ENGINEERING - LESSON PLAN

Grade:	11 years old
Subject:	United in Biodiversity – Climate Change
Lesson n°:	**6-9 sessions**
Topic:	**Eco-Friendly Housing Design** 

Lessons focus and goals:	**Lesson Focus:**
	• Understanding the impact of traditional housing on the environment.
	  ○ Lec-07 Environmental futuristic and traditional method |Societal Global Impacts | Civil Engineering
	  ○ Traditional Environmental Knowledge and Forest Health
	• Exploring sustainable design principles and their application to housing.
	  ○ Exploring Green Building and the Future of Construction by Undecided with Matt Ferrell
	  ○ The Natural Building Blocks of Sustainable Architecture | Michael Green | TED by TED
	• Developing critical thinking and problem-solving skills.
	Lesson Goals:
	• Students will be able to identify key environmental issues related to housing.
	  ○ The Impact of Construction on the Environment

	○ Housing and Pollution • Students will understand the concept of sustainable design and its benefits. ○ BIC: Two minutes to understand sustainable development: ○ What is Sustainability • Students will be able to design and construct a model of an eco-friendly house. • Students will develop an appreciation for the importance of energy efficiency and resource conservation. ○ The importance of energy efficiency ○ Energy Saving Tips for Kids | How to Save Energy | What is Phantom Energy? | Saving Energy for Kids • Students will be able to communicate their design ideas and justify their choices.
Learning objectives:	**Science** • Understand the greenhouse effect and its impact on climate change. • Learn about different types of energy sources and their environmental impact. • Explore the relationship between human activities and climate change. **Technology** • Apply engineering design principles to create sustainable housing solutions. • Use research skills to gather information on eco-friendly materials and technologies. • Develop model-building skills to create representations of eco-friendly houses. **Engineering** • Understand the concept of energy efficiency and its importance in sustainable design. • Design structures that minimize environmental impact. • Evaluate the effectiveness of different design solutions**.** **Art** • Visualize and communicate design ideas through sketches and models. • Develop an appreciation for aesthetics in sustainable design. **Mathematics** • Use measurements and calculations to optimize design features (e.g., insulation, solar panels). • Analyze data related to energy consumption and environmental impact.

Materials	**Basic Materials:** • Cardboard boxes of various sizes • Recycled materials (plastic bottles, paper rolls, etc.) • Glue or tape • Scissors • Markers or crayons **Additional Materials (Optional):** • Small plants or seeds • Solar panels (small, toy versions) • Wind turbines (small, toy versions) • Insulation materials (cotton balls, shredded paper) • Water collection containers (small bowls or jars)
Structure and activities	**Lesson Structure:** **1. Introduction to Sustainable Housing (1-2 sessions):** • Explore the concept of sustainability and its importance. • Discuss the environmental impact of traditional housing. • Introduce the concept of eco-friendly housing and its benefits. **2. Research and Design (2-3 sessions):** • Research different eco-friendly housing features (solar panels, insulation, rainwater harvesting, etc.). • Brainstorm and sketch initial design ideas. • Develop a floor plan for the eco-house, considering factors like orientation, ventilation, and natural light. **3. Model Construction (2-3 sessions):** • Gather materials and prepare the workspace. • Construct the basic structure of the eco-house using cardboard boxes or other materials. • Add eco-friendly features to the model (e.g., solar panels, insulation, green roof). **4. Presentation and Evaluation (1 session):** • Prepare presentations showcasing the eco-house design. • Present the design to the class, explaining the eco-friendly features and their benefits. • Evaluate the project based on design criteria and sustainability principles. **Proposed Activities:** **Session 1: Introduction** • Watch videos about sustainable housing and environmental impact. • Discuss the challenges of traditional housing and the need for change. • Introduce the concept of eco-friendly design. **Session 2: Research** • Provide students with resources on eco-friendly housing features.

	• Guide students in researching and selecting features for their eco-house. • Encourage brainstorming and idea sharing. **Session 3: Design** • Introduce design thinking tools (e.g., sketching, brainstorming). • Have students create floor plans and elevations of their eco-houses. • Discuss the importance of considering factors like climate, materials, and energy efficiency. **Session 4: Model Construction** • Provide students with materials and tools. • Guide students in building the basic structure of their models. • Encourage creativity and problem-solving in incorporating eco-friendly features. **Session 5: Presentation and Evaluation** • Prepare students for presentations. • Provide guidelines for creating visual aids. • Conduct presentations and peer feedback sessions. • Evaluate students' projects based on design criteria and sustainability principles.

