young inventors' PROGRAM®

School Invention Convention

Teacher's Guide

PRESENTED BY

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About This Guide

The *Young Inventors' Program®* School Invention Convention Teacher Guide is principally based on the collective work of a consortium of New Hampshire educators under the auspices of the Academy of Applied Science. Initial distribution of the Guide was made possible by a grant from the New Hampshire Governor's Steering Committee for Excellence in Education.

A 1997 revision was supported through Title II, Eisenhower Professional Development Funding. In its latest version the Guide has been updated and enhanced to ensure its relevance, and to meet current educational standards. The Academy welcomes feedback on this important educational resource, along with any substantive suggestions that will help to make it more useful and effective.

Through a collaborative agreement between the Academy of Applied Science and the Smithsonian Institution, and the generous support of private and corporate donors, this and future editions will be distributed nationally. In this regard, we are especially grateful to the inventive folks at Ghostline®.

To obtain copies of this Guide, contact the Academy's Young Inventors' Program™ Coordinator at the address below.

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In Appreciation

The **Academy of Applied Science** is deeply grateful for the wealth of contributions made to the Young Inventors' Program™ by curriculum developers, educators, inventors, intellectual property experts, educational policy advisors, volunteer administrators and countless others. Their passionate interest and personal investment nurture a new generation of inventors who will address the daunting challenges in the new millennium. The *Young Inventors' Program®* School Invention Convention Teacher's Guide stands as a tribute to their knowledge and hard work. It is an impressive assemblage of what we believe to be among the best practices in inventive thinking education.

To continue as a vital and timely resource for teachers across the country, this Guide remains a work-in-progress. To keep it relevant, we are confident that we can count upon the help of former contributors, as well as those who are sure to find their interest sparked once exposed to this remarkable tool.

Finally, we particularly appreciate the immeasurable, personal commitment on the part of each member of the **Young Inventors' Program™** Advisory Board, the Academy of Applied Science staff and Board, and the unflagging support and encouragement from participating teachers. Their continuing stewardship of and dedication to this important program is vital to the success of the Young Inventors' Program's School and Regional Invention Conventions.

Academy of Applied Science

Fueling the Spark of Genius

An inventor founded the Academy of Applied Science.

Robert H. Rines, was inducted into America's National Inventors Hall of Fame in 1994 for High Resolution Sonar and Radar. He passionately believed that every child and young adult is an untapped reservoir of creativity and inventiveness.

Bob's work began during World War II at the Massachusetts Institute of Technology's Radiation Laboratory where he and others secretly worked on the Microwave Early Warning System. His patents underlie nearly all the high-definition image-scanning radar used to provide early-warning, weapons fire control, and some artillery and missile detection radars during the Persian Gulf war. His inventions were instrumental in locating the Titanic and the Bismarck and are also used in medical instrumentation for noninvasive ultrasound imaging of internal organs. Beginning in 1972 and for many years after, Robert performed scientific sonar searches for the Loch Ness monster, "Nessie."

The Academy of Applied Science, chartered in 1963 as a non-profit 501(c)(3) corporation and headquartered in Concord, N.H., is recognized internationally as an educational resource center dedicated to promoting creativity, innovation, invention and scientific achievement worldwide. The Academy Board members include entrepreneurs, inventors, industrial and intellectual property lawyers, businesspersons, educators and others concerned with nurturing and supporting innovation.

In addition to the **Young Inventors' Program®** the Academy administers several other national and regional programs and initiatives dedicated to inspiring the nation's youth with the spirit of invention and creativity.

The *Junior Science and Humanities Symposia,* administered by the Academy, draws more than 12,000 high school students to regional and national science research competitions that stretch across America and extend to the continents of Europe and Asia.

The Academy's *Research and Engineering Apprenticeship Program* offers high school students summer internships at university science labs throughout the country. These internships are filled principally by socially and economically disadvantaged youth.

The Academy's mission is to fuel the spark of genius by exciting today's youth in Science, Technology, Engineering and Math (STEM).

Learn more about the Academy of Applied Science and its associated programs at www.AAS-World.org.

The Young Inventors' Program™ (YIP)

The first **Young Inventors' Program™ Invention Convention** was held in 1986 by a group of education experts concerned about the declining academic performance of America's school children relative to their foreign peers. Also of grave concern were the apparent decreasing student interest in scientific areas and a marked decline in their subsequent readiness for technology-based careers.

The Academy created the Young Inventors' Consortium to design and implement an invention program offering students an opportunity for expression and creativity as they develop and practice higher-order thinking skills. This consortium includes experts in the fields of education, library science and program management. The components of the program include *Teacher Workshops on Creativity*, individual school invention programs and an annual *Young Inventors' Program Regional Invention Convention.*

The **Young Inventors' Program™** has received two national awards. In 1992, it was identified as a *Program of Excellence* by the Regional Laboratory for Educational Improvement of the Northeast and Islands. The Northeast Regional Laboratory is one of the non-profit organizations funded by the U.S. Department of Education with a mission to improve education nationwide. The Regional Laboratory was asked by Congress to identify and recognize exemplary programs from across the country that assist in the improvement of mathematics and science education. The **Young Inventors' Program™** was among those programs so designated.

