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Aerospace Connections in Education (ACE) Program
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2010-2011 ACE Curriculum

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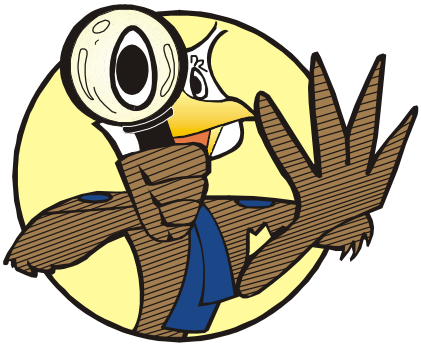
The finger rockets provided by CAP to the second-grade students are to be used with academic aerospace lesson #8, "Rocket to the Planets."

Dunked Napkin
Grade 2 Academic Lesson #2



Topic: air (science)

Length of Lesson: 30 minutes

Objectives:
- Students will conduct an experiment.
- Students will be able to prove that air takes up space.

National Standards:

Science
- Content Standard A: Science as Inquiry
- Content Standard B: Physical Science
- Unifying Concepts and Processes
  - Evidence, Models, and Explanations

Math
- Verifying and Interpreting Results

Background Information:

Gas, solid, and liquid are states of matter found on Earth. One of the basic characteristics of matter is that it occupies space. An observer can "see" a glass of milk sitting on a table. The milk and table are objects that occupy a measurable part of the total volume or space in the room. Although air is present in the room with other matter, a visual aid is necessary for an observer to "see" that air occupies a portion of space as well. In this experiment a plastic cup containing air and a crumpled napkin are turned upside down and placed into a container of water. Air and water cannot occupy the same space at the same time; therefore, the napkin remains dry.

When conducting a scientific inquiry, scientists begin by asking questions about why something is a certain way. In this case, "does air take up space?" Based on the question, they predict what the answer is. This is called forming a *hypothesis*. The next step is to test the hypothesis with an experiment. Scientists draw *conclusions* from the results of their experiment, which leads them to either accept or reject their hypothesis.

Materials:
- clear plastic cup
- napkin
- water
- basin, small aquarium (works great), or large clear bowl or container
- newspapers, drop cloth, or towels

- balloon
- dry erase board/marker or chart paper and marker
- copies of "Dunked Napkin Experiment"

NOTE: This activity can be done as a teacher demonstration or student activity. If done as a student activity, divide students into groups of 4. Have an experiment area set up for each group prior to the lesson. Each experiment area should have a clear pitcher or large container of water, 4 clear cups, 4 napkins, and either a towel or extra napkins. Prior to the lesson, have the aquarium (and other pitchers/containers if applicable) filled with water. You may choose to replace the word "dunked" with "submerged" to introduce the definition of "submerge" to your students. Have the following two questions written on the board or chart paper, (but out of view of the students):

1) How can a napkin be dunked (or submerged) into a container of water without getting wet?
2) If we can dunk (submerge) a napkin into a container of water without getting it wet, what keeps the napkin dry?

Lesson Presentation:

1. Have students discuss what they think air is. Explain that air is a mixture of gases that we usually cannot see. (At times, the air can mix with dust or smoke particles that make it visible.)

2. Ask the following: Which of the five senses lets us experience air? Can you taste or smell air? Can you see it? (No, but you can see things like a wind sock blow in the wind.) Can you feel air? (Try holding your hand over a heating vent, fanning your face with a folded paper fan, or whirling around with a paper lunch bag on your arm.) You might not be able to see air, but you can feel air molecules moving.

3. Ask students why they think air does or does not take up space. Listen to their ideas. To help students answer this question, take a deflated balloon and blow air into it so that it is partially filled. Ask them what is in the balloon and then blow up the balloon until it is full. Is there more air in the balloon now than there was before? (Obviously, air takes up space.) Tell students that as they conduct an experiment today, it will be helpful to remember that they just proved with the balloon that air takes up space.

4. Ask students what an experiment is. (An experiment is an activity that we can do to help answer questions.)

5. Show students the small aquarium filled with water, the cup, and the napkin. Tell students that the class will conduct an experiment to answer two questions. Show the questions on the board or chart paper as you announce the two questions.
   - How can we dunk a napkin into the water without getting the napkin wet?
   - If we can dunk a napkin into the water without getting it wet, what keeps the napkin dry?

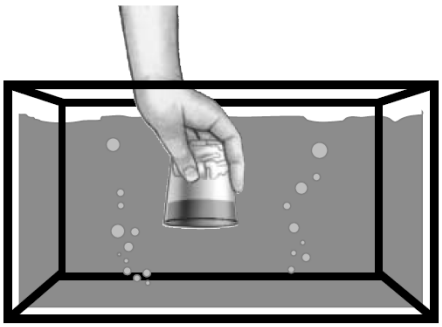
6. Ask a student if they know what a hypothesis is. (If they participated in this program in first grade, they should recognize this term.) Make sure students understand that a hypothesis is their best guess based on everything that they know and have learned. A hypothesis is an educated guess, like a prediction.

