Habitat Design Challenge

In this design challenge, ideas from life science (needs of living things, ecosystems) and engineering are used to design a zoo. The project highlights the importance of understanding and balancing the needs and wants of multiple stakeholders in a complex engineering design challenge. The approach in this design challenge is adaptable to multiple grade levels. Younger students may produce drawings of their habitats with only basic details. Older students may produce more complex representations, physical models, overall zoo layout maps, etc.

STEP 1: Provide students with a broadly stated design challenge: *As a team, we are going to design the animal habitats for an entire zoo. Together, we will be responsible for making overall decisions about the zoo and each person/pair group will be responsible for the detailed design of one animal habitat.* What design questions do you have about our challenge? They can be overall zoo questions or specific habitat questions.

Overall Design Questions	Individual/Pair/Small Group Design Questions
How much total space do we have? Where will the zoo be located? What are the conditions in this location (weather, climate)	What type of animal(s) does our habitat have to contain? Should there be more than one kind of animal in our habitat? Who eats that animal / who/what does that animal eat? What conditions does that animal need and like in the wild?

Note: It is likely that you will get "logistical" questions about the project as well, such as grading, how pairs or groups will be decided, etc. Either put these questions in a separate category OR remind students that we are looking for design questions.

STEP 2: Guide students as they think deeply about the design challenge.
Who will be affected by your zoo design? Who will live in, work in, and visit the zoo? What groups care about the outcome of the project? (It might help to think about these goals from the perspective of the animals, the zookeepers, and the visitors to the zoo. These are called the "stakeholders.")

STEP 3: Guide students as they consider the criteria for success.
Regardless of the kind of animal(s) that you are designing for, what are your criteria (goals) for success of your habitat? Are some of these goals "needs" (must have) and some "wants" (should have)? Give students time to think on their own before sharing with a partner and then with the class. Some examples that they might come up with include:

What animals need and want in a habitat	What zookeepers want in a habitat	What zoo visitors want in a habitat
NEEDS Food/water Sleeping place Temperature range for life Animal-specific needs (lives in water, hangs from ceiling, etc) Safe from predators WANTS Just the right size Just right temperature Friends / a mate Features (water, trees, etc?) Exercise/not boring Noise is low Nothing scary	NEEDS Keeps animals safe (from each other, other animals, visitors, diseases) Keep animals from escaping WANTS Easy to get the animals in and out Easy to feed the animals Easy to clean the habitat	NEEDS Keeps visitors safe from animals WANTS See the animals Animals look happy / are active Looks nice/natural

Next: What kind of habitat will make all of these stakeholders happy?

Students research their animal (chosen from a list or assigned by teacher) and use their research findings to design the habitat. Scale model and or scale drawing. Then, explanations: How does the habitat supply ALL animal needs? How does the habitat meet as many of the "wants" of the stakeholders? How are they going to balance the needs and wants of the 3 stakeholders?

STEP 4: Guide students as they consider the limitations or constraints.
Overall size of zoo divided into all the habitats--size constraints. We can't actually build and test models, so the criteria list will be used in a claims/evidence type discussion or writing as to whether your design meets the design challenge