

Tape and Straws: Teaching Problem Solving on a Budget

Presenters:

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Struggling with finding methods to instruct your student's in problem solving activities? Spending too much on resources in a budget crisis? This session will show teachers simple, cost effective activities that can be integrated into their classroom using simple, easy to find objects. Learn how to use simple hands-on activities to teach soft skills such as team building and problem solving in your classroom.

This session will be hands-on and involve some physical activity on your part.

BASIC SUPPLY LIST

Consumables

- € Aluminum Foil
- € Balloons
- € Card Stock
- € File Folders
- € Glue
- € Glue Sticks
- € Index Cards
- € Masking Tape (multiple sizes)
- € Newspaper
- € Paper Clips (multiple sizes)
- € Pins
- € Plain paper
- € Plastic Wrap
- € Poster Board
- € Spaghetti
- € String
- € Toothpicks
- € Ziploc Style Bags

Non-consumables

- € Crayons
- € Cutting Tools
- € Glue Guns
- € Golf Balls
- € Map Pencils
- € Marbles
- € Markers
- € Rulers
- € Scissors
- € Tennis Balls

If you keep most of these items in stock you can easily teach problem solving at a moment's notice.

FLAG TOWER

Design and construct the tallest flag tower that will support your teams custom designed flag.

CONSUMABLE MATERIALS

2 Sheets of 8 ½" x 11" paper
2 Paper Clips
Masking Tape
1 Index Card

NON-CONSUMABLE

Crayons
Scissors (1 pair per team)
Ruler (1 pair per team)

LIMITATIONS

1. You may use only the consumable materials provided.
2. The flagpole must be free standing and cannot be taped, glued, etc. to the test surface.
3. You have only 30 minutes to construct pole and design your team flag.

INSTRUCTIONS

1. Sketch the design/plan for your pole and flag.
2. Attain needed materials from your instructor.
3. Two students on pole construction and the other two on flag creation.
4. Construct your Flag Tower.

TESTING

1. Flagpole must be free standing.
2. Flagpole and flag constructed of only the materials given.

BALLOON CAR

OBJECTIVE

Students are to design and construct a car that is propelled by a balloon that will travel the farthest distance from the starting point.

MATERIALS

(Per Student)

1. Any non-energy storing materials for the car construction
2. 12" balloon
3. Wheels
4. Axles
5. Masking Tape
6. Glue

TOOLS

1. Scissors
2. Ruler
3. X-acto Knife

LIMITATIONS

1. Car must be able to roll freely.
2. Car must be propelled by a balloon only.
3. Students may not utilize rubber bands, springs, mouse traps, etc... to propel the car.
4. Car must have a minimum of 3 wheels.
5. Students may not push the car.

INSTRUCTIONS

1. Car will be raced on a flat surface.
2. Car must be able to travel a minimum distance of 4 feet beyond the starting line.
3. Cars will be allowed 2 runs.
4. The car that travels the farthest distance will be declared the winner.
4. In case of a tie the winner will be the car that travels the straightest line perpendicular to the starting line.

V-ROOM! V-ROOM!

The objective of this project is to make a vehicle that will travel the furthest distance. Students should work in teams of two or alone. Each group of students will have 20 minutes to complete this activity. A fan will be the only power for the vehicle. Students cannot push or use any other type of object to propel the vehicle.

SUPPLY LIST

3 Index Cards

4 Straws

1 Foot of Masking Tape

File Folder

6 Tooth Picks or Small Paperclips

Teacher Supplies the Fan!!!!

Note:

Students should not be limited to rolling vehicles (although they general work best). Let them try sleds if they to put forth the effort.

A nice teacher might provide students with type of compass or circle drawing aid but that is totally up to you.

PAPER BEAM

OBJECTIVE

Students will design and construct a paper beam that will support 30 pounds.

MATERIALS (Suggested)

(Per Student)

1. Any type of paper (i.e. cardboard, matte board, poster board, copy paper, construction paper, chip board, etc...).
2. Any type of adhesive (tape and staples not allowed).
3. Any type of coating material may be used to add strength (i.e. resin, glue, polyurethane, paint, etc...).