7. Distribute an experiment sheet to students. Have students locate the hypothesis box in the top row in the middle of the page. Have them draw their hypothesis, or their best guess, as to how to dunk the napkin into the water without the napkin getting wet. Tell them that the only items they have to use are the napkin, the container of water, a cup, and one hand!

8. If conducting this activity as a whole group, invite some students to share their predictions. If conducting this activity in small groups, allow the group members to share their hypothesis within their group.

9. If conducting this lesson as a whole group, allow some students to come to the front of the room to try their predictions using the materials. If conducting the activity in small groups, allow each group member to test his or her hypothesis in the group's experiment area.

10. Share the correct way to dunk the napkin with the class. (Crumple the napkin and stuff it into the bottom of the cup. Turn the cup upside-down and plunge it completely into the water. **Do not tilt the cup.** Remove the cup from the water, and remove the napkin. Observe that the napkin is dry.)



11. Ask students to raise their hand if their hypothesis was correct.

12. Have students complete the "conclusion" box at the end of the top row of boxes. Remind students that when conducting an experiment, the term conclusion means "what they learned." Students should draw the correct method of submerging the napkin without getting it wet.

13. Read question two to the students again. Ask them to write why they think the napkin stayed dry in the hypothesis box next to question number two.

14. Ask some students to volunteer to share their hypothesis. After listening to student responses, explain the following to the students if they are confused about why the napkin remained dry.
    Remind students of the balloon and the air. Air takes up space. When the napkin is crammed in the bottom of the cup, and the cup is placed in the water upside down, air is still in the cup. Because air is still in the cup, it doesn't leave room for the water to get in and get to the napkin. Air is in the cup!

15. Complete the experiment sheet by writing, "Air took up space in the cup, so the water could not get in," in the conclusion box.

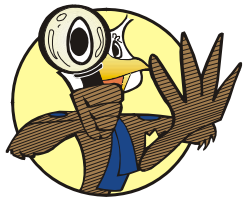
Summarization:
Ask students what they learned today. (Guide students to mention items such as hypothesis, conclusion, experiment, and air taking up space.) Remind students that, just like experiments begin with questions, sometimes we are faced with questions too. We don't always know the answer at first. Sometimes, we make mistakes, which is part of learning how to do things right. Encourage students to learn from their mistakes, keep trying, and make good choices.

Assessment:
- students answers to class discussion questions
- teacher observation
- "Dunked Napkin Experiment" data sheet

Additional activity ideas to enrich and extend the primary lesson (optional):
- Have the students generate a list of examples of air taking up space that they might see in school, at home, or on television: balloons, bubbles, basketballs, etc.

- Ask if students have another question about air that the class could help answer by developing and conducting an experiment.

- Have the students alter variables like cup size, speed, and angle of insertion and removal, and liquids other than water.



Dunked Napkin Experiment

NAME _____

QUESTION #1:

How can I dunk a napkin into water without getting the napkin wet?

MY HYPOTHESIS:

Draw what you think will work.

CONCLUSION:

Draw the correct way to dunk the napkin into the water to keep it dry.

QUESTION #2:

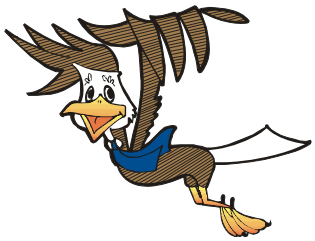
What keeps the napkin dry?

MY HYPOTHESIS:

Write why you think the napkin stays dry.

CONCLUSION:

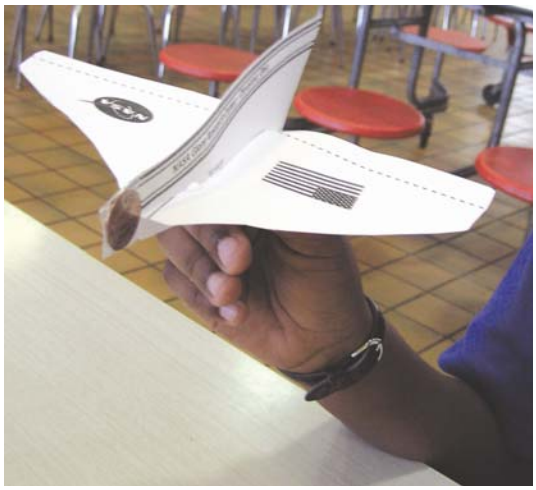
Write why the napkin stays dry.



Glenn Glider
Grade 2 Academic Lesson #4

Topics: flight, cause and effect (science)

Length of Lesson: 45 minutes



Objectives:

- Students will define glider.
- Students will identify fuselage, wings, and elevons.
- Students will experiment with flight.