The **Young Inventors' Program™** Consortium was the recipient of the *Donald J. Quigg Excellence in Education Award*. This annual award is named for former Patent and Trademark Office Commissioner Donald J. Quigg recognizing his well-known support of educators who promote the teaching of invention in the classroom. That award was initiated to recognize the efforts of an individual/group to promote the teaching of inventive thinking at all levels of the curricula, in conjunction with the Patent and Trademark Office's *Project XL.*

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Introduction

Why Invent?

Much has been written about the present condition of American education. It is difficult to pick up a newspaper or magazine that doesn't have an article by someone concerned with the quality of public schools. Parents are concerned that their children are not keeping up with students in other countries, and businesses are afraid of "losing the competitive edge." Studies show that today's youth may lack the basic skills needed to function effectively in the workforce.

In too many instances, corporations must spend capital on upgrading the education of their new recruits so they can handle the increased sophistication of their jobs. In an article published in *Educational Leadership* (1992), John O'Neil reported that "Unless U.S. students are better equipped to enter a changing workplace, the financial future for graduates – and likely the economy as a whole – is likely to remain bleak even after the present recession breaks." A decade has passed since the O'Neil article, and businesses still are concerned with the lack of skills of the entering workforce. Still worse, the National Science Board reports in its latest *Science Indicators* (2000) that American student performance in international math and science competitions remains dismal.

Teaching students to be creative thinkers and problem solvers will address many of the problems of public education and will help prepare students for an uncertain future. Instead of the traditional rote memorization of facts from lectures and textbooks, students must be encouraged to think through problems, analyze, ask questions, and support decisions. In schools as well as in the workplace, individuals are confronted daily with problems demanding solutions. How they solve those problems is often determined by how well they have developed critical-thinking and problem-solving skills.

Learning the process of inventing develops students' problem-solving abilities and creativity in the broadest sense. Inventing provides a unique opportunity for learners of all ages to synthesize and apply knowledge and skills in an interdisciplinary, real-life manner. The process places a strong emphasis on defining an actual problem, formulating an original solution, developing a product, and sharing the results or products with appropriate audiences. A unit on invention, included herein, challenges students to become actively engaged in the learning process. They quickly discover that it's also fun.

The invention process provides an opportunity for all students to participate and be successful. All children can identify problems in their homes or neighborhoods. Almost every day they will face at least one problem. An unmade bed, a dog that eats the cat's food, a mother with a broken leg that must be elevated when she sits, a grandfather who cannot grasp a bar of soap because of severe arthritis – all are examples of real-life

problems identified and solved by students participating in this program. When students identify a problem to be solved, they become actively engaged in the learning process. Once the problem has been identified, teacher and parent have but to stand aside and watch them go.

A unit on inventive thinking, which includes the production of an original invention, is limited only by the imagination of the teachers and students. You might ask, "With everything else I have to teach, why take the time for inventing?"

Research has shown that inventing will:

- Stimulate and foster creativity.
- Enhance self-image.
- Develop the essential skills of logical thinking, creative problem solving, intellectual risk-taking, and communication.
- Relate the scientific method to real life.
- Spark the inventive spirit in our culture.

Students will also:

- Develop higher-level thinking skills.
- Use creative and critical thinking skills.
- Solve actual problems.
- Use library and other research skills.
- Learn to document the inventive-thinking process.
- Experience success and increased self-esteem.
- Produce an original invention and receive recognition for participating in the invention process.

These are all solid reasons for studying inventors, inventions, and the inventive process. For teachers who understand learners and learning, there are three primary reasons for incorporating these ideas into classrooms and the curriculum. These ideas are relevant, they allow for choice, and they connect.

Connections

Not only does the study of invention connect disciplines, it connects school to life. It's "science with a purpose," as one student aptly put it. An invention is the concrete application of the scientific process. Whether studying inventions from the past or creating

their own, students can make connections. The study of invention is the study of humanity's past and its impact on the natural world in recorded history and beyond. It touches all aspects of life. Our economic and sociological history can be examined by the impact of inventions from the earliest days of America's agricultural-based economy and through the industrial and information revolutions.

Have the VCR, automobile, telephone, television and Internet changed the way we live and do business? What is the relationship of invention to geography and the environment? Why were certain things invented in certain places and in certain times? Is "necessity the mother of invention"? What are the ethical issues connected with recent medical and genetic inventions? Has our definition of *artist* changed with the technical advances made in the visual and performing arts?