TOOLS

1. Scissors
2. Ruler
3. X-acto Knife
4. Cutting Board

LIMITATIONS

1. Light must be able to pass through the length of the beam.
2. Beam must be 1" x 1" x 12".
3. Beam must be made from a paper product.
4. Adhesive must be used - **no** tape or staples.

INSTRUCTIONS

1. Students are to have a complete lab report with the beam.
 - a. Sketch showing side and end view of the beam.
 - b. Materials list.
 - c. Written procedure of beam construction.
2. Students are to complete beam for homework (2 weeks).
3. Students will bring beam to class for testing.
4. Testing of beam:
 - a. Beam will span a distance of 10" between tables or desk tops.
 - b. Suspend a 5 gallon bucket with 30 pounds across the beam.
 - c. Beams that support the 30 pounds are satisfactory

SPAGHETTI CHALLENGE

OBJECTIVE

Students will construct a simple structure capable of allowing the spaghetti to extend from the table top as far as possible.

MATERIALS (Per Individual or Team of 2 students)

1. 20 - pieces of Spaghetti
2. 24 inches of masking tape

TOOLS

1. Scissors
2. Ruler

LIMITATIONS

1. You may use only the materials provided.

REQUIREMENTS

1. Structure may be attached to the desk.
2. Structure should allow the spaghetti to extend as far as possible from the table top. Only the amount beyond the table top will be counted in the distance extended.

INSTRUCTIONS

1. Sketch the design/plan for your device.
2. Attain needed materials from your instructor.
3. Construct your device.

TESTING

1. The distance from the edge of the table to the non-supported end to the spaghetti will be measured.

Modification:

The objective of this project is to make a tower with 25 spaghetti noodles and 10 marshmallows that is the tallest. Work in teams of 2-4 students.

25 Spaghetti Noodles per group
10 Marshmallows per group

PROBLEM SOLVING with CUBE STRUCTURES

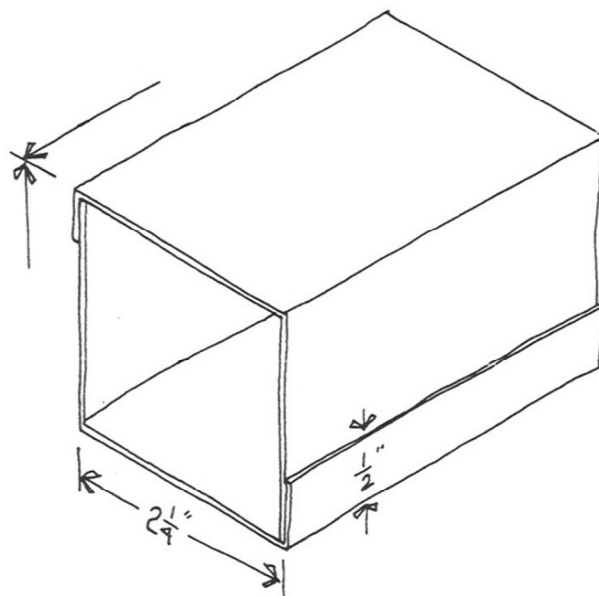
Specifications:

- ☒ The total structure shall be made from no more than 4 – 3"x5" index cards, two of which will form the structural shell and the other two to form the internal structural support system.
- ☒ The overall size of the structural shell shall be 3" long by 2 ¼" wide. The diagram is included.
- ☒ The internal structural support shall be made from no more than 2 – 3"x5" cards. They can be cut, folded, etc. to meet your own design but must be contained inside the shell.
- ☒ Glue or masking tape may be used as a bonding agent.

Grading

The structure must be placed on a flat table. The structure will lay on its side with the open sides at the ends.

- ☒ To pass this assignment with a "C", your structure must hold 10 textbooks.
- ☒ To pass this assignment with a "B", your structure must hold 13 textbooks.
- ☒ To pass this assignment with a "A", your structure must hold 18 textbooks.



TALLEST GOLF TEE

Materials

3 Double Sheets Newspaper
24" Masking Tape
1 Golf ball

Objective

To build the tallest golf tee with the above supplies.

Regulations

Structure must be freestanding without the golf ball and be freestanding for 20 seconds with the golf ball. Structure cannot be taped to floor or table. Golf ball cannot be taped in structure. The measurement will be taken from the floor or table to the center of the golf ball in the structure. There is a 30-minute time limit on construction.