National Science Standards:

- Content Standard A: Science as Inquiry
- Content Standard B: Physical Science
  - Position and motion of objects
- Content Standard E: Science and Technology
  - Abilities of technological design
- Unifying Concepts and Processes
  - Form and function

Background Information: (from http://www.grc.nasa.gov/WWW/K-12/airplane/glider.html and CAP's *Aerospace for the Very Young*)

A glider is a special kind of aircraft that has no engine. Paper airplanes are the most obvious example, but gliders come in a wide range of sizes. Toy gliders, made of balsa wood or Styrofoam, are an excellent way for students to study the basics of aerodynamics. Hang-gliders are piloted aircraft that are launched by leaping off the side of a hill. The Wright brothers perfected the design of the first airplane and gained piloting experience through a series of glider flights from 1900 to 1903. More sophisticated gliders are launched by ground-based catapults, or are towed aloft by a powered aircraft then cut free to glide for hours over many miles. The Space Shuttle flies as a glider during reentry and landing; the rocket engines are used only during liftoff.

Compared to a powered aircraft, a glider has only three main forces acting on it: lift, drag, and weight. The weight acts through the center of gravity and is always directed towards the center of the earth. Lift is the force that holds an airplane and glider in the air. Drag is the force that acts opposite to the direction of motion. It tends to slow an object. An example is putting your hand out of a moving car window and feeling it pull back.
In order for a glider to fly, it must generate lift to oppose its weight. To generate lift, a glider must move through the air. But the motion of a glider through the air also generates drag. In a powered aircraft, the thrust from the engine opposes drag. But a glider has no engine to generate thrust. With the drag unopposed, a glider quickly slows down until it can no longer generate enough lift to oppose the weight.

So how does a glider generate the velocity needed for flight? The simple answer is that a glider trades altitude for velocity. It trades the potential energy difference from a higher altitude to a lower altitude to produce kinetic energy, which means velocity. Gliders are always descending relative to the air in which they are flying.

How do gliders stay aloft for hours if they constantly descend? The answer is that they are designed to be very efficient, to descend very slowly. If the pilot can locate a pocket of air that is rising faster than the glider is descending, the glider can actually gain altitude, increasing its potential energy. Pockets of rising air are called updrafts. Updrafts are found when a wind blowing at a hill or mountain has to rise to climb over it. Updrafts can also be found over dark landmasses that absorb heat from the sun. The heat from the ground warms the surrounding air, which causes the air to rise. Rising pockets of hot air are called thermals. Large gliding birds, such as owls and hawks, are often seen circling inside a thermal to gain altitude without flapping their wings. Gliders do exactly the same thing.

Materials:

- Glenn Glider pattern for each student (works best on cardstock paper)
- scissors
- tape
- one penny for each student

NOTE: Have a finished example of the Glenn Glider to show the students prior to starting the lesson.

Lesson Presentation:

1. Show students the finished example of the Glenn Glider, but do not tell them the name of your aircraft. Ask students what you are holding. Most of them will probably say an airplane. If students agree that it is an airplane, ask them how they know. In other words, what makes it an airplane? Help students understand that airplanes have propellers (blades that spin on an airplane) or some type of engine. Ask students if they see any propellers or engines on this model. Ask students what name we give to aircrafts that do not have propellers or engines. (gliders)

2. Share some information about gliders from the background information to help students understand what gliders are, how they are different from airplanes, and how they fly.

3. Tell students that they will build and test a glider today. Distribute materials.

4. With students looking at the Glenn Glider handout, go over the parts of the glider. The fuselage is the body of gliders and airplanes. The wings help create lift, or the ability to stay in the air. The position of the elevons affects the nose of the plane going up or down, and it also affects the wings tipping to the left or right. Ultimately, the position of the elevons affects the path of the airplane.
5. Have students construct the glider.

1) Cut out the wing and fuselage patterns.
2) Carefully cut the wing slot line located on the fuselage.
3) Slide the wing into the slot making sure that the wing centerline is within the fuselage.
4) Tape the wing to the fuselage.
5) Tape the penny to the nose of the fuselage for balance.
6) Experiment with flight by bending the elevons.

6. Once students have completed their gliders, allow them to practice flying.

Summarization:
Gather students together. Ask them to report on their glider's performance. Remind students that how hard or easy we toss the glider affects the flight of the glider. There are many things that work together to create a good glider flight, such as the entrance into the air, the design of the parts of the plane, how quickly or slowly the air is moving, etc. When everything works well together, great things happen. Encourage students to work well together.