Global civilization can be studied through invention. Science fiction stories even predict the impact of humanity's inventiveness on the future. Invention can be a tremendous organizing theme for a unit, a course, or a year-long, school-wide program. The study of invention will help our students connect the past to the present and to the future.

Relevance

If we want to keep smiling, be effective in today's classroom, and prepare our youth to cope with the incredible challenges that have arrived with the 21st century, our lessons must be relevant. What can be more relevant than studying inventions? Everything students see and use was invented by *someone* - why not by them?

Who is an inventor, anyway? Is an inventor just "a frazzled old man in a white coat with glasses and big hair?" Inventors are simply people – male or female, young or old – any race or creed - everyday people who solve problems. When someone brings a new solution to a problem, he or she is an inventor. Some solutions are simple. Some are complex. But all inventors have common traits:

- Inventors are curious.
- Inventors like to tinker with their ideas.
- Inventors are persistent.
- Inventors share their inventions.
- Inventors are constantly inventing.

In 1899, (then) U.S. Patent Office Commissioner Charles Duell allegedly reported to President McKinley and the Congress that, "I recommend closing the Patent Office, since everything that can be invented has been invented."

Archivists disavow this quote, pointing to many of Duell's verified statements to the contrary. Inventors were operating in high gear at the time, and the Patent Office in 1899 could hardly keep abreast of American innovation. This country was, after all, in the very midst of the *industrial revolution*. Nonetheless, this misquote made the rounds for decades, appearing in advertisements and repeated by lecturers. Too bad for poor Mr. Duell but, still, his *non-statement* does serve a very useful purpose. It keeps reminding us that, just when we thought we've seen everything, more amazing inventions are rolled out. Inventors are constantly inventing.

This has been particularly true of the more recent *information revolution*. We can only dream of the miracles that will flow from the fertile minds of inventors in the days to come. But, educators and curriculum developers can do more than dream when it comes to preparing our students to be ready to become proactive problem solvers; perhaps even to prepare them for roles as tomorrow's inventors.

Through biographies and journals, students can learn about the process of inventing, as well as about individual inventors. They can learn that even though Thomas Edison was reportedly learning disabled – he was still our most prolific inventor. For students who are having difficulties in school, this can be enlightening; it can be an opportunity to identify with determined and successful people.

Another relevant point about the study of inventions or teachers, parents and administrators is that newly published national goals and state academic standards all speak to making connections and to studying unifying themes. In mathematics, science, social studies and language arts, numerous goals and proficiency standards can be easily and clearly addressed through the study of invention, inventors, and inventing.

Choice

What better way to address the work done by Howard Gardner on multiple intelligences than to allow students to follow their strengths and interests through inventing? This is a chance for each student to be the expert, to become empowered, and to exhibit his or her individuality. Whether following a special interest in a research project, conducting a traditional science project, or trying their hands at inventing, the element of choice can be highly motivating for students.

All types of learners can find success when multiple product possibilities are acceptable. Whether the strengths are written, verbal, musical, or body/kinesthetic, inter- or intrapersonal, logical/mathematical, or visual/spatial – all have a place in the invention theme.

In the era of "too much to teach and not enough time," the perfect solution is to use an interdisciplinary approach.

Interdisciplinary Ideas

Although traditional subject areas separate the following ideas, they overlap and repeat and are readily adaptable to a multidisciplinary unit or thematic approach to the subject of *invention*.

Reading/Language Arts

- Use webbing activities to brainstorm about a given year, country, theme, or time period.
- Create a memory game of inventors/inventions.
- Create an invention newspaper (ads, cartoons, inventor profiles, invention critiques – either from the past or present).
- Role play a scene or write a persuasive essay to persuade someone to buy an invention.
- Read biographies of famous inventors.
- Research and learn to read patent descriptions.
- Find examples of inventions that are not accepted at the time of their invention. Why not? What would have made them more acceptable?
- Write step-by-step directions for building a model or invention.
- Write a description of an invention – your own or someone else's.
- Keep a journal or log of how you create your invention (include brainstorming, problems, research, dates, times).
- Read the journals of other inventors.
- Create an advertising campaign for an invention – your own or someone else's – for radio, TV, newspapers, or magazines.
- Study propaganda and other advertising techniques.
- Compare and contrast different inventions or inventors (Venn diagrams, Double Bubble Maps, or in writing).
- Write to patent attorneys or inventors (via "snail mail" or through the Internet).
- Invent a word game, riddles or creative poetry.
- Make an acrostic or name sign for an inventor, including information from biographies.

- Write a new version of a biography of a famous inventor, as told by a pet or friend (a la *Ben and Me* by Robert Lawson). Create a resume or job description for the inventor you researched.
- Remain in the character of an inventor and write a letter to another famous inventor about your latest work (for example, Edison to Marconi).
- Create a comic book parody of a famous invention.
- Debate invention topics (Resolve: "Necessity is the mother of invention" or "The computer is the most significant invention of the twentieth century").
- Write a letter to an inventor you study and describe the impact of his or her invention on life today.

