

Invention Explore-A-Pak

User Guide



PITSCO
EDUCATION

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Safety

Teachers should provide adequate supervision when leading this activity in the classroom. As needed, teachers should implement general safety requirements, including but not limited to the following: eye protection, proper ventilation, and instruction on the use of hand tools. Furthermore, teachers should implement the safety guidelines required by their district and/or state in combination with the safety requirements mentioned in this user guide. Pitsco, Inc. is not responsible for bodily injury or property damage resulting from the misuse of its products or the teacher's failure to implement proper safety measures within the classroom.

Choking Hazard: Children younger than eight years old can choke or suffocate on uninflated or broken balloons. Adult supervision required. Keep uninflated balloons from children. Discard broken balloons at once.

Why Use the Invention Explore-A-Pak?

Historically, technology has been propelled by innovators such as Leonardo da Vinci, Benjamin Franklin, and Thomas Edison – those who dreamed about how things *could* be. These men and others were never satisfied with the way things were and looked for ways to make life easier. Inventors think outside the boundaries of conventional wisdom; they take risks even when they know they will be ridiculed for it.

In the recent past, education was approached by telling students what they must know; they were given the answers and were programmed to think as we wanted them to think. We now know that this method does not teach students foundational skills considered crucial to success in the real world: to think creatively, to use available resources, and to solve problems. Students getting ready to face today's challenges need to be able to take risks, use different resources, invent, and solve problems. This pack provides teachers with tips, supplies, suggested problems, and a guide to solving problems that will challenge your students to problem solve and to think creatively.

Materials Included

- 2 boxes of rubber bands (variety pack and #64)
- 2 boxes of straws (1/4" and 1/8")
- 40 pieces of basswood (1/4" x 1/4" x 24")
- 270 card wheels (135 large and 135 small)
- 30 dowel rods (36" x 1/4" and 36" x 1/8")
- 30 plastic spools
- 30 cool-melt glue sticks
- 2 rolls of kite string
- 200 rubber washers
- 9 boxes of skill sticks
- 100 balloons
- Student Guide (master at end of this guide)

Items Required (not included)

- White glue
- Cool-melt glue guns
- Other tools and materials as needed
- Scissors
- Rulers

Using the Explore-A-Pak

There are some basic steps that can help you and your students as you embark on the first problem-solving activity. The Problem-solving Procedure is not meant to be the only way to teach problem-solving skills, but it can serve as a guide. In addition, a student's guide to solving problems is included in this pack (on back) and can be photocopied and distributed.

To begin, students must be given a problem. Making the problem realistic will help some students relate to the situation. The problems should begin with a little difficulty and, as students become more familiar with the process, become more complex. Sometimes, it helps to keep the problem more general in nature. For example, if you want the students to make a transportation device, it would be better to refer to it as a vehicle or a device rather than a car. Unless you specifically want them to design and make a car, make sure the words you choose do not stifle students' creativity.

Other students respond more to situations where they feel they have a real purpose. Designing special stationary and planning a memo to be sent to employees of a hypothetical company is a nice way to enable them to take ownership of the problem. One difficulty teachers often face when first trying the problem-solving approach is being bombarded by student questions. Often, students are programmed to receive information from the teacher and then communicate that information back to the teacher. To encourage students to think creatively and solve problems, they must discover the answers by using the resources they have available. Oftentimes, it is better for the instructor to respond with another question instead of giving the answer. Given the encouragement and time, most students will be able to handle the problem-solving tasks they are assigned.

Problem-solving Procedure

1. Students must understand the problem.
2. Students must take inventory of their available resources.
3. Students need an appropriate amount of time allotted to brainstorm.
4. Students need to spend time decision making.
5. Students should plan and then implement their plan.
6. Students need to experiment to see if their plan works.
7. Students must evaluate and decide if their invention needs to be improved.

Assessment

Assessment is an important part of any activity. When challenging students with problem solving, they must feel confident that the risks they take are not going to adversely affect their grade. Many of the students will create an invention that does not solve the problem they intended to solve. To fail these students would be a tremendous blow to their self-esteem – failure would likely place a block to their willingness to think on their own and solve future problems. An assessment system that gives students credit for completing the task (successful or not) and rewards students for exceptional work is a good way to encourage them to take risks on future assignments.