Assessment:
- teacher observation
- construction of Glenn Glider

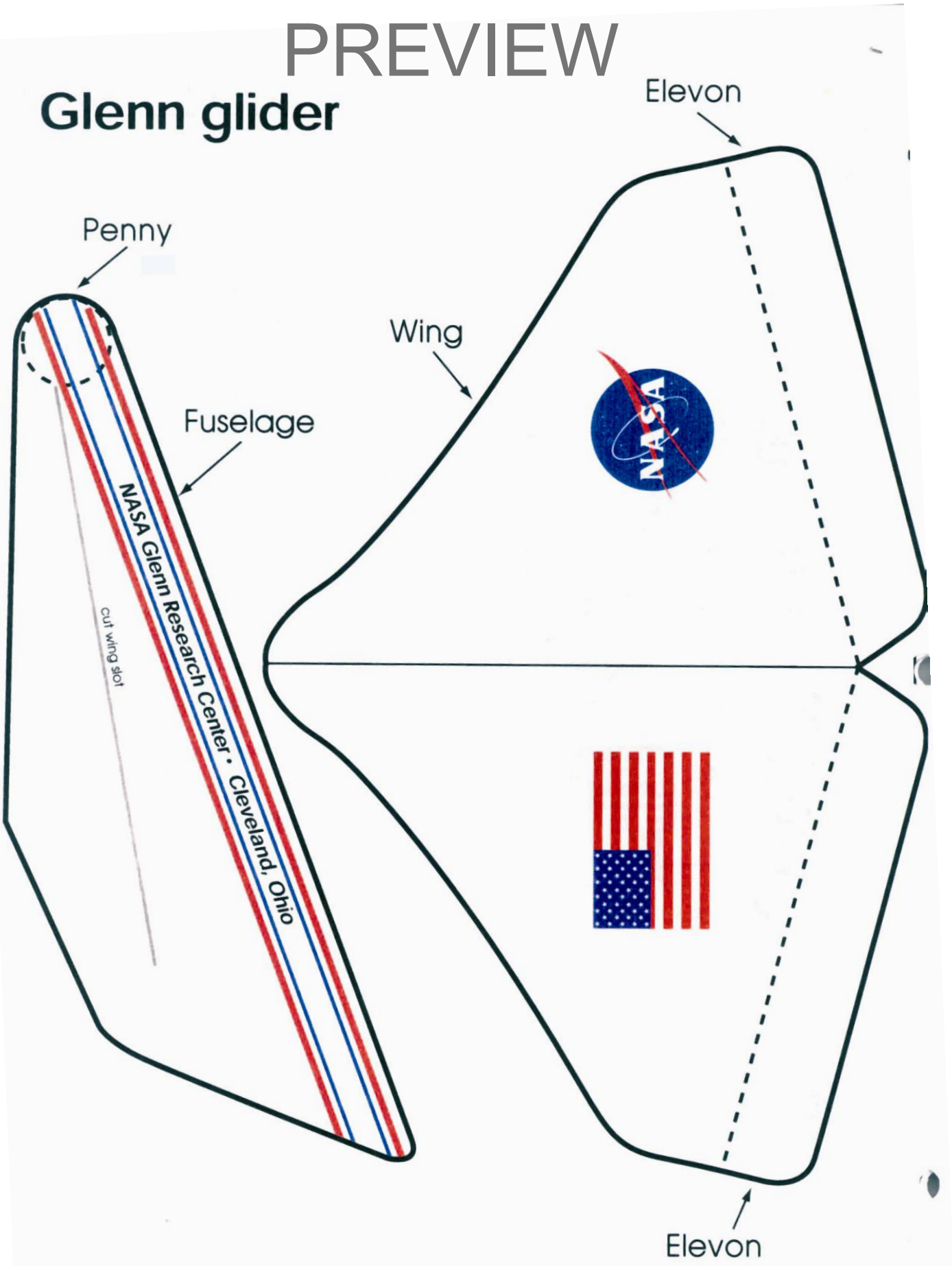
Additional activities to enrich and extend the lesson (optional):
- Have students point to the parts of the aircraft as you refer to them (wing, fuselage, elevon). Have students point to the parts of the aircraft as you give a description of the part: provides lift (wings), body (fuselage), controls whether the plane flies up, shoots down, goes left, or goes right (elevon).

- Using the attached data sheet, allow students to experiment with the elevons. As a class, form a conclusion about how the glider flies with the elevons placed in specific positions. (Students may draw their predicted and actual flight paths as opposed to writing. Demonstrate an example of this for students.)

- Construct a Delta Glider using foam meat trays. This glider also has a rudder, which controls yaw, turning left or right. (Think swivel chair.) If conducting this lesson, you could have students fold the rudder left and right to observe the effect. Directions for the Delta Glider are at www.dfrc.nasa.gov/Education/OnlineEd/K4Guide/PDF/12delta.pdf

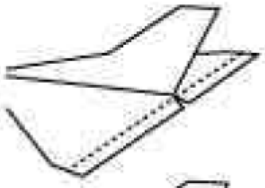
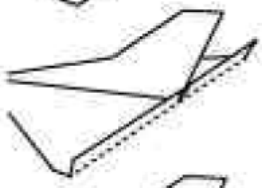
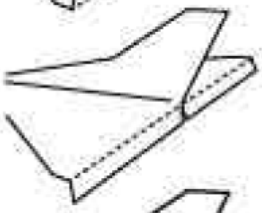
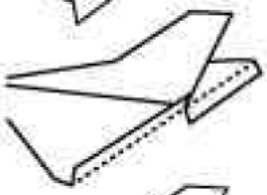
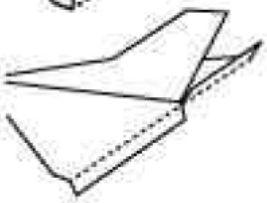
- Have a glider contest and measure the distance each glider glides. Create a graph with the results.

Glenn glider



Directions: Bend the elevons into the positions listed below. Be sure to predict the flight path before flying the glider. Test fly the glider and record the results (up, down, left, right).

