

Teaching Plan: The first 10 minutes will be spent talking about the kid's day followed by a lesson on aerodynamics. The next item on the agenda is 20 minutes to experiment with the air plane module. The following 20 minutes will be spent with the helicopters. And the penultimate 30 minutes will be used for the parachute module. The last 10 minutes will be used for a wrap up discussion.

Mentor Scientific Background: The basic physics behind a paper airplane is lift. The air flow is split by the wing and travels over and under the wing. The air that travels over the wing accelerates and creates a lower pressure than the slower moving air below the wing. The difference in pressures creates a force known as lift and allows the air plane to glide. The paper helicopters function as a result of drag forces and torque. Each blade experiences a force which has both horizontal and vertical components due to the air. Because the vertical components of the 2 forces on the 2 blades cancel each other, the net force is the sum of horizontal components. The horizontal components result in torque that spins the helicopter. The longer the arms of the helicopter, the farther the mass of the wings is from the center of mass, which makes the helicopter harder to rotate meaning it will rotate slower and stay in the air longer. Finally, the parachute hangs in the air as a result of drag. The force of drag equation is $F = bv$ where F is the drag force, b is some constant and v is the velocity of the object.

Introduction for Mentees: The description of these rather complex physics concepts should be kept on level with students. The questions about how airplanes, helicopters, and parachutes should be asked. Kids can come up to the board and draw diagrams of how the air supports and moves each of these mechanisms. The mentor can then direct the mentees in the right direction with the actual answers and draw some diagrams on the board to show how air moves to makes these objects fly.

Modules: Our lesson will consist of three modules to teach kids about flight design and aerodynamics (loosely based off the research of Andrew Packard and/or Gary T. Chapman from the Mechanical Engineering department). The first module will allow the kids to experiment with paper air planes. Multiple paper folding designs for the air planes will be provided and kids will be allowed to pick a design with a challenge in mind. The challenge will be to fold a paper air plane that flies the farthest or is very accurate. A competition will be held to see whose air plane flies the farthest and whose air plane can hit a said target. The next module will be helicopters. These helicopters are basic strips of paper cut in half to create wings. Helicopters will also be entered into competitions for accuracy dropped from the top of stairs and length of time in the air. Finally, the last module will be umbrellas. Given a set amount of materials consisting of straws, newspaper, and masking tape, they need to construct an umbrella to hold as many pennies as possible in a plastic bowl and bring it safely to the ground. The pennies can't jump out of the bowl upon collision.

Closing Activity: The competitions in each module will provide a way to wrap up each lesson individually. At the very end, the winner of each competition will present to the class why they think their design worked the best. This discussion will also be the time where we get to ask the class what we originally taught them about aerodynamics and fluids.

Materials: Paper with folding lines marked on them for air planes. Plain white paper for free style air planes and helicopters. Newspaper, straws, masking tape, and a half pound weight for the umbrellas.

References:

"Physics of Paper Airplanes." 123HelpMe.com. 22 Nov 2010
<<http://www.123HelpMe.com/view.asp?id=153261>>.