Math

- Invent a math game.
- List inventions that use the binary system. Learn about other number systems and their uses (computers, for example).
- Use ratio and proportion to make scale drawings or models of inventions.
- Estimate the cost of marketing, building or patenting your invention.
- Calculate the difference between the cost of inventing something 100 years ago and inventing it now.
- Graph the number of inventions patented by decade in the U.S.
- Make a comparison graph of U.S. patents vs. those of foreign countries; draw conclusions.
- Graph and compare the number of male with female inventors.
- Take an invention survey and display the results (possible topics include inventions people wish hadn't been invented, such as childproof caps, car horns, Susan B. Anthony dollars, watches that beep).
- Learn about the mathematics of imaginary numbers.
- Research the Fibonacci series – its uses, and how it works. Then come up with your own creative use of the series.

Science

- Invent something that would be useful in space or on another planet.
- Invent something for your classroom.
- What spin-off inventions from the space program are used in everyday life?
- Learn about and use the scientific method to test or evaluate an invention.
- Study developments and inventions that deal with packaging and recycling.
- Study new inventions in criminology and/or medicine. How have they changed history?
- Research weather inventions.
- Take things apart to see how they work (first predict how they work, and draw a diagram of the works). (Great source: *The Way Things Work* by David Macauley)
- Research Rube Goldberg®. Find out who he was, and why he is famous.
- Study the Rube Goldberg® method of getting things done, including laws of motion, types of energy, perpetual motion and simple machines.
- Build a Rube Goldberg® Machine.
- Study multiple intelligences and their relationships to the process of inventing. (Great source: *Inventors* by Kenneth A. Brown)
- Consider inventions that are patterned after things found in nature, such as Velcro, airplanes, geodesic domes.
- Select one present-day tool, appliance, or other invention and trace changes to it over time (such as the bicycle, pen, camera).

Social Studies

- Research inventions through the ages. What has been invented in your lifetime? Your parents' lifetime? Your grandparents' lifetime?
- Design a timeline to show inventions, inventors, events, etc.
- Do "the times make inventions," or do "inventions make the times"? Debate the issue with the classmates.
- Research patent laws. Have they changed?
- Visit a patent library (such as the Franklin Pierce Law School Patent Library, Concord, N.H.) to find examples of patents.
- Learn about *intellectual property*, how it is defined and protected.

- Show the impact on society of a few specific inventions.
- Produce and present a *You Are There* newscast (a la Edward R. Murrow) in which you re-enact the introduction of a new invention from any period in history.
- Hold a panel discussion or debate, role-playing famous inventors.
- Research a local patent to learn more about famous inventors.
- Research which countries hold the most patents. Speculate why this is. What effect does this have on trade and the economy?
- Invent *Patent Office Trivia*, or another game involving inventions.
- Research bizarre (but real) inventions that received patents (resource: *Absolutely Mad Inventions* by A.E. Brown and H.A. Jeffcott, Jr.).
- Research inventions that didn't last (resource: *Inventions No one Mentions,* Scholastic Books).
- Examine the likelihood of various hypothetical consequences suggested by an invention, such as robots with artificial intelligence.

The Arts

- What inventions in the music field have changed the way music is made today?
- Write a rap or jingle to promote an invention.
- Research the development and uses of computer graphics. How have they advanced or changed the fields of medicine, design, engineering and films?
- Build a model of an invention. Draw a diagram and label all the parts.
- Draw a picture of a Rube Goldberg® invention and label all steps. Create your own.
- Role-play scenes from inventors' lives. Dramatize a scene of a "Eureka!" experience.
- Do a collage of similar inventions or about an inventor's life.
- Invent a new recipe.
- Create a new dance.
- Study inventions related to the theater and how they have changed it.
- Create a calendar of U.S. patent dates:

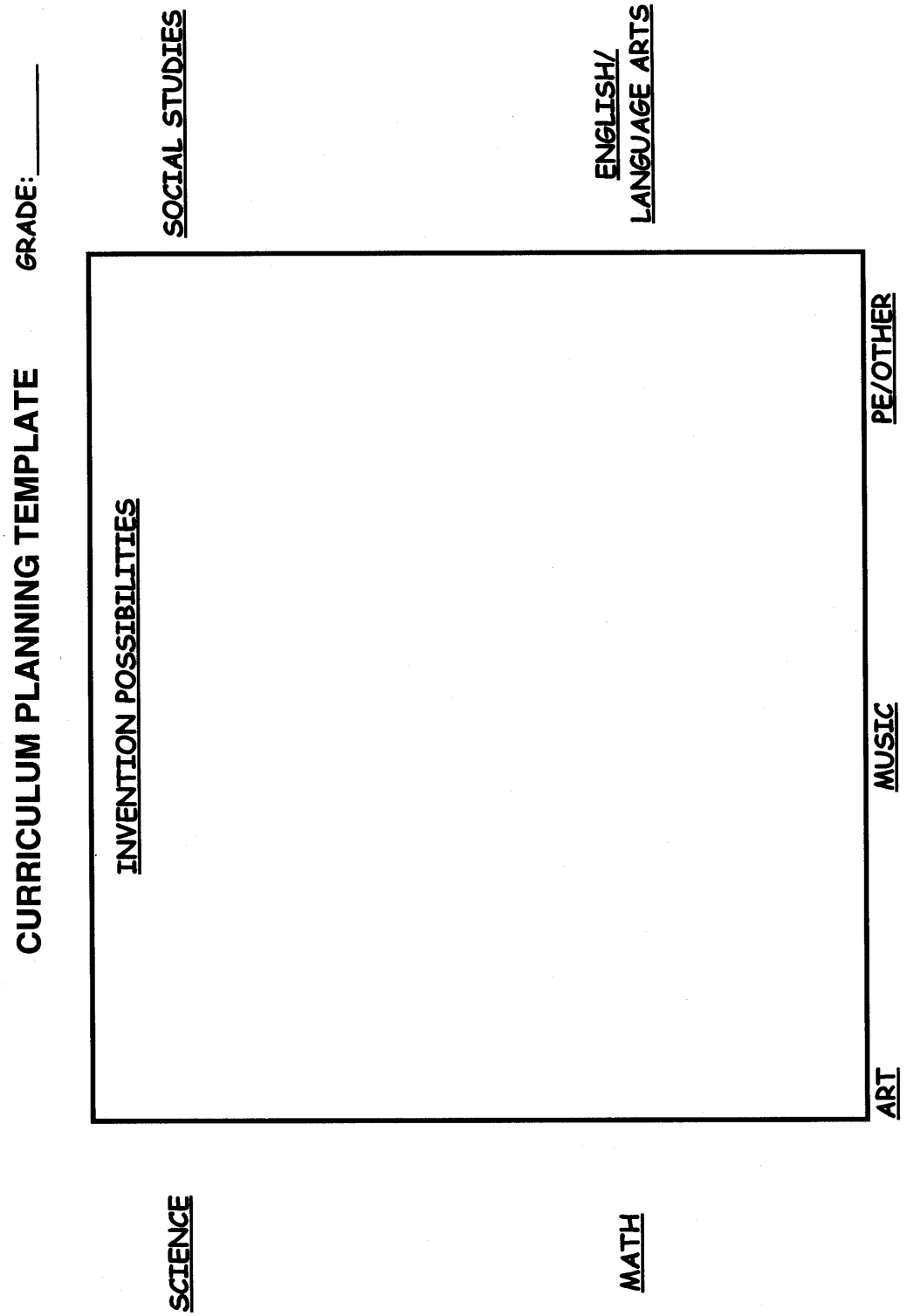
  February 18 (Statue of Liberty)

  March 7 (telephone)

December 9 (suspenders)

- Design an *Invention Trivia* board game.
- Study the artist as inventor: da Vinci, Picasso
- How is software designed? Interview someone to find out.

Curriculum Planning Template



Overview: Activities, Ideas and a Timeline

Following is a brief overview of how to get started, and how to keep going. Additional explanations appear later in this guide. The length, depth and outcomes of the unit will vary according to the class and teacher.

Thinking Skills Activities

To encourage creative and productive thinking, start working with some creative thinking processes, including brainstorming, SCAMPER, FFOE, and Creative Problem Solving (Pages 14 – 32). The included activities put these skills in practice and tie in with inventing. Decide how much time you can devote to this area, keeping in mind that these thinking skills can be used with other subject matter.

The Invention Process

Now that your students are familiar with ways to think creatively, they are ready to begin inventing. One possible model for inventing is included (Pages 33 – 35). It's a good idea to develop a Student Handbook with an outline and focus for the invention unit. It might include:

- A letter to inform parents about the unit and its value.
- A timeline for each student.
- General directions for each student on how to proceed.
- Pages from this manual that you wish to duplicate.

Student inventors may wish to work in teams (two students per team is ideal). Students, especially young students, may "reinvent the wheel" unknowingly. *If this happens, that's fine.* The process of invention is by far the more important goal. You can encourage older students to conduct product research to determine if their inventions are original. By stressing and encouraging simplicity, your students will see the process as fun, rather than intimidating.

Timeline

A minimum of six weeks should allow plenty of time for a unit on inventing. This allows time for the incubation of ideas, experimentation with form and process, and revision of plans and outcomes. A possible timeline follows:

WEEK ONE

- Introduce creative thinking skills activities.
- Introduce the concept of inventions and innovation.
- Conduct activities and discussion on strange and unusual inventions.
- Share invention stories of real or student inventors.