Extensions: Digital Tools for Eco-Housing Education	**Simulation and Modeling Apps**
	1. **SketchUp Free**: 3D modeling software for designing eco-houses
	  ○ Students can create digital house models
	  ○ Explore spatial design and sustainability features
	2. **Autodesk Tinkercad**: Web-based 3D design platform
	  ○ Accessible for elementary students
	  ○ Allows collaborative design and prototyping
	Environmental Impact Calculators
	3. **Carbon Footprint Calculator for Kids**
	  ○ Interactive web tools showing environmental impact
	  ○ Helps students understand real-world sustainability metrics
	Augmented Reality (AR) Applications
	4. **EcoHouse AR**
	  ○ Virtual overlay of sustainable technologies

Co-funded by the European Union

	○ Students can visualize solar panels, insulation, etc. **Coding and Computational Thinking** 5. **Scratch Programming** ○ Create interactive simulations of eco-friendly house features ○ Develop basic programming skills while exploring sustainability 6. **For Research and Exploration** ○ **Google Earth**: Explore examples of sustainable housing and natural environments worldwide. ○ **Khan Academy**: Offer lessons on climate change, energy efficiency, and sustainability. 7. **For Data Analysis** ○ **Microsoft Excel** or **Google Sheets**: Teach students to input and analyze energy consumption data. ○ **Energy Star Portfolio Manager**: Introduce basic energy tracking concepts in real-world buildings. 8. **For Interactive Learning** ○ **Minecraft Education Edition**: Have students build and test eco-house designs in a collaborative, virtual environment. ○ **EcoChallenge App**: Engage students in sustainability challenges related to energy and resource use. **Recommended Implementation** 9. Integrate these tools across 2-3 lesson sessions 10. Provide guided tutorials and learning objectives 11. Encourage collaborative digital exploration

Assessments:

#1 - Sustainability

Objective: Evaluate the extent to which the design incorporates sustainable features
Rubric: Sustainability

Description of performance	**Initiating**	**Developing**	**Excelling**
Understanding of Sustainability	Limited understanding of sustainability principles.	Basic understanding of sustainability concepts.	Demonstrates in-depth knowledge of sustainability and its implications.
Incorporation of Sustainable Features	Minimal incorporation of sustainable features.	Some sustainable features included in design.	Extensive incorporation of sustainable features, creating a holistic eco-friendly design.
Energy Efficiency	Limited consideration of energy efficiency in design.	Some consideration of energy efficiency, but with limited impact.	Effective integration of energy-efficient features, optimizing resource use.
Material Selection	Limited consideration of sustainable materials.	Some use of sustainable materials, but with inconsistencies.	Consistent use of sustainable and recycled materials throughout the design.
Water Conservation	Minimal consideration of water conservation.	Some consideration of water conservation, but with limited impact.	Effective integration of water-saving features, optimizing water use.
Sample student response	**Initiating**	**Developing**	**Excelling**
Understanding of Sustainability	"I don't know what 'sustainable' means."	"It means saving energy and water, right?"	"Sustainability is about protecting the environment and using resources wisely."
Incorporation of Sustainable Features	"I just used boxes to make a house."	"I put some plants on the roof."	"My house has solar panels, rainwater collection, and insulation."
Energy Efficiency	"I don't know about energy."	"I think big houses use more energy."	"My house uses the sun for heat and has

Co-funded by the European Union

			thick walls to keep it warm."
Material Selection	"I used whatever I found."	"I used some recycled boxes."	"I used mostly recycled materials and natural wood."
Water Conservation	"I didn't think about water."	"We can collect rainwater, I guess."	"My house has a rainwater tank and water-saving toilets."

#2 Functionality
Objective: Assess the practicality and usability of the eco-house design. Rubric: Functionality

Description of performance	**Initiating**	**Developing**	**Excelling**
Space Utilization	Ineffective use of space within the model.	Some consideration of space utilization, but with inefficiencies.	Optimal use of space, creating functional and comfortable living areas.
Accessibility	Limited consideration of accessibility for people with disabilities.	Some consideration of accessibility, but with limitations.	Incorporates accessibility features for people with different needs.
Structural Integrity	Model lacks structural stability.	Model has some structural stability, but is prone to collapse.	Model is structurally sound and can withstand normal use.
Comfort and Livability	Limited consideration of occupant comfort.	Some consideration of occupant comfort, but with limitations.	Creates a comfortable and inviting living space.
Sample student response	**Initiating**	**Developing**	**Excelling**
Space Utilization	"I just put everything in my house."	"I tried to put rooms in, but it looks crowded."	"My house has different rooms for different things, and they all fit."

Accessibility	"I didn't think about that."	"The door is hard to reach."	"My house has a ramp for people in wheelchairs."
Structural Integrity	"My house is kind of wobbly."	"It stands up, but it might fall."	"My house is strong and sturdy."
Comfort and Livability	"I don't know about comfort."	"It's okay, I guess."	"My house is cozy and has lots of light."
Practicality for Daily Living	"I don't know what you mean."	"It has a kitchen and a bedroom."	"My house has a kitchen, bathroom, and even a garden!"

PROJECT REFERENCE NUMBER:
2022-1-EL01-KA220-SCH-000086967

Co-funded by the European Union