Sample Problems

Type 1: General Problem with Many Solutions

Assignment: Make a holder.

Question most frequently asked: What is a holder?

Simple answer: Something that holds something. On this problem and some more complicated problems, the amount of resources allowed should be determined before the problem is assigned. Problems similar to this one might work with one student and would require a very limited amount of materials. A suggested list of resources you might want to use with this problem is listed below. Teachers can add additional resources or increase the amount given to each student.

- 4 rubber bands
- 4 large wheels
- 12" of heavy string
- 6-1/4" straws
- 1 balloon
- 10 Skill Sticks
- 1 plastic spool

Type 2: Specific Problem with Guidelines

Assignment: Make a transportation device that will travel at least 10 feet. The device must safely transport an object (selected by the teacher). The object must be visible and must not be glued or taped to the vehicle.

Tip: You could use the word “car,” but that term will limit the number of solutions for the problem. A question often asked is whether or not the students can touch the vehicle before or during the transporting of the object. You, as a teacher, can decide the parameters for launching or constructing the invention. As problems become more complex, you may consider allowing students to use other resources not included in the pack. For example, plastic two-liter bottles are usually easy for students to bring from home.

Type 3: The Word Problem

Assignment: Read the following problem and determine what is the best solution.

Problem: A woman was completing a very long trip. She was wishing she had some water because it was a very hot day. As she glanced up at the Sun, she became very concerned about dehydrating. She evaluated the resources available to her. What can she do with the resources she has available?

Tip: For this type of problem you will need to provide enough resources for a variety of solutions. In developing future problems, make sure they are worded vaguely enough for students to be innovative. In other words, do not box them in.

Type 4: The Memo (recreate this or similar memo on “letterhead” and hand to students)

To: All Employees

From: N. Ott Toohaught

Subject: Safety Contraption

The city of Burnsville has had a large number of fires at tall apartment buildings in the last six months. Several injuries have been sustained by firemen in their attempt to get close enough to the fire to rescue the people trapped. We have been asked to invent a device, which can be used by firemen that not only can catch people from upper stories but also can be remotely pulled from the building to prevent injury to the firemen.



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Student Guide

Problem Solving: Creating an Invention

1. To begin, you must understand the problem you want to solve. This problem may be assigned by your teacher or it could be a problem you have discovered on your own. When stating the problem, it may be necessary to write it in a simple sentence so your teacher clearly understands the problem you are trying to solve.
2. Often, your ability to solve the problem by creating an invention depends on the amount and types of resources you have. Resources include materials, tools, equipment, and information that you have and can use. It is important to take the time to research needed information. In some situations, your teacher may limit the amount and types of resources you can use, but you might be able to gather some resources from home.
3. When you are ready to form a hypothesis, spend some time brainstorming about different solutions to the problem. At the National Aeronautics and Space Administration (NASA), the process of brainstorming is often referred to as “skunking,” because at this point, no ideas stink. You should feel comfortable in sharing any idea that you feel could be used to solve the problem.
4. After coming up with several possible ways to solve the problem, you should decide which one is the best. There might be several factors to evaluate so you can determine which idea to use. At this point, take some time to finalize the plans and details of your invention. Keep in mind that you must use only your available resources.
5. When your plan is completed, it’s time to put your plan into action. While building your invention, you might have to rethink, modify, or change your design. You might need to back up a few steps to look at resources or other ideas you listed while brainstorming.
6. When the invention is finished, test it to find out if it successfully solves the problem. Some inventions are easy to test while others require extensive testing. Remember, Orville and Wilbur Wright’s first airplanes didn’t fly very well, but they kept working to reach their desired outcome.
7. During the testing process, gather information necessary to evaluate your invention. It will be necessary to take a closer look at your invention and its purpose to determine if modifications need to be made, if you need to start over, or if you need to go back to an earlier step in the process.