Week Two

- Talk about how any invention works, its purpose and the problem it solved.

Week Three

- Introduce journal keeping.
- Identify problems.
- Do "junk" inventing activity.

Week Four

- Establish classroom work groups.
- Find solutions to the identified problems.
- Start to make plans.
- Select a problem and a possible solution.

Week Five

- File an "Intent to Invent."
- Draw a diagram or sketch.
- Start a "Breadboard Model."

Week Six

- Create a marketing plan for the invention, which includes naming it.
- Discuss patents.

YIP School Invention Convention

While the students' progress with their ideas, your major function as teacher is to provide encouragement and show a continuing lively interest. A classroom "YIP Invention Convention" is a rewarding culmination activity. It can be as simple or as elaborate as your time allows. You will find more information on planning an event like this starting on page 90.

Thinking Skills

Thinking skills are important in all fields of endeavor. In the invention process, they are essential. Creative thinking allows an inventor to generate new insights, strategies and solutions. Critical thinking allows an inventor to sort through a potentially overwhelming collection of ideas and identify those that have promise. Both are required and inter-woven in the invention process, from identifying the initial problem, to successful marketing of a product.

Brainstorming

Brainstorming requires quick thinking and creativity. Many ideas are produced, but value judgments are avoided. Most students enjoy brainstorming and may generate ideas that will amaze you. Using brainstorming in a variety of situations will demonstrate to students that it is not just an exercise, but also a useful tool.

Before starting the first brainstorming session, establish the ground rules. Post them so everyone can see them, and review them before each session. Keep the rules simple and positive.

Rules

Defer Judgment

Both teacher and students need to *accept all ideas without comment* at this stage, no matter how wild or crazy they may seem. Students whose ideas are put down will not continue to respond and may avoid using this important skill in the future. By praising one individual for a response, the teacher relays the message that the others were not as good. Although it is difficult for teachers, who are used to responding positively to student ideas based on quality, the only praise should be to the group for the *quantity* of their ideas during brainstorming.

Work for Quantity

The leader of a brainstorming session should write down every idea. Most groups get the obvious responses on the list before they really begin to think. The most creative ideas are usually at the bottom of the list.

Piggy-Back

Encourage students to combine or improve ideas that are already on the list. Adaptations may enhance the original response.

Freewheel

Encourage humorous, ridiculous, or crazy ideas. One of these may be just what is needed.

Everyone Should Participate

All students should be involved in this process. As the teacher, your contributions should demonstrate piggybacking or freewheeling, but not overpower student participants.

Teacher Tips for Brainstorming

- Have lots of space available for student ideas. Chart paper is useful, because it can be posted for future reference.
- Students need to contribute their ideas to the group list and then relinquish "ownership" of the ideas. Don't refer to a particular item from the list as "Jane's idea." Don't require students with new responses to identify whose idea they are piggybacking or combining with.
- Start the session with a one-minute think time before anyone raises a hand. This allows a moment of silence for thinking before starting the list.
- If the group is stuck, look at the list and use an idea from it to help them get unstuck. For example, if one response is an animal, ask what animals might be added to the list. Conversely, if all of the responses are animals, ask what else might be possible besides animals.
- Leave the brainstormed list posted so that students can add to the list over the next day or two. This allows those students who process more slowly to add their ideas.
- Don't always record ideas in a list. Use a web, illustrations or small pieces of paper to demonstrate alternative techniques.

Activity 1: Brainstorming with Objects

This is a good warm-up activity. It helps students refocus and change into a creative thinking mode from other activities of the day.

- Choose an item that all students are familiar with, such as a coat hanger, paper clip, comb, skateboard or paper cup.
- Allow students one minute to think of possible uses for the object.
- Give the group three minutes to respond orally. Write all the responses on chart paper or an overhead transparency.
- As a group, count the number of ideas generated.
- Have pairs or small groups of students choose a particular idea from the brainstorming list and add details to develop the idea more fully.
- Allow students to share their ideas.

As an alternative, bring in an object that students have never seen before and allow them to look at it before and during the brainstorming session. Tools, kitchen utensils and antiques are good for this. You can also use photographs or drawings such as those in *Weird and Wacky Inventions* and *Guess Again: More Weird and Wacky Inventions,* by Jim Murphy.

Activity 2: Brainstorming with Language

Your success with this activity will depend to a large extent on the experience background of your children. Activities such as this will enrich their vocabulary. Spontaneous problems from the *Odyssey of the Mind* books by Sam Micklus are a great source of questions like these.

Use one of these ideas as a starting point for your brainstorming session.