Student Test Pilot Record Sheet (What I Observed)

Position of elevons		Predicted Flight Path	*Path of Test Flight*
Right and left straight		_____	_____
Right and left up		_____	_____
Right and left down		_____	_____
Right down, left up		_____	_____
Right up, left down		_____	_____

CLASS CONCLUSIONS:

1. What happens when both elevons are in the up position?

   _____

2. What happens when both elevons are in the down position?

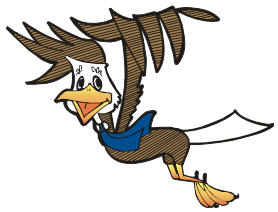
   _____

3. What happens when the elevons are in opposite positions?

   _____

4. Does changing the position of the elevons change the glider's flight path? _____

www.dfrc.nasa.gov/Education/OnlineEd/K4Guide/PDF/12delta.pdf



Civil Air Patrol's ACE Program

Responsibility Bingo
Grade 2 Character Lesson #6

Topic: responsibility (language arts, social studies)

Length of Lesson: 30 minutes

Objectives:
- Students will define responsibility.
- Students will identify responsibilities when playing games.

National Character Education Partnership (CEP) Standards:
- Principles 1, 2, 3, 6, 7

Background Information:
Responsibility is a noun meaning the quality of being dependable. A synonym for responsibility is obligation. Being responsible means being accountable for a task or expectation and doing what one is suppose to do. Some tips to help one be responsible are:
- Plan (even think ahead before you say or do something to consider the consequence)
- Do your best
- Be honest (even if it is admitting you made a mistake)

The purpose of this lesson is to have students identify responsible behaviors.

Materials:
- board/marker
- bingo sheet for each student (one copy included)
- pencil
- "Keeping Up With My Responsibilities" copies (one copy included)

Lesson Presentation:
1. Tell students to clear their desks of everything except a pencil to get ready for a game.

2. Tell students that they will be playing Bingo. Before playing, ask students to name the rules for playing bingo. As they are named, list the rules on the board.
   - Listen carefully! The caller should not have to repeat the answer.
   - Only place a chip on a space that is called out.
   - 5 chips must appear in a line – up/down, sideways, or diagonal to win.
   - Must have all 5 chips in correct order before saying "Bingo."
   - Boards must be cleared after a winner is declared.

3. Distribute the Bingo sheets. Tell the students that they must fill-in each square with a word from the bottom of the page. As soon as they write a word, they need to scratch it off so that they do not write it again. Emphasize that they will only write a word once, and they can write it in any square they want. They may choose one space as a "free" space. Remind them to mark off the word "free" at the bottom of their bingo sheet.

4. Before playing, have a student get a dictionary to read the definition of "responsible" and let students give examples for discussion.

5. Tell the students that when a word is drawn for the bingo game, the word must be used in a sentence that demonstrates responsibility or being responsible. State that you will begin the first game by providing sentences for the words. Tell them to pay attention, because during the next game, they will have to make "responsible" sentences with the words.

6. Play the game using the bingo information provided on the pages following the "Bingo Board."

7. Play the game a couple more times allowing the students to provide a sentence using the word.

8. Ask students to explain their responsibilities during the game. (Students should name each of the rules listed earlier. Also, students were responsible for being honest about whether or not they got a bingo. They were trusted to use a word only one time on their bingo sheet. They were responsible for using the chips correctly – not eating them. They were trusted to follow the class rules while they were playing, such as keeping hands and feet to oneself. They had to use a word correctly in a sentence about responsibility.)

9. Distribute the "Keeping Up With My Responsibilities" sheet. Have students write some of their responsibilities in the balloons. (They may write keywords.) Have them write their names on their papers. (Consider using this page with the balloon art extension activity.)

Summarization:
Tell students that throughout their lives, they will engage in games, sports activities, and competitions. Explain that no matter what they are doing, they have responsibilities. Encourage them to do their best. Whether or not they play responsibly affects the game for everyone. Especially remember to play honest and be a good sport. Compliment the students for things they did well during the bingo game today.

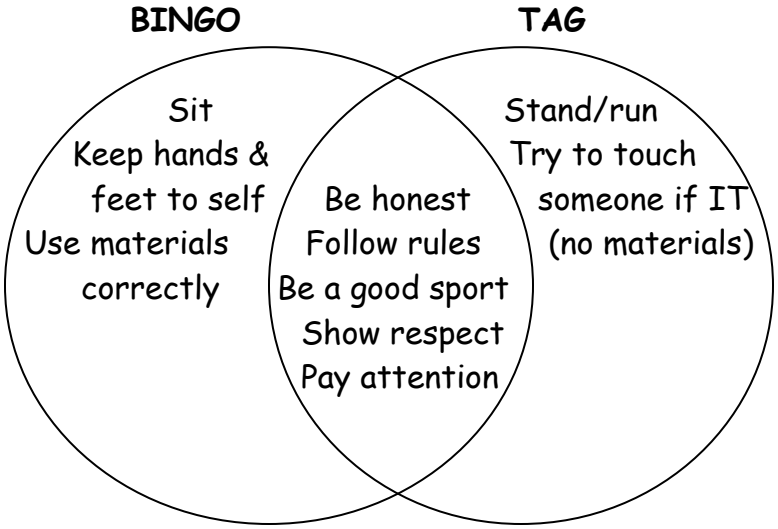
Assessment:

- student answers to class discussion questions
- student sentences during bingo

Additional activity ideas to enrich and extend the primary lesson (optional):

- Have students cut out the "balloon responsibilities" and paste them on a piece of large construction or manila drawing paper. Have them draw a picture of themselves holding their responsibility balloons.

