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Topic 7B

At Home in Space

(2+ lessons)

Students work in teams to research and design a space colony. They present a written and oral proposal. This project requires one computer with Internet access for each team, and preferably a media projector. The scope and length of the topic may be adapted. Teachers do not need to be technical experts—students will be!

Outcomes

SLO 2.1 Show sufficient control over linguistic structures...

SLO 2.2 Use several visual techniques

SLO 6.2.7 Use elaboration...

SLO 6.2.8 Use imagery in the form of mental or actual pictures...

SLO 6.2.12 Use inferencing to guess the meanings...

SLO 1.5 Examine and interpret various visual media...

SLO 1.7 Evaluate a given text...

SLO 5.4 Show understanding of the effect of cultural background...

SLO 6.1.6 Use self-monitoring to check...

SLO 6.1.8 Use self-evaluation to check...

SLO 6.2.7 Use elaboration...

SLO 6.2.8 Use imagery in the form of mental or actual pictures...

SLO 6.2.12 Use inferencing to guess the meanings...

SLO 6.3.2 Use co-operation...

Instructional and Learning Sequence

Sequence 1

Activation

Discuss with the class the design of a large city that they know. What kinds of materials are common in the structures? What kinds of public facilities are available? (health, education, recreation, etc.) What are the main businesses and industries? How are the basic needs supplied? (power, food, water, waste management, transportation, etc.) What is the effect of the physical environment on the development of the city? (e.g., location, climate, soil, transportation)

Language Features

Vocabulary

words related to urban life, space (as determined by the readings the students choose)

Academic Language Functions

clarification

Many people predict that, in the future, we will have cities in space—on orbiting stations or on the moon or Mars. As on Earth, the physical environment of these cities will partly determine their design. Provide visuals of artists’ depictions of space colonies (see Teacher Notes and References).

Discuss how realistic these and other depictions of life in outer space (e.g., in movies) are. How do these images indicate what people thought about the future at the time they were produced?

Language Features

Academic Language Functions

describing

evaluating

Journal: Each day during the team project that is discussed in the preceding page, students should summarize in their journals what they did that day: decisions made, resources found/consulted, progress made, strategies used, problems encountered, group dynamics, and changes they need to make. At the conclusion, they should reflect on their own contribution to the overall group project. If they could change one thing next time, what would they do? What did they feel pleased about?

Student Learning Tasks

Discuss the design of a large city. (C)

Discuss how realistic are the depictions of life in outer space. (C)

As a journal entry, summarize what you did each day: decisions made, resources found/consulted, progress made, strategies used, problems encountered, group dynamics, and changes you need to make. (G)

Teacher Notes and References

Internet Resources: “Space Settlement Design Teacher’s Resource Page” (NASA) at: www.nas.nasa.gov/Services/Education/SpaceSettlement/teacher/.

This site provides excellent links to background readings, mainstream lesson plans, activities, technical information, and images.



These concepts lend themselves to a cluster web or concept map. The main categories could be developed by pairs or triads of students, then joined together for a large map to be left on the wall during the project that follows.



Visuals of artists’ depictions of space colonies from 20 or more years ago (teacher-provided). Excellent images are available from the NASA Ames Research Center at www.nas.nasa.gov/Services/Education/SpaceSettlement/70sArt/art.html. These are best viewed with a media projector, but they can be viewed individually or printed.

OR

Show a video clip from an older and a more recent space movie or television show.

Outcomes	Instructional and Learning Sequence
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- SLO 1.1** Engage with increasingly difficult oral and/or visual texts...
- SLO 1.2** Respond to texts with increasing independence...
- SLO 1.4** Show an awareness of organizational patterns...
- SLO 2.1** Show sufficient control over linguistic structures...
- SLO 2.3** Produce a variety of short and extended text forms...
- SLO 2.4** Use the steps of the writing process...
- SLO 3.1** Seek, organize, and synthesize information...
- SLO 3.2** Develop and implement a plan for researching...
- SLO 4.1** Use language to encourage...
- SLO 4.2** Communicate effectively to work with others...
- GLO 6** Students will know and use effectively metacognitive, cognitive, and social and affective learning strategies to enhance learning.

Brainstorm the basic needs for a colony of humans to live and work in outer space. (See the Teacher Notes and References column.)

Divide the class into several teams and assign the space colony project. Each team will be required to research and prepare a written proposal for their “space city” to the governing body of their fictional country and/or deliver a short presentation to their class. The outline of the project is in the Student Learning Tasks column.