- List all the words or expressions you can think of that have the word "cat" in them (Catskill Mountains, "let the cat out of the bag," catacomb, catastrophe).
- Think of different ways the letter "X" can be used (the 24th letter, a Roman numeral, a kiss, a movie rating, an error, "X marks the spot").
- Think of ways the word "brain" is used (part of the body, "lamebrain," brainwash, "pick his/her brain," brainchild).
- Think of sayings that use parts of the body ("have a heart," "all hands on deck," "swept off your feet," "tip your hand").
- List different ways the word "blue" can be used (Bluegrass State, blue ribbon, "out of the blue," "have the blues," Blue Cross).

Have students illustrate some of their responses and display them. The illustrations could be literal or figurative.

Extend this activity by having students ask their parents to help them add to the list at home.

Activity 3: Keeping a Brainstorming Log

A brainstorming log is a good way to get students into the habit of recording their thought processes. It will become an important part of their invention log.

Identify a problem for the day such as:

- How might you find an invisible person?
- How might you paint a ball?
- How might you improve student lockers?
- How might you keep the cat from sleeping on your keyboard?

Have individuals or groups record all of their solutions in a log. The record might be in the form of a web, a list and/or illustrations.

Have each student or group underline the three ideas they think are the best, then select one idea as a favorite, and tell why it was chosen.

Ask students to share their favorite ideas and their reasons for selecting them.

Creative Thinking Process

Bob Stanish further describes four skills for brainstorming. They are the creative thinking processes of fluency, flexibility, originality, and elaboration. During all the creative thinking activities in this chapter, look for and encourage these skills:

Fluency The production of a large number of ideas, products or plans.

Flexibility The production of ideas or products that show a variety of possibilities or thought patterns.

Originality The production of unique or unusual ideas.

Elaboration The production of ideas that display intensive detail or enrichment.

Activity 4: Cups of Creativity

This activity is described using a cup; however, it can be done using any item. It is helpful if each child can have a cup to manipulate while thinking. As an alternative, one or several cups could be passed around. Try doing this both with items children are familiar with and with some that are strange to them.

- Give each child a paper cup.
- For fluency spend one minute thinking and three minutes brainstorming ideas for alternative uses of the object.
- Look at the list for ideas that fit together in groups, such as ideas for animals, or for clothing.
- Continue brainstorming, with the added guideline of trying to think of different kinds of ideas. After three minutes, stop and look back at the list. Has the group shown flexibility by exploring different types of ideas?
- Identify ideas that are not like any of the other ideas. These show originality.
- Have each child illustrate one of the ideas, including as much detail or elaboration as possible.

Activity 5: Leaf Transformation

Transformations are drawn and require very different production skills from verbal brainstorming. Watch for students who excel here, but who did not do as well with the written activities.

- Give each child an outline drawing of a leaf or other simple shape.
- Ask the students to think about possible things the shape could be. Turn it in different directions for inspiration. Allow at least two minutes of thinking time.
- Ask students to think about their ideas, and identify the one they feel no one else in the room will have thought of. Ask them to draw a picture of their idea using pencil, until the drawing is sketched out. Then allow them to use markers or crayons to add details.
- Share pictures. As students share, group their pictures with those that are similar.
- Look at the collection of pictures and talk about the processes. Are there many pictures (fluency)? Are there many different kinds of pictures (flexibility)? Are there some pictures that are different from all of the rest (originality)? Have students added extensive detail to their pictures (elaboration)?

This activity can be done with simple and complex shapes. Use the curriculum for ideas, such as the outline of a geometric shape, a continent, a Pilgrim hat, or a star.

S.C.A.M.P.E.R. – A Brainstorming Strategy

SCAMPER, from Bob Eberle's book of the same name, is a list of the kinds of thinking and doing cues that spur ideas. Eberle has taken Alex Osborn's ideas from *Applied Imagination* and rearranged them in an easy-to-remember list. Use these strategies during brainstorming to increase the number of ideas your students generate.

S Substitute Have a thing or person act in the place of another. *Example:* Who else instead? What else instead? What other ingredient? Material? Power? Place?

C Combine Bring together or unite. *Example:* How about a blend, an alloy, an ensemble? Combine units, purposes?

A Adapt Adjust to suit a condition or purpose. *Example:* What else is like this? What other idea does this suggest? Does the past offer a parallel? What could be copied?

M	**Modify** **Magnify** **Minify**	Alter or change the form or quality. Enlarge or make greater in quality or form. Make smaller, lighter, slower, or less frequent. *Example:* New twist? Change meaning, color, motion, sound, odor, form, shape? What to add? More time? Greater frequency? Higher? Longer? Thicker?
P	**Put to other uses**	Use for purposes other than the one originally intended. *Example:* New ways to use as is? Other uses if modified? Other places to use it? Other people to reach?
E	**Eliminate**	Remove, omit, and get rid of a quality, a part, or the whole. *Example*: What to subtract? Condense? Miniaturize? Lower? Lighten? Omit? Streamline? Understate?
R	**Reverse** **Rearrange**	Place opposite or contrary to its original position, or turn it around. Change the order or adjust it, make a different plan, adapt a layout or scheme. *Example:* Interchange components? Another pattern? Another layout? Another sequence? Transpose cause and effect? Change pace? Transpose positive and negative? Opposites? Backward? Upside down? Reverse role?