- Distribute the Venn diagram worksheet. Draw a Venn diagram on the board. Have students compare and contrast their responsibilities in a game like Bingo and another game like Tag. Below are sample answers. Use this opportunity to discuss what it means to use good sportsmanship!!!!



- Discuss what happens when students do not play responsibly. Discuss what happens when professional players do not play responsibly. (They get penalties for their team, and may even get thrown out of the game.) Find a news article about a sports player who got in trouble for making a bad decision. Share it with the class and discuss it.

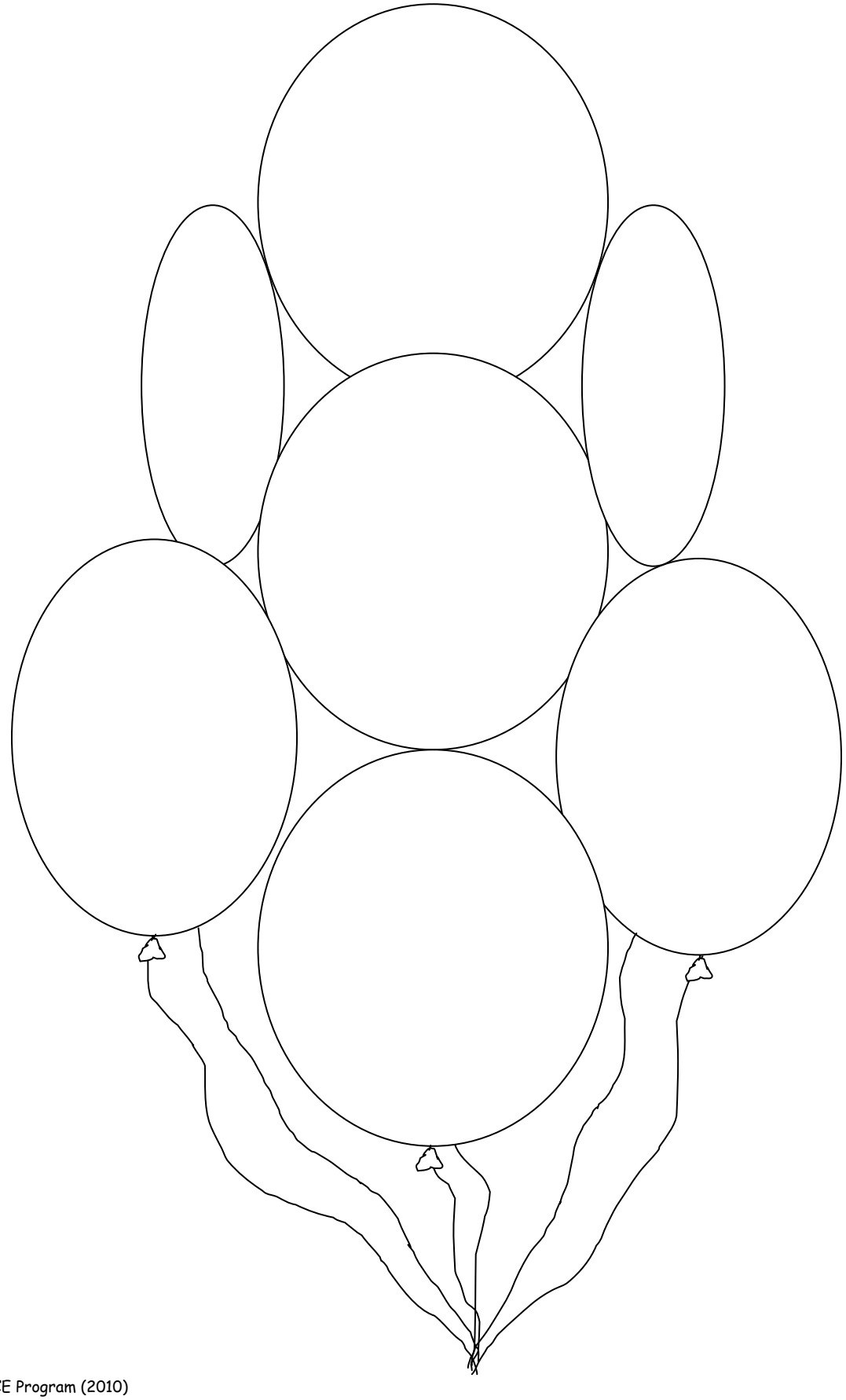
- Divide students into small groups. Have them invent a game that would be played in space or on another planet. Have them develop a list of rules/responsibilities for the game.

