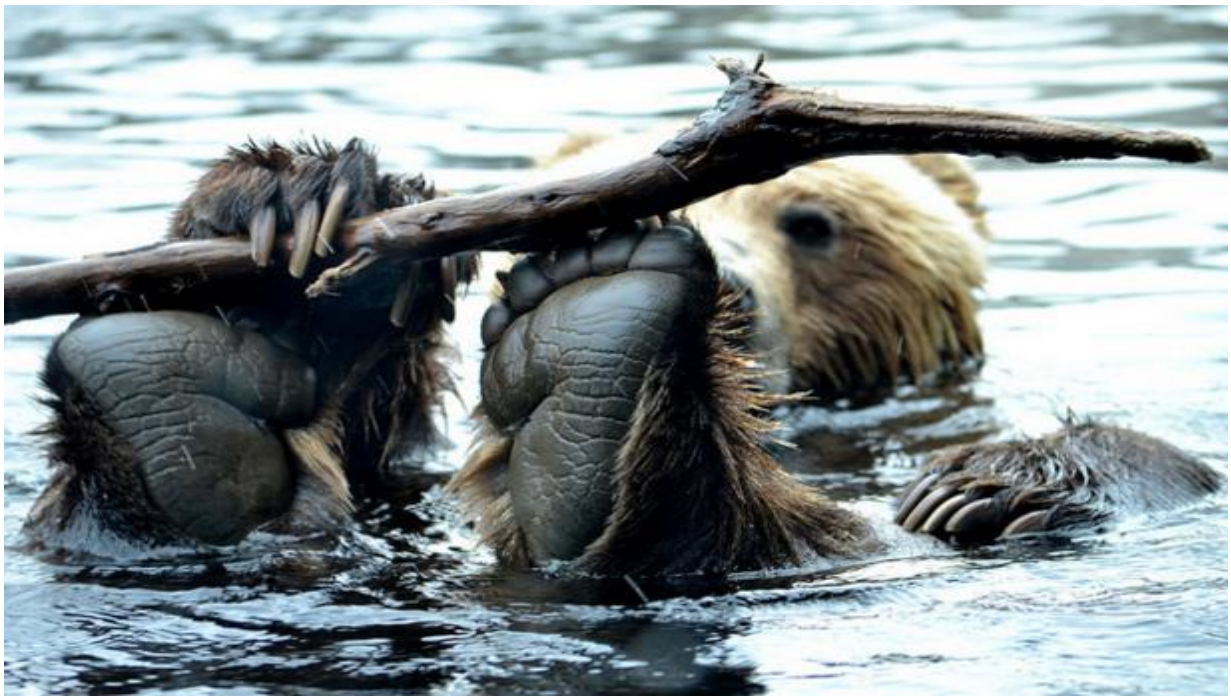
ZooMS! Enrichment Design Challenge

MINNESOTA ZOO

2016-2017

The ZooMS design challenge offers students a chance to develop a solution to a 'real' problem faced by zoo keepers and staff at the Minnesota Zoo. From designing an enrichment, to engineering a model of a renovated animal exhibit, the problem will challenge students to use their science and math knowledge, creativity, problem solving, and research skills during the engineering design process in order to best solve the problem and present a solution. Selected students will then be invited to showcase their design challenge solution in the ZooMS Design Exhibition in March at the Minnesota Zoo for a chance to win a backstage pass experience with our animals!



The Challenge

The Minnesota Zoo's is home to three orphaned brown bears from Alaska. The two males, Haines and Kenai, are joined by Sadie, the smallest of the three and the only female. Each bear has its own unique personality, playfulness, and sense of curiosity that keepers must consider when providing enrichment. Throughout the week, keepers move things around, give the bears a variety of toys to investigate, and provide food at random times to keep them on their toes with fresh surprises. This encourages them to explore and respond to their environment by challenging them to use all five senses, their minds, and to exercise their large bodies, just as they would in the wild. Keepers are looking for new ideas to enrich each individual bear based on its personality and interests, while also encouraging natural behaviors. Providing enrichment that is durable, safe, and long lasting is a challenge when used with these three very strong and curious bears!

The Task

The Enrichment Design challenge will require students to design a durable and unique enrichment device to engage the brown bears at the Minnesota Zoo.