PAPERCUT

Materials

8 ½" by 11" paper
scissors

The objective of this project is to cut the longest sheet of paper using only an 8 ½" by 11" paper and a pair of scissors.

Work in teams of two. Each team is allowed 15 minutes of cutting time and 5 minutes of set up time.

Paper cannot have any breaks. Each team tapes the beginning of the paper onto the floor and carefully stretches it out, and tapes the other end.

If the paper breaks, only the longest piece can be used.

RAFT DESIGN

OBJECTIVE

Students will design and construct a raft that can support the greatest amount of weight before sinking.

MATERIALS (Per Team or Individual)

- 20 - craft sticks
- 4 - large paper clips OR straws
- 1 - 12" x 12" sheet of plastic wrap
- 2 feet of string
- 1 - 6" x 12" sheet of aluminum foil
- Glue, hot glue, or masking tape

TOOLS

1. Scissors
2. Glue gun (preferably low temp./cool melt)
3. Ruler
4. Wire cutters (access to if needed)

LIMITATIONS

1. You may use only the materials provided.
2. Device cannot be attached to bottom of the testing pool.
3. Device must be able to float.

4. Sizes:	Minimum	Maximum
Length	3"	6"
Width	3"	6"

TESTING

1. Students should set up their device for testing one at a time in the tub.
2. Coordinator will provide jumbo paper clips or marbles for weights.
3. Vessels should be weighed before testing.
4. Paper clips should be weighed after testing.
5. Efficiency of vessel can be determined by the following formula:

Weight of supported Paper clips (grams) / Weight of Vessel (grams) 10 (grams)

Note: use colored marbles they are easier to find

PAPER BRIDGE

OBJECTIVE

Students will design and build a bridge to span a given distance (5 inches).

MATERIALS

(Per Group)

1. 2 - Index Cards
2. 2 - Paper Clips
3. Masking Tape (6 inches)

TOOLS

1. Scissors
2. Ruler

LIMITATIONS

1. The bridge must have a span of 5 inches.
2. The roadbed must be at least 1 1/2 inches above the ground.
3. No part of the roadbed, or supports under the roadbed may touch to ground.

INSTRUCTIONS

1. This can be an individual or small group project.
2. The instructor will test the bridges by using weights such as quarters, dimes, and nickels. The weight will be applied to the center of the bridge until the bridge fails. Bridge failure is to be defined as the point where the roadbed touches the ground. Roadbed is that part that is meant to be traveled on.

Modification:

The objective of this project is to make a bridge with one complete newspaper and one roll of masking tape that will hold a briefcase for 10 seconds and will allow a printer paper box to slide underneath. Work in teams of 3-6 students. Each group of students will have 15 minutes to discuss design strategies and to measure briefcase and box. Then each table will have 25 minutes to construct the bridge. THERE WILL BE ABSOLUTELY NO TALKING DURING THE 25 MINUTES OF CONSTRUCTIONS, only writing and hand gestures. The Bridge cannot be taped to the table. Students cannot hold the bridge while the box is being passed underneath of the briefcase is placed on top.

PAPER PLATFORM

OBJECTIVE

Develop and construct a platform that will support the weight of a concrete block or text books

MATERIALS

(Per Group)

1. 4 - Index Cards
2. Masking tape (3 inches)
3. White glue

TOOLS

1. Scissors
2. Ruler

LIMITATIONS

1. Students may only use the materials provided.
2. The platform must be within these specifications:
 - Height - 1/2" to 1" tall
 - Width - 2 1/2" to 3" wide
 - Length - 4" to 5" long

INSTRUCTIONS

1. Students may work individually or in groups.
2. Students will brainstorm solutions.
3. Students will construct a platform using the provided materials.
4. The instructor will test the platform at the end of the allotted time frame (usually 1 class period).
5. The structure must support a concrete block.

Note: this project can also be done with plain white printer paper. Challenge students to build a structure or set of structures that hold the most textbooks.

Structure must hold books at least 2-3 inches off table top.

STRAW TOWER

OBJECTIVE

Students will build a straw tower as tall as possible that can support the weight of a tennis ball.