Associated Literature:

- *What a Wimp*, C. Carrick
- *Henry Huggins*, B. Cleary
- *Salt Boy*, M. Perrine
- *Inch and Miles*, J. Wooden

Keeping Up With My Responsibilities!

Directions: Write a responsibility you have in each of the balloons below. Then, color your balloons.

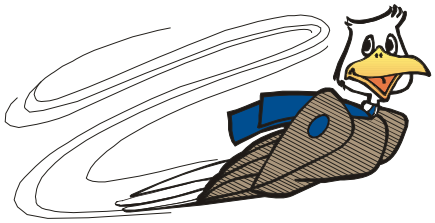


_____'S Bingo Board

RESPONSIBILITY

FREE	game	lunch	honest	pencil
dog	work	jogging	air	hands
house	time	sister	nice	math
school	fair	lightening	trash	TV
clothes	toys	respect	homework	library

Shuttle Tag
Grade 2 Physical Fitness Lesson #3



Topic: aerobic activity

Length of Lesson: 30 minutes

Objectives:
- Students will work as a team to complete a game.
- Students will show good sportsmanship.
- Students will name U.S. shuttles/orbiters that have been used in spaceflights.
- Students will define meteoroid.
- Students will compare and contrast changes in heart rate before and after physical activity to demonstrate endurance.

National Physical Education Standards:
- Standards 2, 3, 5, 6

Background Information:
This activity will help develop the children's endurance. Endurance is one element of fitness. Endurance is developed when someone regularly engages in aerobic activity. During aerobic exercise, the heart beats faster and a person breathes harder. When done regularly and for continuous periods of time, aerobic activity strengthens the heart and improves the body's ability to deliver oxygen to all its cells.

In this game, the students are trying not to let the "meteoroid" tag them before they reach the other side of the playing area.

Materials:
- gym or large open area
- (optional) For a class of about 25, have 5 sets of laminated cards labeled 1-5. If using colored paper, each number set, such as the 1's, should be on a designated color. (For example, all of the 1's may be yellow, the 2's red, etc.)
- (optional) yarn, plastic string, or shoestrings to create "necklaces" with the numbered cards
- picture or model of space shuttle (picture included)

Lesson Presentation:
1. Before the activity, have the students check their heart rates. Help them find their pulse using two fingers at the neck, the wrist, or just put their hand over their heart. Give them 15 seconds to count the beats. Tell them they will check it again at the end of the activity to see if it has increased, so remember how many times their heartbeat now.

2. Conduct warm-up exercises.

3. Tell students that today's game will be a version of tag. Students will try to run from one side to another without getting tagged. Tell students that the students who are "IT" will be called meteoroids. Ask students if they know what meteoroids are. (A meteoroid is a rocky object that is traveling in space that could be as small as a speck, but not as large as an asteroid which is a large rocky body in outer space that goes around the sun) Ask for one to three student volunteers, depending on the total number of students playing, to be "meteoroids."

4. Ask students if they have ever seen a picture of a space shuttle. Ask if they know what the space shuttle is. (The space shuttle is a launch vehicle capable of carrying people and things into space. It is like an 18-wheeler truck that can go to space, but it looks very different from a truck. Show a picture or model of the space shuttle. Tell students that the part of the space shuttle that looks like a plane is called the orbiter. Tell students that there have been 5 orbiters that have flown in space: Columbia, Challenger, Discovery, Atlantis, and Endeavour. Tell them that during today's game, they will be divided into groups and given the name of an orbiter. Explain that even a meteoroid that is the size of a pebble could damage an orbiter in space if it "tags" the orbiter. The orbiter might have to go to the space station to make repairs or make repairs after it returns to Earth.

5. Divide the students into five groups with an equal number of members in each group. Assign each group the name of an orbiter and a corresponding number (1. Columbia, 2. Challenger, 3. Discovery, 4. Atlantis, 5. Endeavour). Explain that students should remember their orbiter name and number. [OPTIONAL: If you have laminated sets of numbered card "necklaces," give all of the "1's" to the Columbia group to wear, all of the "2's" to the Challenger group, etc. By doing so, it will make it easy for you, as instructor, to ensure that the correct group or individuals are running when called.]

6. Give the parameters of the game. Show students the playing area including the lines behind which "orbiters" stand, the area where meteoroids can run, and the sidelines where those tagged by the meteoroid stay. Tell the students that this game requires listening for their orbiter name and number to be called, and when it is called, they run to the "safe" area at the other end of the field. If the teacher calls "entire fleet," everyone needs to run from one side of the playing area to the other. They do not want to get tagged by the "meteoroids." Meteoroids must tag only someone's shoulder, arm, or back. The "meteoroids" will remain between the two lines of the playing field. If a meteoroid tags an "orbiter," the orbiter must go to the sidelines for repairs. To "conduct repairs," the student must immediately do 5 jumping jacks and remain on the sideline. At any time when the teacher or meteoroids call out "repairs," those on the sideline again do 5 jumping jacks.

7. Call out the name and number of a group, and that group will try and run from one side of the playing area to the other. Continue the game until only 1 orbiter is left. This will be the "winner," and/or this person represents the winning team. The winner can now become a meteoroid and can select one or two other students to be meteoroids.