Language Features	Vocabulary
	emphasize precision and variety of lexis (e.g., instead of people, use inhabitants, residents, occupants)
	Structures
	it-cleft (it is obvious/clear/apparent/unfortunate/because of..., etc. that...)
	Discourse Features
	proposal format (refer to “Technically Write” by Ron S. Bliq—see Bibliography), using the basic Summary—Background Facts—Outcome arrangement
	the difference between formal and informal register
	conversational gambits for group interaction

Student Learning Tasks

Brainstorm the basic needs for a colony of humans to live and work in outer space. (C)

Project Instructions:

- Divide students into three “aerospace companies” with teams of up to five students. Students may choose to design a lunar-based, Mars-based, or orbiting colony, for 10,000 residents.
- Each design team should elect a project manager; the other members will serve as the medical doctor, design engineer, industrial engineer, urban planner, space psychologist, business manager, or any other professional role that is applicable. Each professional is responsible for relevant topics; some topics may need more than one person’s input.
- To begin, each team should research the physical conditions of the base environment on the Internet or in books.
- Each team’s plan should include the following elements, explaining the effects, of any, of the physical conditions:
 - Name of colony and reason for establishment, and seven of the following:

<ul style="list-style-type: none"> ■ building materials ■ jobs and skills needed ■ transportation to and within the colony ■ provision of necessities (air, light, food, shielding, etc.) ■ recreation facilities ■ services needed 	<ul style="list-style-type: none"> ■ general layout ■ businesses and industries ■ scientific research ■ government ■ one other element ■ If desired, a flag, song, sports teams, etc. can also be chosen.
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Finally, all companies should estimate the cost to build the colony (in today’s currency).

Each team researches and prepares a written proposal for their city, including the points provided by the teacher to the governing body of their country, and/or a short presentation to the class. (G) (C)

Teacher Notes and References



Internet Resources (preferably demonstrate these with media projector): “Human Needs in

Outer Space” at: <www.nas.nasa.gov/Services/Education/SpaceSettlement/designer/needs.html>

“Space Settlement” <www.nas.nasa.gov/Services/Education/SpaceSettlement/>

“Space Settlement Basics” at: <www.nas.nasa.gov/Services/Education/SpaceSettlement/Basics/wwwwh.html>

“Colony Design” at: <www.nas.nasa.gov/Services/Education/SpaceSettlement/designer/>

“The Problems of Space Travel” at: <www.hq.nasa.gov/office/pao/History/SP-4026/contents.html>

Training materials for an international space settlement design competition at: <<http://space.bsdi.com/p.train.html>>

Outcomes

Instructional and Learning Sequence

Extension Activities for the Preceding Project

- Have students create computer-aided designs, physical models, or drawings of their cities.
- Show tourist brochures from several cities and let students prepare a tourist brochure for their city. They should include topics such as best restaurants, weather, tourist sites, historic sites, museums, and recreation.
- Have students create a front page of *City News*, a daily newspaper that communicates current events in their space city.
- Have students write “A Day in the Life of... (a scientist, teacher, doctor, business owner, etc.)” in their city.

Extension Activities for Mathematics and Physics

Consider the Lunar Olympics: What would the events look like if staged with lunar gravity?

Lunar conversion table:

- To convert Earth weights into Moon weights: multiply by $\frac{1}{6}$ or .17
- To convert Earth distances thrown/kicked into Moon distances thrown/kicked: multiply by 6
- To convert Earth height jumped into Moon height jumped: multiply by 6

Advanced

Several of the resource websites provide formulae for various technical aspects that students may include in their projects.

Have students research Newton’s laws of motion, if necessary. Direct each team to design its own demonstration of Newton’s First or Third Law and present it to the class. Tell students that the demonstration must be applicable to space travel.

As an extension, have students examine the relationship between force, mass, and acceleration in Newton’s Second Law, $F = ma$, by designing experiments to test one variable at a time.

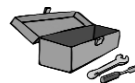
Student Learning Tasks

- Create computer-aided designs, physical models, or drawings of your city. **(G)**
- Prepare a tourist brochure for your city. **(G)**
- Create a front page of *City News*, a daily newspaper about current events in your space city.
- Write “A Day in the Life of... (a scientist, teacher, doctor, business owner, etc.)” in the city. **(I)**

Consider the Lunar Olympics: What would the events look like if staged with lunar gravity? **(C)**

Design a demonstration of Newton’s First or Third Law and present it to the class. **(G) (C)**

Teacher Notes and References



Other Internet Resources: Try a search engine with the terms “space + tourism.”

Example of scientific paper format: “Space Elevators, Space Hotels and Space Tourism” at: <http://members.aol.com/Nathan2go/SPELEV.HTM>

Canadian Arrow-space entrepreneurs at: www.canadianarrow.com/index.htm

“How Space Elevators Will Work” at: <http://science.howstuffworks.com/space-elevator.htm>

“How Terraforming Mars Will Work” at: <http://science.howstuffworks.com/terraforming.htm>

“Terraforming Information” at: www.users.globalnet.co.uk/~mfogg/index.htm

“Technological Requirements for Terraforming Mars” at: www.users.globalnet.co.uk/~mfogg/zubrin.htm