MATERIALS

(Per Group of 3)

1. 100 - Plastic Straws
2. Straight Pins (many)

(For Testing)

1. 1 - Tennis Ball

LIMITATIONS

1. The students will use only the materials provided.
2. The students may not cut the straws.
3. The tower must support the tennis ball for 30 seconds.

INSTRUCTIONS

1. The students will draw a design for their tower.
2. The students will then obtain 100 straws and a container of pins from the instructor.
3. The students will build their structure.
4. The instructor will test the towers at the end of the allotted time frame (usually 3 to 5 days).

KITE DESIGN

OBJECTIVE

Design and build a flying object, kite, that will fly in the wind when held by a string.

Requirements:

- Flying object cannot be larger than 36" x 24"
- Use only materials listed above.

Materials:

- Newspaper
- Glue (white)
- Plastic soda straws
- Clear tape
- Kite String

Tools:

- Ruler
- Scissors

CONTAINER TO HOLD VOLUME

OBJECTIVE

Students will design the smallest, re-sealable container to hold 91 beans.

MATERIALS

(Per Person or Team of 2)

1. Card Stock
2. Masking Tape (12 inches)
3. Glue or other adhesive

TOOLS

1. Ruler
2. Scissors
3. Paper cutter (for class use)

LIMITATIONS

1. You may use only a half sheet of poster board.
2. You may only use the tape to hold the container while the glue dries.
3. You must remove all tape from the container before testing.

INSTRUCTIONS

1. Sketch the design/plan for your container.
2. Build your container so that it can be opened and closed.
3. Container should only be large enough to hold 91 beans.
4. Container should hold 91 beans.

TESTING

1. Student will open the container.
2. Instructor will provide 91 beans to poured into the container.
3. Student must close the container. (The container must be able to remain closed.)

PAPER AIRPLANE DESIGN

OBJECTIVE

Students will design and build a paper airplane that will have the longest flight time.

MATERIALS

(Per Person)

1. 1 - Piece of Graph Paper
2. 1 - Sheet of Paper (8 1/2" x 11")
3. 1 - Paper Clip
4. Scotch Tape (12 inches)
5. Colored Pencils or Markers (optional)

TOOLS

1. Ruler
2. Scissors
3. Wire Cutters

LIMITATIONS

1. You may use only one sheet of paper for construction of your airplane.

INSTRUCTIONS

1. Sketch the design/plan for your airplane on graph paper.
2. Build your airplane and decorate if desired.
3. Test your airplane design.
4. Make modifications to your design.
5. You will be allowed two attempts for your airplane to attain the greatest flight time. The instructor will test each aircraft. (Note: A stop watch will be needed for accurate time keeping.)

BUSINESS CARD

OBJECTIVE

To design a business card that provides your contact information and represents your hobbies, interests, or job skills

MATERIALS (Per student)

1. 1 - 3" x 5" index card
2. Colored pencils

TOOLS

1. Ruler

LIMITATIONS

1. You may use only the materials listed above.
2. Your card should only have 5 colors (white excluded).

REQUIREMENTS

1. Business card should include the following information:
 - Name
 - Street Address
 - City, State & Zip Code
 - Home Phone Number
 - Graphics or pictures to represent your hobbies, interests, or job skills.
2. Business Card should be created on the unlined side of the card.

MARBLE MAZE

OBJECTIVE

Students will design and construct a maze that will allow a marble to travel from point A to point B in the longest time possible.

MATERIALS (Team of 2 or 3 students)

1. 1 – poster board
2. 1 - marble
3. 3 - file folders
4. Glue
5. Masking tape

TOOLS

Scissors
Ruler



LIMITATIONS

1. You may use only the materials provided.

REQUIREMENTS

1. The marble must start in one corner (Point A) of the soda flat and end at the opposite corner (Point B).
2. The base of the maze (bottom of poster board) must be placed in the horizontal position and may have no more than a 5 degree slant forward or backwards.

INSTRUCTIONS

1. Sketch the design/plan for your device.
2. Attain needed materials from your instructor.
3. Construct your device.

TESTING

1. A stop watch will be needed to time travel of each marble.
2. Students will be allowed to place the marble at the starting position and release the marble.
3. Once the marble has begun its journey, no one may touch the marble or the maze.
4. If the marble get stuck in the maze, one team member may tap the starting corner of the maze once to dislodge the marble. Tapping the corner of the maze will result in a 5 second penalty,
5. The time that the marble is stuck will be deducted from the overall time.
6. Time will begin when the marble is released from point A and end when the marble reaches point B.
7. Each device will have three attempts and the best time will be recorded.
8. Appearance and construction should be considered in grading.

