John Ball Zoo STEM: Exhibit Design Class

Description:

Zoos are more than a mere collection of animals. Exhibits are engineered immersive experiences to educate and provide a conservation haven for animals. Learn and apply the challenges and considerations that must be considered when designing an exhibit while trying to balance keeper, animal, and visitor needs.

Objectives:

- Students will recognize that zoo exhibit design heavily relies on engineering skills and practices in order to ultimately meet their mission of protecting species and supporting conservation efforts through education and recreation.
- Students will construct a zoo exhibit habitat model that meets the need of animal, keeper, and visitors.
- Students will assess the quality of their constructed zoo exhibit model using feedback to steer revision and redesign, in order to meet design considerations of animals, keepers, and visitors more effectively.

MI Science Standards:

3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

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.

Materials:

- Computer and Zoo Exhibit Design powerpoint
- Animal Info cards (1 per group)
- 5 exhibit construction kits (1 per group)
- 5 exhibit bases (1 per group)
- Zookeeper/Visitor Feedback cards

Abbreviated Procedure:

1. Introduction to Zoo Exhibit Design (5 minutes)
2. Exhibit Designers as engineers for animals (10 minutes)
3. Engineering an exhibit challenge activity (20 minutes)
4. Evaluation Designs for exhibit improvement (5 minutes)
   a. Animal needs
   b. Visitor needs
   c. Keeper needs
5. Redesigning exhibits (10 minutes)
6. Reflection/Addressing constraints (10 minutes)
7. Cleanup/Conclusion (5 minutes)

**Introduction to Zoo Exhibit Design (5 minutes)**

1. Welcome students. Have you ever wondered how Zoo’s decide on what animals to have? Do they know the process of creating the animal space?
2. Explain we will be discussing how animal exhibits are designed at the zoo, first we are going to talk about the purpose of zoos and how their purpose and design has changed to lead us to the type of exhibits we see now.
3. What is the purpose of a zoo? (Powerpoint Slide)
   Let students brainstorm on answers to this question.
   A. Click to reveal answers: Education, Recreation, Conservation
   B. The purpose of most modern zoos is to education the visitors, help in conservation efforts through breeding endangered species and conducting research, and also being a place for people to come and have a good time. So the purpose includes education, conservation, and recreation. Zoos today also take an active rol in helping in the conservation of animals and their habitats in the wild.
   (give examples of current projects JBZoo is involved in; massassauga rattlesnake research in Michigan, turtle conservation on-site, conservation fund that supports research abroad all over the world (S.A. Tapirs, primate protection in Africa)
4. Evolution of Zoos (powerpoint slide)
   A. Menagerie: Collection of Animals The first people to collect exotic animals were kings and other royalty. They kept animal for their own personal enjoyment and to display their power and wealth. The animals’ health and physical and mental needs were not taken into consideration. This reflects the idea that many people had at the time for the need to conquer nature rather than appreciate it.
   B. Zoological Gardens: Animals with Scientific Value 1700-1800’s: They could study these animals to learn more about the natural world. Plants and animals were protected and exhibited together in parks, thus you have the first zoo. At this time exhibits began to resemble natural habitats. *John Ball Zoo (zoological garden) began in 1891!
   C. Improve Animal Conditions – 1970’s: Less individuals in captivity. Study the wild to improve captive management.
   D. Immersion Exhibits – Current: Immersing both the animals and visitors in the animal’s ecosystem. Let them experience the habitat the way the animal does.
   E. Conservation Centers and Saving Species – Now and the Future: Help preserve animals and their habitats in the wild.
Exhibit Designers as Engineers (10 minutes)

1. What do engineers do? (power point slides)
   A. Engineers follow and engineering process in order to solve problems by coming up with a solution.
   B. Why do you think exhibit designers are considered engineers? Exhibit designers follow the engineering process every time they create new exhibits. They need to use research, problem solving, build models, and evaluate their work until they reach the perfect design. Exhibit designers are great examples of how human can engineer FOR animals. Let's take a look at the Grizzly Bear exhibit to see an example of what it looks like to follow the engineering process in a zoo setting when engineering an exhibit for a specific animal.
      i. Identify the needs/the problem
         JBZoo has an aging exhibit space for the two brown bears they house. They need a more enriching, naturalistic space!
      ii. Set a goal/generate ideas
         How are we going to get there? What do we do with the bears during construction? How do we meet the needs of the animals, visitors, keepers? Do we need any permits? How much are we willing to spend?
      iii. Form a plan
         What does it look like? How will it function?
      iv. Act
         Build it
      v. Evaluate
         How is it used?
      vi. Redesign it
         What needs to be improved or modified?

2. What does an exhibit designer need to consider before designing an exhibit?
   A. There are three groups that you must keep in mind when designing an animal exhibit: the vistiors, the animals, and the keepers. It can be difficult to meet the needs of all three groups. The end result is usually a compromise between the three and restrictions imposed by the budget.

