

# Transformation 2013

## Design Challenge

### Planning Form

Design Challenge Title: Designer Zoo

Teacher(s): Stan Gabel

School: Taylor High School

Subject: Biology

Abstract: At the request of the Taylor City Council, Biology students are instructed to design a zoo that incorporates the eight major biomes of the earth.

MEETING THE NEEDS  
OF STEM EDUCATION  
THROUGH DESIGN CHALLENGES

# Begin with the End in Mind

- Does this design challenge meet the criteria for STEM student needs (21st century skills, TEKS, TAKS)?

Summarize the theme or “big ideas” for this design challenge.

At the request of the City Council Biology students are to design a Zoo that incorporates the seven major biomes of the earth.

Identify the TEKS/SEs that students will learn in the design challenge (two or three).  
8AB, 12DE

Identify key skills students will develop in this design challenge.

- Collect and classify organisms at taxonomic levels.
- Analyze relationships among organisms
- Interpret interactions among organisms exhibiting predation, parasitism, commensalism, mutualism
- Compare variations, tolerances, and adaptations of plants and animals in different Biomes.
- Identify materials needed to design and complete a zoo.

Identify the 21st century skills that students will practice in this design challenge (one or two).

- Critical Thinking and Problem Solving Skills
- Communication Skills
- Collaboration Skills

Identify STEM outcomes to be included in this design challenge.

- Students use science knowledge (biomes) and math skills to determine the amount of space and materials necessary to create a livable place for all organisms involved.

# Craft the Driving Question

- *Have you posed an authentic problem or significant question that engages students and requires STEM knowledge to solve or answer?*

State the essential question or problem statement for the design challenge. The statement should encompass all design challenge content and outcomes, and provide a central focus for student inquiry.

At the request of the Taylor City Council, our class has been commissioned to study the eight biomes of the earth and design a zoo for the preservation of species and the enjoyment and education of visitors. This organization would like to bring people to their zoos to educate the public about Biomes and the interdependence of living organisms and the environment.

# Plan the Assessment

## STEP 1: Define the products and artifacts for the design challenge.

### Early in the challenge:

- Introduce, locate and assign biomes.
- Discuss abiotic factors such as light, temperature, and rainfall.
- Explain climatograms, food chains and food webs.
- Discuss energy pyramids, symbiotic relationships
- Research and gather the necessary materials for the design

### During the challenge:

- Field trip to local or area zoo.
- Research and design a wing of the zoo.
- Keep a daily log of activities and progress

### End of the challenge:

- Create new groups, one from each biome. Finalize the design of the zoo that includes: the biome, walkways, food courts, souvenir shops, parking, and restrooms.
- Present design to city council for approval.

# Plan the Assessment

## STEP 2: State the criteria for exemplary performance for each product.

- *Do the products and criteria align with the standards and outcomes for the design challenge?*

Product: What determines the types of plants and animals that thrive in an area?

Criteria: Research from textbook, Internet sources, library the types of plants, animal and conditions related to biome topic.

Product: Explain climatograms.

Criteria: Investigate the monthly temperature and precipitation to make a graph. How does latitude and radiant energy, the effects of large bodies of water and the effects of mountains have on climate?

Product: Food Chains and Food Webs

Criteria: List the names of all of the organisms involved in the food web of the biome. Indicate the flow of energy, and predator/prey relationships.

Product: Introduce the idea of designing a wing of a zoo showcasing all aspects of their Biome.

Criteria: Plants, animals, temperature, precipitation, soil, vegetation.

# Map the Design Challenge

Look at the major product for the design challenge and analyze the tasks necessary to produce a high-quality product. What do students need to know and be able to do to complete the tasks successfully? How and when will they learn the necessary knowledge and skills?

- Do the products and tasks give all students the opportunity to demonstrate what they have

Product: Eight Biome Zoo			
Knowledge and Skills Needed <i>Elaborate on the knowledge and skills (TEKS student expectations) required to accomplish each step of the task.</i>	Already Learned	Taught before the project	Taught during the project
1. collect and classify organisms at several taxonomic levels	X	X	X
2. analyze relationships among organisms	X		X
3. interpret interactions among organisms exhibiting predation, parasitism, commensalism, and mutualism;			X
4. compare variations, tolerances, and adaptations of plants and animals in different biomes		X	
5. investigate and explain the interactions in an ecosystem including food chains, food webs, and food pyramids.			X
6. evaluate the significance of structural and physiological adaptations of plants to their environments	X	X	X
7. Critical Thinking and Problem Solving Skills	X	X	X
8. Communication Skills	X	X	X
9. Collaboration Skills	X	X	X
10.			

