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Elective 8: Resources with NGSS Crosscutting Concepts

I. Two Resources

- Resource one: PhET Forces and Motion: Basics, Forces and Motion, and Fluid Pressure and Flow.
    - The students would use these various PhET resources to learn about basic forces and how they relate to objects in motion as well as any outside forces acting on these objects. They will then investigate fluids and how they move/affect objects motion. For each of the simulations, students will begin by playing around with the simulation and then they would work through guided inquiry with check in's as a class to summarize the concept of the simulation and its relation to the specific guided question they are investigating. Each of these resources has a place throughout the connecting of the CCC. Additionally, the students will work collaboratively throughout the process to develop a conclusion for the forces acting on both objects in motion and fluids.
- Resource two: NASA Aeronautics, The Simple Science of Flight
    - The students would use this resource to learn about aircrafts, how they have evolved, and what are key components to aircrafts staying in motion. Students would utilize the Flight and Motion lesson plan I created for this course (not attached here) to learn about calculations and all aspects relating to forces and motion of flying.
- Instructional Plan:
    - The guiding question will be "How do we analyze and understand the variables keeping planes in the sky?"
    - Students will be introduced to the Phet simulations Forces and Motion: Basics and then Forces and Motion to begin to analyze how forces act on objects in motion. By the end of the simulation investigation students will be able to analyze and explain both balanced and unbalanced forces on objects.
    - After the simulations students will draw free body diagrams of objects at rest, in constant motion, and then with changes to motion and compare the different FBDs.
    - Students will then complete the lesson plan I created on flight and the analysis of flight.
    - Students will use the PhET simulation for Fluid Pressure and Flow to determine how forces act on fluids and by

the end of the simulation activity students will be able to explain how fluids affect objects in flight.
    - To combine together the various PhET simulations and flight and motion lesson plan, students will be asked to select an image of an airplane and have it in 3 different positions: at rest on the runway, takeoff, and then at cruising altitude. In these 3 different positions students will be asked to draw FBDs of each and analyze the motion of the aircraft so it can remain in flight. They will also have to analyze what equations they would use to determine the various forces acting on the plane at each of the three positions. This will work as a summary to show the connection between the PhET simulations and the flight lesson plan to explain motion and flight.

II. Crosscutting Concepts

- The CCC that I selected to tie these two resources together is: Systems and System Models
- I believe that this is the appropriate CCC because the final assessment of the combined resources activity is to have the students create a model of the airplane in flight system at three distinct stages. By creating this model they will also need to explain the various components of system at each stage with in the overall model and how it is integral in the airplane staying in motion, which is the overall system model. This CCC makes the students connect 1) learning about forces keeping objects in constant and accelerating motion with 2) learning about airplanes, their flight, and their design and with 3) fluids flowing over airplanes and their effect on motion to accurately create an overall system model of flight to show these varied interconnections. By the students being able to accurately complete this system model, they are completing one of the important aspects of 3D learning, where they are showing what they learned and creating a product that explains a phenomena they investigated. Additionally, by breaking the CCC into smaller components and then having the students build back into it at the conclusion of the learning plan, they can track their growth and understanding of real world phenomena and explain it in their own words. This shows their learning and understanding in a more meaningful and authentic way than assessing it as a traditional written exam.