Coral Creations Lesson Plan

Description: Introduce students to the fascinating world of deep-sea coral habitats currently being restored from the 2010 *Deepwater Horizon* oil spill through an engaging and interactive program that includes hands-on activities using 3D printing pens. This lesson plan was developed by Texas State Aquarium's education department with support from the Mesophotic & Deep Benthic Communities restoration project staff.

Audience: 3rd-8th (extension for high school below)

Duration: 1.5 hours

Learning Goals & Objectives:
By the end of the program, students will:

1. Develop a basic understanding of deep-sea coral habitats.
2. Identify some of the unique creatures living in these habitats.
3. Know how the *Deepwater Horizon* oil spill impacted the Gulf.
4. Create simple 3D printed coral models.

Assessment:
By the end of the program, students will:

1. Participate in a group discussion about the importance of coral habitats and threats to them.
2. Present their 3D printed coral models and explain one interesting fact about deep-sea corals.

Materials:

- Child-safe 3D printing pens and filaments
- Colored construction paper
- Glue, scissors, markers
- Printed images of deep-sea coral species
- Presentation materials (images, short videos)

Texas Science Standards:
Science TEKS: 3(A), 3(B), 8(A), 8(B), 8(C), 8(D)

Set-up/Prep:
Set up tables with 3D printing pens and materials for crafting.
Arrange seats for a group discussion area.
Set up a screen for visuals.

Program Overview:

Introduction:
Welcome and introduction to the ocean and its fascinating creatures.
Brief overview of deep Gulf coral habitats and *Deepwater Horizon* oil spill using background resources linked in this lesson plan.

Explore and Discuss:
Group discussion about the importance of coral habitats and why they need protection.
Show images of various deep-sea coral species and discuss their characteristics.

Hands-On Activity - 3D Printing Coral Models:
Brief safety guidelines for using child-safe 3D printing pens.
Provide pre-cut shapes of corals from colored construction paper.
Students use 3D printing pens to add 3D elements to their coral shapes.
Encourage creativity and discussion about the features they are adding.
Allow students to decorate their coral models with markers, creating an underwater environment.

Presentation:
Each student presents their 3D printed coral models.
Discuss the importance of each element they add to their coral models.
Students share one interesting fact they learned about deep-sea corals.

Conclusion:
Recap key points about deep-sea coral habitats.
Emphasize the importance of taking care of the ocean and its ecosystems.

Break-down:
Collect and organize the 3D printed coral models.
Allow students to take their crafts home as a reminder of the lesson.
Clean up the classroom.

Background/Resources:
Deepwater Horizon impacts and coral habitat restoration: https://ocean.si.edu/conservation/ gulf-oil-spill/deep-gulf-restoration-after-monumental-oil-spill
Coral basics: https://flowergarden.noaa.gov/education/coralbasics.html
Twilight zone corals: https://flowergarden.noaa.gov/about/mesophotic.html
Deep coral habitats: https://www.fisheries.noaa.gov/national/habitat-conservation/deep- sea-coral-habitat
Human threats to corals:
https://oceanservice.noaa.gov/education/tutorial_corals/coral09_humanthreats.html
3D pen options: https://www.amazon.com/s?k=3D+printing+pen&i=toys-and-games&crid=280OVMOLVRRZ6&sprefix=3d+printing+pen%2Ctoys-and-games%2C119&ref=nb_sb_noss_1

Extension for high school:

Audience: Grades 9-12

Duration: 2 hours

Learning Goals & Objectives:
By the end of the program students will:

1. Understand the significance of deep-sea coral habitats.
2. Identify key species and their adaptations to deep-sea environments.
3. Demonstrate knowledge of threats to deep-sea coral ecosystems, including the *Deepwater Horizon* oil spill, and the importance of conservation and restoration efforts.

Assessment:
By the end of the program students will:

1. Create a visual representation (diagram or model) of a deep-sea coral habitat.
2. Participate in a class discussion showcasing their understanding of the ecological importance of deep-sea coral habitats.
3. Complete a short written reflection on threats like oil spills and conservation strategies for deep-sea coral ecosystems.

Materials:

- Research materials such as reference books and articles on deep-sea ecosystems
- 3D printing pens and filament
- Paper, markers, and other art supplies
- Whiteboard and markers
- Computer/Screen for multimedia presentations

Texas Science Standards:
Biology TEKS: 3(A), 3(B), 8(A), 8(B), 8(C), 8(D)

Set-up/Prep:

1. Set up a presentation area for visuals.
2. Ensure each student has access to a 3D printing pen and research materials.
3. Set up tables for group activities and discussions.

Program Overview:

Introduction:
Welcome and brief introduction to the importance of coral habitats.
Overview of the deep Gulf coral ecosystems and *Deepwater Horizon* oil spill impacts and restoration work related to these habitats using background resources linked in this lesson plan.

Explore and Discuss:
Group discussions on the unique adaptations of organisms in deep-sea environments.
Q&A session to address any questions and facilitate deeper understanding.

Hands-On Activity - 3D Printing Coral Models:
Brief tutorial on using 3D printing pens.
Safety guidelines and precautions.
Assign each group a specific deep-sea coral species.
Research the habitat, adaptations, and characteristics of the assigned species.
Design a 3D model that accurately represents the chosen coral.
Each group uses 3D printing pens to create their coral models.
Facilitate assistance and guidance during the printing process.

Presentation:
Groups present their 3D printed coral models.
Explain the chosen adaptations and how they contribute to the coral's survival.

Conclusion:
Recap key learnings about deep-sea coral habitats.
Discuss the importance of conservation efforts to protect these ecosystems.

Breakdown:
Collect and organize 3D printed coral models.
Provide feedback to students on their presentations and models.
Clean up the classroom/presentation spaces.

Background/Resources:
Deepwater Horizon impacts and coral habitat restoration: https://www.fisheries.noaa.gov/southeast/habitat-conservation/mesophotic-and-deep-benthic-communities-restoration
Coral basics: https://flowergarden.noaa.gov/education/coralbasics.html
Twilight zone corals: https://flowergarden.noaa.gov/about/mesophotic.html
Deep coral habitats: https://www.fisheries.noaa.gov/national/habitat-conservation/deep- sea-coral-habitat
Human threats to corals:
https://oceanservice.noaa.gov/education/tutorial_corals/coral09_humanthreats.html
Smithsonian example 3D model of Gulf mesophotic coral species: https://3d.si.edu/ object/3d/muricea-pendula:1420bb06-146f-4fc6-b81f-245cf9efb819
3D pen options: https://www.amazon.com/s?k=3D+printing+pen&i=toys-and-games&crid=280OVMOLVRRZ6&sprefix=3d+printing+pen%2Ctoys-and-games%2C119&ref=nb_sb_noss_1

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