### What PBL tools will you use? (check appropriate box)

- X Know/need to know lists  \_\_\_\_\_
- X Daily goal sheets  \_\_\_\_\_
- X Journals  \_\_\_\_\_
- Briefs  \_\_\_\_\_
- X Task lists  \_\_\_\_\_
- Problem logs  \_\_\_\_\_
- X Project flow charts  \_\_\_\_\_

<p>Title: Designer Zoo</p> <p>TEKS: Biology 8AB, 12DE</p>	
<p style="text-align: center;"><b>Engage</b> Activity (Time: 1 day )</p> <p>Identify/focus on instructional task, connect between past &amp; present learning experiences, lay groundwork for activities (ex. Ask a question, define a problem, show a surprising event, act out a problematic situation)</p>	<ul style="list-style-type: none"> <li>• Explain project parameters</li> <li>• Each study team will choose a world biome (Rainforest, Temperate Deciduous Forest, Boreal Forest or Taiga, Chaparral, Grassland, Savannah, Desert and Tundra) and create a model and presentation indicating the animals and plants to be included, a comprehensive design of the facility and an economic feasibility study based on access, transportation and available lodging.</li> <li>• Assign groups</li> <li>• Assign biomes</li> </ul>
<p style="text-align: center;"><b>Exploration</b> Activity (Time: 2 days)</p> <p>Students get involved with phenomena and materials, students work in teams to explore through inquiry</p>	<p>Study teams conduct research on their biome using the internet resources, and any other library resources, focusing on animal and plant species', climate and weather, and one endangered species found in the biome.</p> <ul style="list-style-type: none"> <li>• Where is the biome located? Use maps</li> <li>• Describe common ecological relationship among species.</li> <li>• What are the major characteristics of the biome?</li> <li>• Field trip to the zoo.</li> </ul>
<p style="text-align: center;"><b>Explanation</b> (Time: 3 days)</p> <p>Students discuss observations, ideas, questions and hypotheses with peers, facilitators, groups. Learners apply labels to their experiences – thus developing common language, clarification/explanation of key concepts (ex. Writing, drawing, video/tape recordings)</p>	<ul style="list-style-type: none"> <li>• Design a wing of the zoo showcasing all aspects of the biome and share ideas with the class, soliciting feedback.</li> <li>• Create a blueprint of design</li> <li>• Build scale model revealing details of plan</li> </ul>

<p style="text-align: center;"><b>Elaboration</b> (Time: 1 day)</p> <p>Expand on concepts learned, make connections to other related concepts, apply understandings to the world. (ex. Extend &amp; apply knowledge)          Leads to more inquiry and new understandings.</p>	<ul style="list-style-type: none"> <li>• Create a study as to how zoo's can act as future gene pools.</li> </ul>
<p style="text-align: center;"><b>Evaluation</b> (Time: 1 day )</p> <p>Ongoing diagnostic process to determine if the learner has attained understanding of concepts &amp; knowledge (ex. Rubrics, teacher observation with checklist, student interviews, portfolios, project products, problem-based learning products, assessments)          Leads to opportunities for enrichment through further inquiry and investigation.</p>	<ul style="list-style-type: none"> <li>• Present final product to the city council for approval.</li> <li>• Model biome using diorama</li> <li>• Power Point presentation discussing organisms, and major characteristics to be included.</li> </ul>
<p>Materials/Equipment: Computers, library, textbook, internet, zoo, software</p>	
<p>Resources:          Design a Zoo Webquest: <a href="http://www.sandomenico.org/page.cfm?p=1181">http://www.sandomenico.org/page.cfm?p=1181</a>  <a href="http://bruin.brittan.sancarlos.k12.ca.us/zooquest/zooquest.html#info">http://bruin.brittan.sancarlos.k12.ca.us/zooquest/zooquest.html#info</a>  <a href="http://cuip.uchicago.edu/~mwarden/curricwebzoo/design.html">http://cuip.uchicago.edu/~mwarden/curricwebzoo/design.html</a>  <a href="http://www.zoolex.org/zoolexcgi/gallery.py">http://www.zoolex.org/zoolexcgi/gallery.py</a>          Career Opportunities in Zoo Design: <a href="http://www.zoolex.org/publication/coe/career.html">http://www.zoolex.org/publication/coe/career.html</a></p>	