Lesson Guide: Form and Function in Virtual Reality

Fantastic Contraption

Designed by Craig Frehlich B.Ed., M.Ed.

**Beginner Content-Note this guide is intended for players new to this application. Additional guides will be available for intermediate and advanced levels*

Target Age:	**Target Subject/Field:**	**Essential Idea:**
10-Adult, Grade 5 and up	Science, Engineering/Physics	Machines can be adapted to improve mobility and stability and function to meet human needs.

Goal of the Learning Application:

Players must build a device or "contraption" that is both mobile and capable of transporting a jelly ball object from point A to B. The mobile contraption will optimally operate like a tank, rolling over obstacles and knocking down blockades. Players can choose from 5 different objects when building their contraption. There are 3 wheels: one that spins clockwise, one that spins counter clockwise, and one that will not rotate until pushed or moved by momentum. There are also two connectors: a solid stick and a water stick. The water stick can pass through walls and wheels, but not everything. Players have free reign when designing their contraption, so trial and error plays a major role in this learning experience. But what makes a structure strong, stable and rigid in order for it to complete its task?

Possible Learning Objectives:

- Students will be able to infer how the stability of a model structure will be affected by changes in the distribution of mass within the structure and by changes in the design of its foundation and parts.
- Students will be able to create novel solutions to complex problems.
- Students will be able to identify points in a structure where flexible or fixed joints are required, and

Key Concepts & Vocabulary:

- Adaptation
- Form
- Function
- Stability
- Moveable Joint
- Rigid Joint

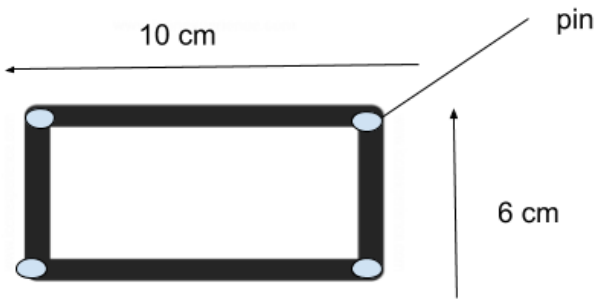
evaluate the appropriateness of different types of joints for the particular application. - Students will be able to apply scientific skills and knowledge in unfamiliar situations. - Students will be able to combine scientific knowledge, understanding and skills to create products or solutions.	

Pre-Application Guidelines & Questions:

Before entering the game/application here are some ways to engage students in ideas to prepare them for success.

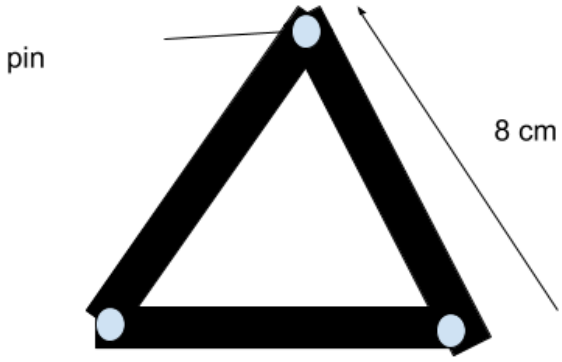
Consider The Importance of Shape in your Design.

- Design a rectangle out of 4 strips of cardboard and pins that looks something like this shape.



- Stand the rectangle up and apply a force to it downwards. What happens?
- Now apply a force horizontally. What happens?

Now design a triangle shape out of 3 strips of cardboard that looks something like this.



- Stand the triangle upward and apply a force to it downwards on the top, What happens?

- Now apply a force horizontally? What happens?
- Have a look at this video, https://www.youtube.com/watch?v=r-2UIZU8u0M, what did you learn?
- Find some pictures of structures that utilize triangular shapes to keep them strong and insert them into this document or draw them by hand below.
- What is the difference between a fixed and movable joint?

Important Tips & Tricks to Consider Inside this VR Application

What to expect?

When players first enter the game they are introduced to how the game works and the controls. For example, they first learn how to change the size of a stick (an important building block) as well as how to join them together. Additionally, players also learn how wheels work to propel structures forward. Users are given shadows to guide them on how to build their first contraption before they enter real game play. The tutorial takes approximately 3-5 minutes. When the user finishes their first contraption they are presented with Neko, a cat, that holds all the materials/parts the user will need to build your next contraption. The user should start building their second contraption. In the interest of time, allow the user to build and advance levels for approximately 20 minutes before they move on to the post game questions.

Post-Application Guidelines & Reflections

Once the student/user has explored and navigated through the VR experience they should answer the following questions:

- Sketch one or two of your Fantastic contraption designs. In the space provided below. Label all your parts.
- Engineers and designers always use trial and error when designing structures. Sometimes your first ideas are not successful. Explain how you used trial and error in designing one of your contraptions.
- The key idea for Fantastic Contraption is that machines can be adapted to improve mobility and stability and function to meet human needs. Let's say you were an engineer who was hired by a firefighting company to design a vehicle that extinguished fires on the third floor of a building. Using only materials like those used in Fantastic Contraption, design and draw a prototype of what your device might look like.

Extension Activities

- The music band, Ok Go, using contraptions in their music videos. Have a look at this TED Talk on how designers of these experiences have learnt a lot about building and problem solving, https://www.youtube.com/watch?v=uarlIjkHlAs . Please note, between the time (5:17-5:22), there is an offensive word, so you might need to fast forward that part. What is one thing you agreed with from watching this Ted talk. What is one thing you disagreed with? What is one thing you learnt from watching this Ted talk.
- Try this engineering type building game online to enhance your building and problem solving skills even further, http://www.engineering.com/gamespuzzles/dynamicsystems.aspx.