

Los Angeles Unified School District
Office of Curriculum, Instruction and School Support
Elementary History-Social Science and
Elementary Science Divisions

Days 8 and 9
Colony Structures

ESSENTIAL QUESTION: What do human beings need to survive and thrive in a new environment?

FOCUS QUESTION: How does shelter design fulfill physical, social and economic needs?

Objective

Students are expected to determine types and functions of structures their space colony will have. They need to consider all they have learned during the past 7 days. Through analysis of 17th century documents about Jamestown and Plymouth colonies, and their notes on location, survival needs, economic purpose, occupations and government, students will now be able to plan their space colony.

They will create a 3D model of their colony. Using the engineering design process they will revise their model based on feedback from other students and artists' interpretations of space colonies.

Quick Look

- Conceptual Flow: Students will now apply knowledge gained in days 2-7 to build a model of their space colony.
- Summary: This lesson takes place over 2 days. The students will consider the kinds of structures the 17th century colonists built and then consider all the needs that they have explored on days 2-7. They build a 3D model of their colony using cubes and other model materials. After looking at each other's models and other illustrations they revise their models and transfer them to 2D maps. They then create a final map of their colony in a smaller scale.
- Time: 7 - 8 hours over 2 Days
- Science Content Standards
 - *Engineering Design Process*
- *Common Core State Standards
 - SL 1,2,4,5
 - W 2,7,8
 - RIT 1,3,9,10

*See appendix A

- **Visual Arts Content Standards**

- VPA5.2 Identify and design icons, logos, and other graphic devices as symbols for ideas and information.

- **Student Products**

- Space colony structures worksheet
- Journal Entries
- 3D model of colony
- Reduced scale map of colony
- Written explanation of colony
- Entries on Space Colonization Application

BACKGROUND

This lesson provides students with an opportunity to apply their knowledge by designing a model space colony. They are then challenged to transfer their three dimensional model to a smaller scale two dimensional map. The cognitive demands of transforming a 3D model to a “bird’s eye view” map is developmentally appropriate for this age. By explaining their models to others and providing supportive feedback, students develop their oral presentation skills. The process of revising based on feedback is a major focus of the engineering design process.

Vocabulary

archetype, structure, function, model, map, grid, transparency, revise, legend, landscape

Materials

- Digital Orbit Photographic Atlas of the Moon
http://www.lpi.usra.edu/resources/lunar_orbiter/bin/lst_nam.shtml
- NASA’s Mars Exploration Program <http://mars.jpl.nasa.gov/gallery/atlas/index.html>
- Moon Terrain video:
<http://www.lpi.usra.edu/nlsi/moonVideo/index.shtml>
- Mars Terrain Video:
http://en.wikipedia.org/wiki/File:Patrick_Henry_Rothermel.jpg
- PowerPoint “Day 8 Shelter Model (Teacher Resource 8.15)
- FOSS Landforms Overlay Grid Master (Teacher Resource 8.14)

For each colony group:

- Space colony structures worksheet (Student Handout 8.1)
- **From FOSS 4th Grade Kit, Solid Earth**
 - ☐ FOSS Landforms trays
 - ☐ FOSS sand/ powdered clay mixture
 - ☐ Basins (to hold the material)

- *Optional*
 - *Substitute with homemade playdough (Teacher Resource 8.1)*
 - *Substitute with sand/cornstarch matrix (Teacher Resource 8.2)*

For the classroom

- Space Colony Pictures:
 - Space Colony Structure A (Teacher Resource 8.5)
 - Space Colony Structure B (Teacher Resource 8.6)
 - Space Colony Structure C (Teacher Resource 8.7)
 - Space Colony Structure D (Teacher Resource 8.8)
 - Space Colony Structure E (Teacher Resource 8.9)
 - Space Colony Structure F (Teacher Resource 8.10)
 - Space Colony Structure G (Teacher Resource 8.11)
 - Space Colony Structure H (Teacher Resource 8.12)
 - Space Colony Structure H (Teacher Resource 8.13)
- Rainbow cubes/Unifix cubes/base ten blocks
- Three 1-inch transparency grids
- Transparency markers
- Tape
- Paper /post its
- Colored pencils/markers/crayons
- Red food coloring for Mars models
- Model Revision Organizer (Student Handout 8.2)
- Travelers and Talkers Protocol (Teacher Resource 8.3)
- Engineering Design Process (EDP) Visual (Teacher Resource 8.4)
- Reduced scale map grid (Student Handout 8.3)

Optional

- Austin's Butterfly Drawing video <http://www.youtube.com/watch?v=hqh1MRWZjms>
- Materials for landscape drawing

PART I LOOKING BACK

Engage/Introduction

Teacher reviews the historical colony chart with the class. Remind students of the various sources of information they have studied over the last few days that have provided evidence for the chart entries.

Explore/Analysis


Call their attention to the Historical Archetype portion of the application. Facilitate a discussion around the question –What had the greatest impact on the early colonies?

Explain/Conclusion

- **Space Colonization Application entry (Teacher Resource 1.2)**

Teacher will say:

- *All **Space Colony Teams** will review the application that will be submitted to Congress.*
- *Work with your team to prepare the information to enter in the section: “**Historical Archetype**”.*
- *In preparation for filling out this section, the team must come to consensus about the most significant factor(s) that impacted the early colonies.*

 *By doing this activity collaboratively, students have an opportunity to reinforce vocabulary while practicing speaking and listening skills.*

PART II LOOKING FORWARD

Objectives

Students will determine appropriate terrain for their space colony and create a model of the colony based on physical, social and economic needs.

Engage/Introduction




Refer back to the Mars Map and Terrain/Moon Map and Terrain information sheets from Day 2. Review the various landforms that exist on the Moon and Mars.