SLOW COASTER

OBJECTIVE

Students will design and construct a device that will control the fall of a marble, allowing the marble to roll as slowly as possible.

MATERIALS (Team of 2 or 3 students)

1. 1 - 18" x 24" cardboard or poster board base
2. 24 - 3" x 5" index cards
3. 6 sheets of 8 1/2" x 11" copy paper
4. 24 strands of dry spaghetti
5. 1 - marble
6. 36 inches masking tape

TOOLS

Scissors
Ruler

LIMITATIONS

1. You may use only the materials provided.
- 2.

REQUIREMENTS

1. The marble must start in one corner of the base and, change directions at least 3 time.
2. The marble must come to a resting point at any corner other than the one it started from.
3. There must be a triggering mechanism that can be released to start the marble. The triggering mechanism must be able to be reset for multiple tests.

INSTRUCTIONS

1. Sketch the design/plan for your device.
2. Attain needed materials from your instructor.
3. Construct your device.

TESTING

1. A stop watch will be needed to time the fall of each marble.
2. Once the marble has begun its journey, no one may touch the marble.
3. Students will be allowed to place the marble at the starting position and release the starting mechanism.
4. Each device will have three attempts and each time will be recorded.
5. Time will begin when the marble is released from point A and end when the marble reaches point B.
6. Appearance and construction will be considered in grading.

PRINGLES CHALLENGE

OBJECTIVE

Students are to create a package design that will allow a Pringles chip to safely survive a trip through the US mail system or your school district mail system.

MATERIALS (Per Individual or Team of 2 students)

1. 1 - legal size envelope
2. 1 - Pringles Chip
3. 3 - 3" x 5" index cards
4. 2 - 8 1/2" x 11" sheets of copy paper
5. 4 craft sticks
6. 2 - drinking straws
7. 12 inches of masking tape

TOOLS

Scissors
Ruler

LIMITATIONS

1. You may use only the materials provided.
2. Your envelope must be treated as a normal piece of mail.

REQUIREMENTS

1. Students should address the envelopes to the School Technology Lab (provide address) from the individual student or students.

INSTRUCTIONS

1. Construct your Pringles package and prepare for testing.

(TESTING

Impact Test - Place the envelope on a table or the floor. Hold a text book 12" above the envelope and drop the book onto the envelope. Investigate how well the idea worked. Survivors proceed.

Mail Test - Turn-in the envelope to your instructor to be mailed. Good luck.

EGG DROP PROJECT

OBJECTIVE

Design a device that will hold the egg and prevent from cracking when dropped from a distance of 6'.

Materials:

Egg
30" Masking Tape
8 Popsicle Sticks
2 Paper Towels
10 Drinking Straws

Rules:

You do not have to use all material. You may build the package first and add the egg when completed. Device will be dropped, not thrown. You can break the sticks but cannot cut the straws. You have 30 minutes to complete this project.

HANG-GLIDING CHALLENGE!

OBJECTIVE

Your challenge is to design a new hang-glider to be used by the U.S. Special Forces. In many cases these men are forced to create complicated devices using simple tools and equipment. You are being faced with that same challenge.

Using only the materials provided in the bag, you must design, build, and test a hang-glider.

Rules:

- 1) Only used materials supplied
- 2) Ruler, scissors, building tools, etc... cannot be used in the actual solution
- 3) Glider must carry single passenger (included in bag) and he/she must be securely attached to the hang-glider
- 4) **Official testing** will take place on the testing platform that will be provided.

MATERIALS

- 10 straws
- 20 craft sticks
- 1' of masking tape
- Plastic bag
- string
- small toy figure

Notes:

I used a 4' ladder as the testing platform. It helps a lot.

Special thanks to our fellow engineering and technology teachers in the great state of Georgia for leading the charge in the 90's in developing resources for teachers to use when teaching problem solving. Several of the projects in this packet are inspired or taken directly from their creation.

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