been objects for artistic, cultural and religious expression. The design of a building serves many functions and represents societal values.
- The complete stock of buildings in any given area, along with other infrastructure, constitutes the built environment.
 - **Infrastructure:** Roads, pipes, bridges, power stations and other facilities and services needed for the functioning of a community
 - **Built Environment:** Man-made structures and their surroundings that provide the setting for human activity, ranging in scale from individual homes to neighborhoods to entire cities
- Design of the built environment throughout history and around the world varies tremendously. These variations are due to a wide array of factors including climate and landscape, availability and price of land and building materials, range of desired function, and aesthetic, cultural and religious preferences. This is called **vernacular architecture**. Examples of this architecture include: bungalows on risers in humid, equatorial communities or the large porches in homes of the southern United States.
- We come across dozens or even hundreds of buildings each day, often without recognizing the range of forms and functions, and without thinking about how the built environment shapes us as individuals and as a society. Consideration of variations in the built environment and its effects on our experience can provide us with insight into our own cultural values as well as those of other societies. This understanding is valuable as we continue to design and build into the future.

DISCUSSION

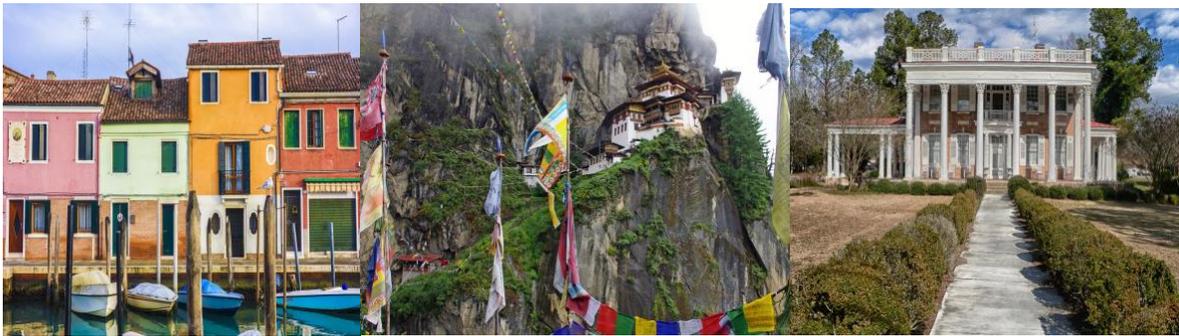
- Facilitate a classroom discussion and lead the students using these guiding questions:
 - What are buildings for? They provide us with shelter and a space for productivity.
 - What purposes do buildings serve? They keep humans safe and comfortable. They provide us with amenities.
 - How do buildings shape our daily experience? We spend most of our time in buildings. Depending on the building's design and infrastructure our experiences within these buildings can differ.
 - How do buildings reflect our cultures? The aesthetics of a building and its designs differ depending on the place. Building design typically represents the culture of the environment that it is surrounded by.
 - How do buildings affect our lives in unplanned or indirect ways? They represent our values. They demonstrate class, power, prestige, and religion. Depending on the stability of a building, they can be the factor of life or death in situations like hurricanes, floods, and earthquakes.
- Generate a list of building functions based on the classes answers. Some functions include:
 - Shelter—safety, security, comfort
 - Amenities—water, light, heat
 - Aesthetics—style
 - Activities—work, eat, sleep
 - Representation of values – class/power/prestige/family/culture/religion

ACTIVITY 1: THE SCIENCE OF BUILDINGS

- Provide each student with a copy of The Science of Buildings Handout and allow time for students to read the building science overview silently, have them take turns reading aloud in class, or assign for homework the night prior to this lesson. Answer the questions in the handout together (or for homework) and direct discussion as needed to ensure comprehension of the general concepts in the overview.
- Lead a walking tour to look at how the school was designed.
 - What are some features used to allow for wide, open spaces inside the school?
 - What types of materials are used in the exterior walls?
 - What types of materials are used for the interior walls, floor and ceiling?
 - What features prevent the school from falling down or sinking into the earth?
 - Can you see these features, and if not, where might they be hidden?

ACTIVITY 2: THE INFLUENCE OF ENVIRONMENT AND CULTURE ON BUILDINGS

- Computers are necessary for this activity. Provide each student with a copy of the Traditional Homes Around the World Handout.
- On the whiteboard write the following list of building types: school, church, home, hotel, factory and airport terminal.
 - How does each building serve a distinct function?
 - How is the building designed and constructed to accommodate that function?
 - How might a school in the mountains be different than a school in the desert?
 - How might a school in Ireland be different than a school in Thailand?
- With the Traditional Homes Around the World Handout, students will use computers to investigate how function, the local environment and human culture influence how our buildings are designed and built.
 - Have each student select a country in which to investigate traditional housing design and construction.
 - Provide time for students to complete the handout and draw a sketch of the traditional housing of their chosen country or region.



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¹ Source: <https://pixabay.com/>