Teacher will ask:

- *Where on the surface of the Moon or Mars do you think you should build your colony's structures? Consider the advantages or disadvantages of being in a canyon, flat area, steep area, crater, high area or low area.*
- Use the Digital Orbit Photographic Atlas of the Moon http://www.lpi.usra.edu/resources/lunar_orbiter/bin/lst_nam.shtml and
- NASA's Mars Exploration Program <http://mars.jpl.nasa.gov/gallery/atlas/index.html> to help make this decision.
- In addition, refer back to the Moon and Mars terrain video clips:
 - Moon Terrain video: <http://www.lpi.usra.edu/nlsi/moonVideo/index.shtml>
 - Mars Terrain Video:

http://www.huffingtonpost.com/2013/10/29/mars-flyover-video-red-planet-terrain_n_4173025.html

Explore/Analysis

- Give each colony group copies of the Colony Structures Worksheet (Student Handout 8.1). Ask them to list the kinds of work and living areas they would need in their colony. Remind them of the physical, social, (including personal, governmental and occupational factors) and economic needs that were determined earlier.
 *This is an opportunity for students to clarify comprehension with other students and prepare to share understanding in the following steps.*
- **Journal Entry:**
After the group completes the worksheet each student will write a journal entry summarizing their reasons for building the structures they have chosen.
 *Journal entries provide an opportunity for students to develop organizational skills in writing after having experienced oral practice with other students and the teacher.*
- Give each group the FOSS Landforms trays or other flat containers filled with the FOSS sand/powdered clay mixture. Provide various materials such as rainbow cubes, unifix cubes, base ten blocks, etc. Each group will create a model of their colony. (Add red food coloring to water. Use a small glue bottle to squirt the water on the Mars terrain) Show the PowerPoint “Day 8 Shelter Model” (Teacher Resource 8.15).
 - In preparation, you can view the FOSS Landforms video *Part 1:Schoolyard Models, Part 2:View From Above, Part 3 Mapmaking*. The procedure is basically the same, we have altered it to fit this unit.
http://lhsfoss.org/fossweb/schools/teachervideos/5_6/Landforms_flash.html
- Have group members count off A-B-C-D. Form “traveling groups” of all As, Bs, and Cs. Ds will stay with their model. Divide the A, B, and C groups in half creating 6 groups of 4. Place paper or post-its by each model so students can provide feedback. Groups will do a “Talkers and Travelers” (Teachers resources 8.3) activity where they observe each other’s models. When they arrive at a specific colony the member of that colony will explain their model. Other students can comment and make suggestions. Remind students of appropriate feedback statements and questions. (Optional: Show students the video, Austin’s Butterfly Drawing, to model effective critiquing:
<http://www.youtube.com/watch?v=hqh1MRWZjms>).
 *This is an opportunity for students to apply oral communication skills.*

BREAKPOINT (end Day 8)


Explore/Analysis (continued)

- Show students the artist’s interpretations of space colonies. (Space Colony Structures A-H) Post pictures on butcher paper and conduct a gallery walk. Discuss how they are similar to their models and how they are different.

- Show EDP cycle (Teacher Resource 8.4) Point out that they have been following this process over the last few days. They have asked lots of questions about past and future colonies, imagined what it could look like, planned and created a model. They are now at the revision stage. Using the feedback from their classmates, and the pictures that others have imagined, students complete their model revision chart. (Student Handout 8.2).
- Students will modify their 3D model making the changes they discussed.
- When revisions are complete, students will transfer their 3-D model to a 2-D map grid 8.6. Tape 3 transparency grids over the FOSS trays. Use overhead markers to trace the outline of their colonies structures. Label the structures.
- Change scale. Each student recreates the map on a smaller grid paper. (Student Handout 8.3) including a legend indicating type/purpose of structures.
 - Make three copies of Student Handout 8.3.
 - Cut the grids out and tape them together side by side.
 - Run off a copy on legal paper for each group.
- (Optional) Students may draw a landscape picture of their colony.

Explain/Conclusion

- Each student will write a journal entry that together with their map explains the design and function of their colony.


 *Journal entries provide an opportunity for students to develop organizational skills in writing after having experienced oral practice with other students and the teacher.*
- Take pictures of model to add to the Space Colonization Application

PART III BRINGING IT ALL TOGETHER

- Project pictures of Jamestown and Plymouth (See Day 2) and post students' space colony designs.
- Revisit the chart from Part 1. Compare and contrast the factors that influenced the kind of shelters in each period.

Teacher will say:

- *What were the structures of the 17th century colonies made of? [wood] Why?*
- *Would your space colony structures be made of wood? [No, not a source of building material in space; too heavy to transport]*
- *What material do you think you should use to build your structures? [Answers will vary. Ideas can come from NASA pictures]*
- *What kind of protection did the 17th century colonists need? [disease, unfriendly natives, cold weather]*
- *What kind of protection to the space colonists need? [harmful radiation, extreme temperatures, lack of atmosphere, gravity effects.]*

- *What is significant about the space colony location? Cite evidence.* [near mining source, water source, flat area for ease of construction, consideration of seasonal changes]
- *How are the living quarters for the space colonists different from the living spaces of the early colonists* [no open air walkways, all structures enclosed]
- *How are they the same?* [private and public spaces, areas for work and rest]
- *What is the source of energy in the 17th century colonies?* [fire from burning wood]
What is the source of energy in the space colony [solar panels; wind generators, nuclear fission]
- **Journal Entry:**
 - Students will write a journal entry answering the focus question:
How does shelter design fulfill physical, social and economic needs?
 *Journal entries provide an opportunity for students to develop organizational skills in writing after having experienced oral practice with other students and the teacher.*