Nature Inspired Design

Career Day: Biomimicry Design Challenge

Grade Level

Grades 5-12

Engage

This activity is designed to start your students in recognizing themselves as scientists and thinking critically about problem-solving. The goal is to teach concepts through discovery and to encourage using scientific thought processes. As with all lessons provided, please feel free to adapt them according to your students' abilities. You may find it more successful to lead activities and discussions as a whole group as opposed to having your students' work in small groups. Certain scientific vocabulary may or may not be appropriate for your students' level of understanding. Take these ideas, make them your own and your students will have a greater chance at success.

How could a biomimetic-inspired exhibit design improve an animal exhibit, either for the animals and/or for the people using it?

Explore

1. Begin this lesson by breaking students into small groups. Each student group will be designing a zoo exhibit for an animal of their choice. Have each student group select an animal and begin brainstorming what things they need to consider when designing for this animal. If animal information is needed to assist in this brainstorm, refer student groups to the Zoo's Online Resource Library at http://resourcelibrary.clemetzoo.com/.
2. To assist student groups in their brainstorming, provide each with a copy of *Exhibit Design Considerations*. This list is designed to enhance, not replace, what is generated by the students. (Option: If time is limited, ask the students to limit their design to meeting three animal needs, three animal management staff needs and three zoo visitor needs.)

Explain

3. At some point during the brainstorming, have a conversation with student groups about incorporating a biomimetic-inspired design element into their work. Start the conversation by giving students a definition of biomimicry: the imitation of natural biological designs or processes in engineering or invention. Brainstorm with the students what this definition means to them and how they imagine it can be applied to

inspiring a building. If students are having trouble understanding biomimicry as a concept, have them spend some time exploring asknature.org to see some examples of biomimetic-inspired designs.

4. Provide each exhibit design group with poster board or easel paper, pens/pencils, markers and various art supplies for creating their design. Inform the groups that they will present their finished designs to the class, explaining why the exhibit is designed the way that it is, how it meets the needs of the animal, animal management staff and zoo visitors and how it was inspired by nature.

Expand

5. Following the exhibit design presentations, have the class as a whole critique the exhibit designs. What were some of the biggest challenges the students had to overcome in order to create their exhibit designs? Which design was the most creative with the biomimetic-inspired design element?

Assess

6. Share your work! When you and your class have completed this activity, we'd love to see what you came up with! Click the "Share Resources" button at the top of the Zoo's Online Resource Library at http://resourcelibrary.clemetzoo.com. From the dropdown menu, select the appropriate type of file. Attach your file and complete the form on the page. Please include your school's name and the grade you teach. When you're done, click "Submit." When we receive your submission, we'll share your class's work!

Standards

Ohio Academic Content Standards
Grade 7 Life Science Topic: Cycles of Matter and Flow of Energy In any particular biome, the number, growth and survival of organisms and populations depend on biotic and abiotic factors.
High School Environmental Science Topic: Earth's Resources Wildlife and wilderness management – endangered species
High School Environmental Science Topic: Global Environmental Problems and Issues Species depletion and extinction

Next Generation Science Standards
Engineering Design MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

Exhibit Design Considerations

Animal Behavior and Health

- Does the animal live alone or in groups? How many should live in the exhibit?
- What size should the exhibit be?
- Does the animal have shelter from the weather?
- What will the animals be fed?
- Should there be plants in the exhibit? What type?
- Would it be a good idea to put other kinds of animals in the exhibit with your animal? Why or why not?
- What does your animal need water for? How will you provide it?
- Does the exhibit have different microhabitats that allow the animal to choose the temperature at which it is most comfortable (i.e., cool spots for when it's too hot/warm spots for when it's too cold)?
- What is the main substrate on the exhibit floor? Does this provide for a need of the animal?
- What types of enrichment (playthings, food items presented in a creative way, training, etc.) will be used in the exhibit to keep your animal mentally stimulated?
- Does the animal have a place to go for privacy?

Animal Management Staff Needs

- What types of barriers will you use to keep the animals in and the people out?
- Where would the keepers enter the exhibit to feed the animals?
- Do you want visitors to see the keeper and/or the food?
- What is the main substrate on the exhibit floor?
- Is the keeper able to keep this area clean?
- Can the keeper separate animals if need be (to prevent breeding, to allow new mothers private time with their newborns, etc.)?
- Is the keeper safe at all times (while feeding, while cleaning, while training, etc.)?

Visitor Needs

- How would you make sure the animals are visible to the public?
- Is your viewing area accessible to everyone, including people in wheelchairs and small children both in and out of strollers?
- What important facts about the animal should visitors learn from viewing your exhibit?
- What important facts about the habitat should visitors learn from viewing your exhibit?
- Would the zoo graphics be words only or would you use drawings, photographs, etc?

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Supplemental Materials

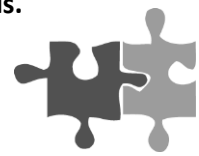
My Research Plan

1. Questioning
State the problem.
Make a hypothesis.

How could a biomimetic-inspired exhibit design improve an animal exhibit, either for the animals and/or for the people using it?

2. Planning
Make a plan by asking these questions (think, talk, write)

3. Implementing
Gather the materials.
Follow the procedures.
Observe and record the results.



4. Concluding
Draw a conclusion.

5. Reporting
Share my results (informal)
Produce a report (formal)