***Level 1:** Choose one bear to design an enrichment for (1 enrichment device)*

***Level 2:** Design an enrichment specific for 2 or all 3 bears (2-3 enrichment devices)*

Students will need to make special considerations such as:

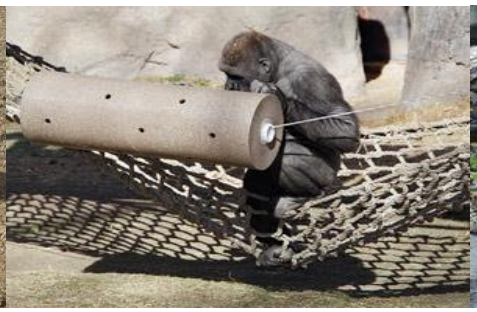
- What type of enrichment would serve each bear best?
- How can the enrichment be designed specifically to a bear's unique personality and behaviors?
- How will you expect the animal to interact with the enrichment?
- How will the enrichment encourage natural behaviors?
- What materials are most durable and safe to avoid immediate destruction from a bear?

A Closer Look at Animal Enrichment

Animals in zoos don't have the same opportunities for physical and mental stimulation that wild animals do, so zoo keepers provide the animals with objects or changes to their environment that will stimulate the behaviors of healthy wild animals. Enrichment can help to improve animal welfare and reduce stress.

Enrichment gives animals something to think about, encourages exercise and gives animals a degree of control of their environment by giving them choices. Basically, enrichment helps keep animals active and interested in their environment. Zoos may do this by presenting objects for animals to explore (manipulable), or changing how their food is presented to encourage natural foraging and hunting behaviors (dietary enrichment).

Goals of Enrichment
Encourage animals to use their natural abilities Increase their activity Allow them to make choices Give them new experiences. Animals in a stimulating environment have fewer physical problems, breed more successfully, are better parents and live longer. Challenges and stimulation make animal life in captivity more normal and visitors are more likely to see natural behavior from behaviorally-enriched animals. Food, or rather the way an animal gains access to food is a major component of behavioral enrichment. Presenting food in a way that makes animals search, forage, climb, jump and cooperate, will stimulate them.


The Solution Requirements

Level 1: 3rd – 5th Grade Enrichment Challenge



- Enrichment solution must be designed to meet the needs of one brown bear.
- Development of one prototype enrichment device that is specifically adapted to one of the bear's personality, interests, and daily exhibit behaviors.
- **Measurements/Dimensions** of enrichment
    - Length, Width, Height of key features, including dimensions of openings/holes if applicable (English or metric)
    - Optional:
        - Volume: How much food it can hold
        - Area of any openings/holes
        - Area of any key measurable surfaces

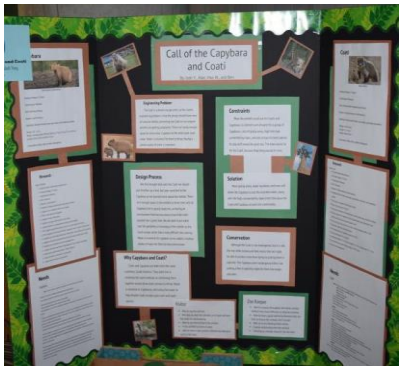
Level 2: Middle School Enrichment Challenge



- Enrichment solution must be design to meet the needs of two or all three bears.
- Develop two or three separate prototypes that can be used with your choice of two or all three bears.
- **Metric measurements/dimensions**, of each device
    - Length, width, height of key features
    - Total Surface Area
    - Include if applicable to design:
        - Volume of Feeder/Amount of food it can hold
        - Surface area and circumference of any openings/holes

ALL Levels of student submissions for the enrichment challenge will need to include:

- ☐ **3D prototype**: Hand built model of the enrichment design(s)
- ☐ **Poster Tri-Fold**: A visual presentation documenting the following:



- ❖ ***Identify Problem***: Why is this solution needed?
- ❖ ***Research*:** What are the natural behaviors of the animal in the wild? What are typical enrichments used with bears? What adaptations and other facts are important to know before designing?
- ❖ ***Design Process:*** Prototype ideas. How did you modify your design along the way? Save sketches and documents created through the process
- ❖ ***Prototype Overview*:** What will the design be called? What bear(s) does it serve? What are the main features? What are the instructions for use? What are the dimensions/measurements?
- ❖ ***Constraints*:** What factors prevented a perfect design? Could your solution exist in real life? If the animal was to use your prototype, what might impact a successful use of the enrichment?
- ❖ ***Solution***: How does the enrichment act as a solution to the problem?
    - Does the enrichment encourage natural behaviors?
    - Is the enrichment object safe, functional, and engaging? What are the main features?
    - How was a zookeeper use the enrichment with the animal?
    - How can the enrichment be modified to serve the other species? Is the enrichment challenging enough without being too difficult? It is realistic?
- ❖ ***Conservation Connection***: How does the solution/process connect to conservation efforts? How does this design process (in research or design) highlight important conservation with the animal?