8. Leave time at the end of the session to have the children take their heart rate again for 15 seconds. Have them compare the amount of heartbeats per 15 seconds before and after the game.

Summarization:
Ask students why the game was important. (Example answers would be: Allowed them to practice following directions, allowed them to practice good sportsmanship, gave them exercise – including their heart, and learned the names of the orbiters that have flown in space) Tell students that by exercising regularly, they maintain strong, healthy bodies, and that will help them "fly" well in life. It will give them energy to keep going! Also, just like you had to pay attention during the game, you have to pay attention during life to make good choices. If something tags you during life, you have to "make repairs" and get yourself going in the right direction again!

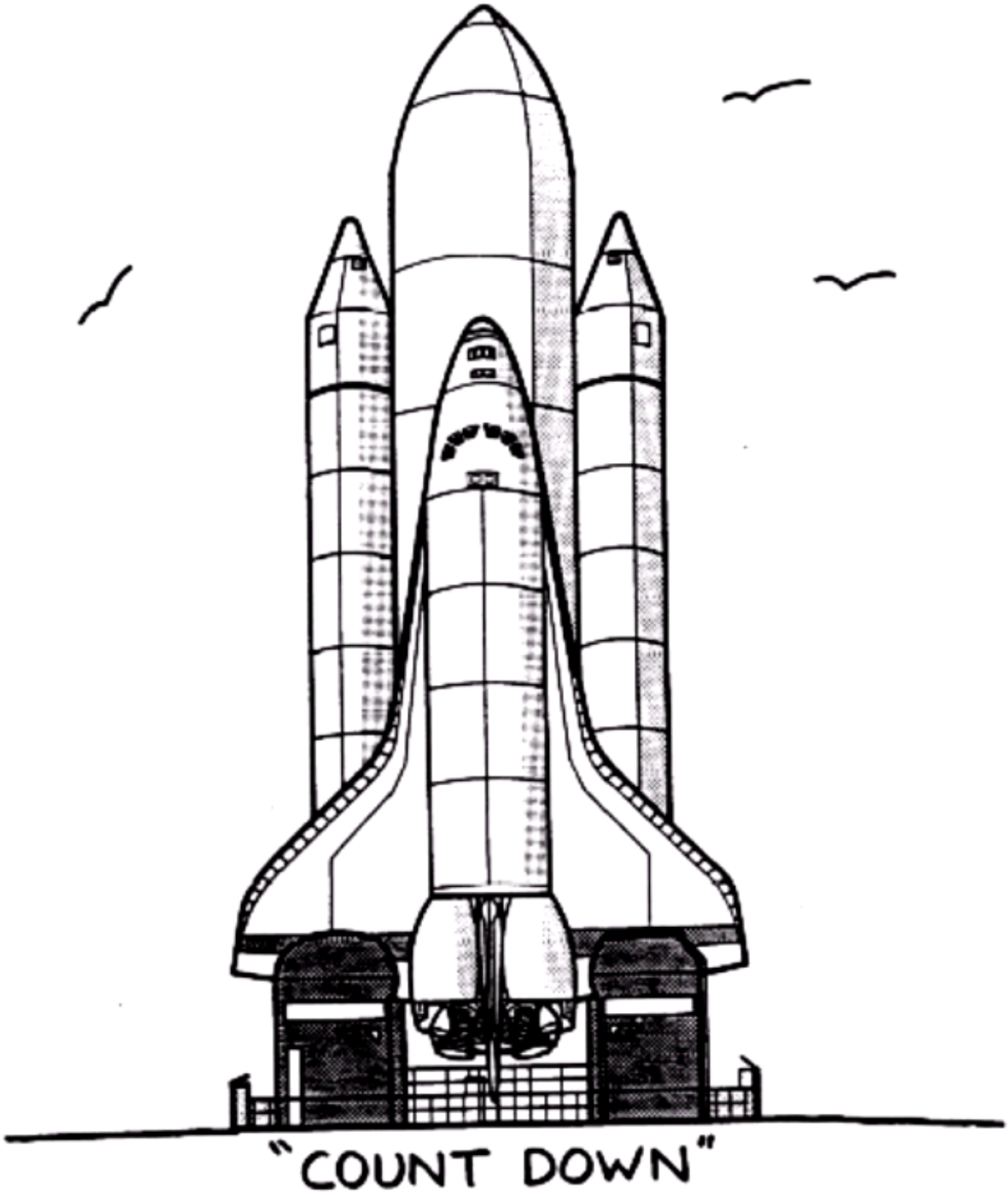
Assessment:

- teacher observation of the students completing the activity as planned

Additional activity ideas to enrich and extend the primary lesson:

- Arrange students in teams of five members per team. Give each student on the team a different orbiter/shuttle name so that a team consists of one person representing Columbia, another person representing Challenger, etc. Play "orbiter" tag again, but this time, the winning team will be the one who gets the most "orbiters" (team members) from one side to the other without getting tagged after 3-5 passes.

SPACE SHUTTLE



http://www.nasa.gov/audience/forkids/activities/cp_countdown.html