ANIMAL NEEDS: All of these needs must be met if the animals are to stay healthy and possibly reproduce

- For the animals it does not matter if their exhibit looks like their natural habitat; only that it functions like it.
- If an animal is adapted to spending most of its time in trees and travels, eats, and sleeps in the treetops, it needs an exhibit that provides it with plenty of “branches” for moving around, as well as places to sleep and possibly eat.
- Animal needs that must be taken into consideration include:
- Adequate space. Quality space is more important than quantity. If the animal’s needs are met, less space is often required.
- Environmental conditions including temperature, light, and humidity.
• Places to hide from the public view (Visitors should be kept beyond an animal’s flight distance or the distance an animal will tolerate between himself and a threatening situation before he will run).
• Activities and objects to stimulate natural behavior
• Other animals if the animal is social.
• Appropriate substrates on floor and walls.
• Adequate resting, eating, and drinking sites.
• Possibly a back area for nighttime.
• A safe enclosure (this is defined by the animal)

VISITOR NEEDS: in order for the visitor to have a fun and educational visit, they also have certain needs that must be taken into consideration.
  • The exhibit must be pleasing to look at
  • The exhibit must be accessible to everyone, including those with special needs.
  • The exhibit must be safe for visiting publice.
  • The exhibit should be educational
  • The visitor should be able to know by looking at the exhibit, what the animals natural habitat is, interesting graphics play a role.
  • Animals must be easy to see

KEEPER NEEDS: keepers must be able to provide care for the animals and access the exhibit for cleaning.
  • The needs of the keepers are often the last thing taken into consideration. However, in order for them to do their jobs effectively they need exhibits that are designed properly. Their needs include
    • The exhibits should be easy to clean and maintain.
    • The exhibit should be safe.
    • There should be areas that allow keepers to separate individuals for treatment, shipping or birthing, and introducing new animals.
    • The safety of the keepers needs to be considered.

**Engineering an exhibit (20 minutes)**
1. A lot of considerations need to be made when designing exhibits. We are going to put your engineering problem solving skills to the test. Just like our own John Ball Zoo exhibit designers, you will be asked to develop an exhibit model for an animal that is expected to arrive at John Ball Zoo. It needs a ahome and it is your job to develop a design that would work well in the space that is given.
2. Pass out materials to each group. Each group will receive one ‘base,’ or your space that you are limited to working with. Very rarely do we get to build new exhibits from scratch!
3. Once your group receives your designated animal, animal info card, and exhibit construction kit, it is your job to meet the needs as best you can with the information
you are given. You will receive more details once your first prototype design is constructed.

A. Instruct students to read their animal information card as a group first so they can effectively approach a good solution.

B. Give a brief run through of the materials available to them. No materials will need cutting, gluing, or breaking apart. They must be used as is. Remind students that whatever they construct they will have to deconstruct at the end of class. Be gentle with materials and pay attention to where materials were taken from so they can be returned to the right place.

i. Tip: ask each student to claim a bin from the kit to oversee before they empty everything on to the table. That way they will be the ‘expert’ on knowing what materials should be returned to the bin they are in charge of to make cleanup more efficient.

Evaluating Designs for Exhibit Improvement (10 minutes)

1. Once students have had about 20 minutes to put together an exhibit, have students reflect as a group back on their process of building their model.

A. What is impacting your ability to make the perfect design?

B. What decisions were easy to make? How does working with a group influence the design process?

C. What information would be helpful in order to help you engineer the best exhibit?

2. Revisit the Animal, Keeper, and Visitor needs graphic. Ask students to reflect on how they believe their exhibit balances the needs of all 3 groups. Which group needs did you end up focusing on the most? The least?

Redesigning Exhibits (10 minutes)

1. You are going to be provided with some more information that will help shape your exhibit to better meet the needs of the keeper, animal, or visitor. Based on this new information, just like an engineer, you will be able to analyze improvements that could be made and revise/redesign your current model to account for things you did not include because it was unknown at the time.

2. Since you had the exhibit design requirements for your animal already, you will now be receiving some feedback from the zookeepers, and visitors about their suggestions for improvement. These are suggestions that you may/may not have considered in your exhibit. Do your best to keep your animals needs met in order to fulfill the ‘wishlist’ of the keepers and visitors.

A. Be aware that the feedback cards may not apply to a group’s exhibit. Be sure to pass out feedback cards to group that would require the exhibit to be changed.

a. Feedback Topics:

   i. Keeper – need room for another animal
   ii. Keeper – enrichment delivery system for keepers
   iii. Keeper – adapting exhibit to welcome a different species
   iv. Keeper – consider the keeper more
   v. Keeper – animal training area
   vi. Visitor – I can’t see the animal
   vii. Visitor – more interactive for kids
Addressing Constraints (5 minutes)
If time, have students share aloud how they constructed their exhibit and revised their design based on feedback provided.

1. How did the new information and analyzing your exhibit help with your redesign decision making?
2. Were you able to effectively meet the needs of keeper, animal, and visitor in your exhibit? Why or why not?
3. What needs did you find yourself ‘sacrificing’ the most? Why?
4. What are some constraints that need to be considered when taking the 3D model design to reality?
   A. Possible factors to consider when creating exhibits
      i. Site access
      ii. Schedule vs zoo activities
      iii. Weather
      iv. Other animals
      v. The guest experience
      vi. Cost
      vii. Drainage
5. Do you think your design could exist in real life?
6. Have students clean up their exhibits and put materials away.

Conclusion:
Challenge students to look critically at the exhibits in the remainder of the zoo. What is good or bad about them? How could they be designed better to meet the needs of the animals, visitors, and keepers?
Wrap up by reviewing what students should consider when designing an animal exhibit. Discuss why zoos are important and the role they play in educating the public and breeding endangered species. Challenge them to view the exhibits critically as they visit the rest of the zoo.

Challenge them to create their own animal exhibit back at school. They can use cardboard boxes, clay, foam board, or anything they can find in a craft store or in the recycle bin.

**The exhibit design class is based on the Minnesota Zoo’s ZOOMS curriculum.**