Evaluation

Enrichments will be evaluated based on the following criteria: *(A rubric will be provided at the teacher workshop)*

1. **Creative Ability (10 pts):** Approach and solution is innovative and unique.
2. **Use of Engineering Process (30 pts):** Presentation and demonstration of engineering design process was used in development of solution. Evidence of design/redesign and connection to conservation.
3. **Addressing Solution Requirements (20 pts)**
    a. Does it encourage natural behaviors? Is it safe and durable?
    b. Plan for implementation- how will it be introduced? Can it be cleaned?
    c. Measurements/Dimensions
    d. Designed specifically for 1 bear (Level 1 -1 device) or 2-3 bears (Level 2 – 2 or 3 devices)
    e. Can it realistically be used with a bear?
4. **Teamwork/Presentation (10 pts)** Effective communication, organized presentation, demonstrates collaboration

Advancing to the ZooMS Exhibition

How do I select the top projects to advance to the ZooMS Exhibition?

Option 1: Host an Exhibition Event at your school attended by Minnesota Zoo Staff

One or two education staff members may be available to assist in informally evaluating or listening to student presentations. Because of staff time constraints and the number of student participants, education staff are not able be the sole evaluator. We ask teachers to be responsible for determining which projects advance to the zoo for consideration. Appointments for zoo staff to attend your school's Exhibition Day must be scheduled 2 weeks in advance. We cannot guarantee availability to attend. Please contact Kristi.Berg@state.mn.us to arrange.

Option 2: Plan a Classroom Showcase

Teachers may use the evaluation criteria rubric provided and host their own Design Challenge Classroom Showcase with the teacher submitting the top student designs to the Minnesota Zoo before February 19th to be involved in the Design Exhibition. Contact Kristi.Berg@state.mn.us for exhibition registration of school wide winning designs.

How many projects can I submit to the Zoo?

- Each teacher may submit up to **¼** of the number of projects created**.**
  Example: 15 total projects = 3 to 4 project submissions
- All teachers can submit a minimum of one project
- Not all projects submitted will advance to the March ZooMS Exhibition. Projects will be narrowed by zoo staff and announced.

What must be included in the Zoo submission?

- Online Submission Form
    - Names of team members
    - Teacher and school name
    - Grade
    - Student written description of the solution and how it met design requirements
- 1 Photo Word document including:
    - 1-2 Photos of up close views Tri-Fold Board
    - 1-2 Photos of Students with prototype
- Signed Media Release Form

Conditions

- Open to all 3rd-8th grade teachers and their students
- Students must work in a group of 2-4 students
- Teachers must register to participate no later than Monday September 19th.

Teacher Registration and Design Challenge Implementation Training

Teacher and student participation in the ZooMS Design Challenge FREE! Teachers can also attend a full one-day training (recommended!) in the fall to gain background knowledge of each challenge and gather resources to implement into the classroom.

Register online by visiting mnzoo.org/stem and clicking the 'Apply Now' link under the 2016-2017 Design Challenge The first 10 elementary teacher and 10 middle school teacher registrations will receive a $200 stipend upon completion of the following:

- ☐ Attendance to one of the ZooMS Design Challenge Workshops offered
- ☐ Participate in periodic ZooMS program assessment surveys
- ☐ Implement the ZooMS design challenge in to your classroom
- ☐ Submit student projects to be considered for the ZooMS Design Challenge Exhibition in March.

Important Dates

Closing Date for Application Forms	Friday, September 23rd	
ZooMS: Design Challenge Workshop (*Choose one*)	Tuesday September 27th	9:00 am – 3:30 pm
	Saturday October 1st	9:00 am – 3:30 pm
**Design Challenge Implementation Support -*Optional*	Saturday October 29th	9:00 am – 12 pm
	Saturday November 19th	9:00 am – 12 pm
Closing Date for Top Project Submissions	Thursday February 16th	
Projects Advancing to MN Zoo ZooMS Exhibition Notified	Wednesday February 22nd	
Elementary ZooMS Design Challenge Exhibition	Tuesday March 21st	
Middle School ZooMS Design Challenge Exhibition	Thursday March 23rd	

** A zoo classroom will be reserved and available to serve as an open ended Design Challenge Implementation Support space for teachers to come to the zoo to work with the ZooMS coordinator, collaborate with other teachers, or work independently anytime between 9 am and 12 pm.

Contact

Contact Kristi Berg for further questions and information

Email: STEM@mnzoo.org Phone: 952-431-9243

Visit mnzoo.org/stem to learn more!



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