Activity 6: SCAMPER with Ice Cream

This activity uses ice cream cones, but any other object could be used. The cones are nice because most children have used them and experienced their common problems: leaks, drips, and lost ice cream.

- Give each child an ice cream cone. Tell the story of the invention of the ice cream cone at the World's Fair in St. Louis in 1904. The need for the ice cream cone arose when an ice cream vendor ran out of the paper dishes he had been using for his ice cream. A nearby vendor was selling thin waffles. Whether the waffle vendor or a girl in the crowd had the idea first is debatable. What is not debatable is that a rolled-up waffle became the first ice cream cone.
- Ask students to concentrate while you read the series of SCAMPER cues and related questions. Each child can write down his or her ideas as they think of them.

S	**Substitute**	What could be substituted for the cone? What could be substituted for the ice cream? What could be substituted for the taste? The texture?
C	**Combine**	What could be combined with the cone? With the ice cream? What other foods? What other non-food items?

A	**Adapt**	How could the cone be adapted so it wouldn't drip? So it would keep the ice cream code? So it would not get soggy?
M	**Modify**	Modify the ice cream cone. What is it like?
	Magnify	If it were magnified, what might it be used for?
	Minify	What if it were miniaturized?
P	**Put to other uses**	What else could an ice cream cone be used for? Who else might use it? Where else might it be used?
E	**Eliminate**	What could be removed from an ice cream cone? How could it be streamlined? Made lighter?
R	**Reverse**	What if it were upside down? Inside out? What shape could it be?
	Rearrange	

- Have students select one idea, illustrate it, and share it with the class. Ask each child to tell about his or her idea and why it was chosen.

Activity 7: SCAMPER-ing Animals

This is an opportunity for the artistic child to shine and for imaginations to run wild.

- Read Dr. Seuss's book, *Oh, the THINKS You Can Think*, or any other book with wild and crazy animals, to the class.
- Ask the students to think of their favorite animals.
- Use SCAMPER to help them create fantastic animals of their own. Use the key words and ask questions like those below.

S	**Substitute**	What could be substituted for part of the animal? What color, body covering, or appendages could be substituted?
C	**Combine**	What animal could be combined with it? What else might be combined with it?
A	**Adapt**	How could a part of the animal be adapted so it could fly? Dig holes? Build tree houses? March in rows?
M	**Modify**	Modify the animal. What is it like? What could be magnified on it? What could be "minified" on it? What if it were microscopic? Or as tall as a house?
	Magnify	
	Minify	
P	**Put to other uses**	What could be changed about the animal so that it would be useful to people? To other animals? To plants?

E	**Eliminate**	What could be removed from the animal? Could it be streamlined?
R	**Reverse** **Rearrange**	What if the animal walked upside down? Or backwards? How might its parts be rearranged?

- Have students draw their new animals and share their drawings while the rest of the class tries to guess what the original animal was for each picture.
- Use the drawing and a story starter such as, "As I was walking through the woods, I saw…"
- Share stories and drawings.
- Look back through Dr. Seuss's book and try to decide what each animal might have been before Dr. Seuss started changing it.

Attribute Listing

Attribute listing means examining the characteristics and functions of an object. This is a very different way of viewing an object for many people. If you start by listing the attributes of an object, you have a place to start when thinking about how to change it.

Activity 8: Attributes of Shoes

This activity can be done with any collection of similar objects, such as coins, marbles, gloves, buttons or shoes, which are always handy.

- Have students sit in a circle with their shoes on and their feet in the center.
- Brainstorm a list of the attributes of shoes, including color, size, shape, weight, purposes, materials of construction and methods of fastening. Record the list on chart paper.
- As a class, select one attribute, such as materials of construction, and brainstorm changes that could be made in shoes by changing that one attribute.
- Have students write a story to describe how the new type of shoe would feel as it was being worn.

Activity 9: Force-fitting Attributes

Students will have to mentally stretch to identify inventions or new uses for some of the combinations they generate in this activity.

- Make a list of two or more attributes an object might have or select some from the list of attributes of shoes. For example, use the attributes *red* and *protecting.*
- For each attribute, have students list at least ten objects which share that attribute:

Red	Protecting
Apple	Shoe
Nose	Knee Pads
Anger	Band Aid
Marker	Police Officer
Tomato Soup	Smoke Detector
Fire Engine	Dog
Shirt	Seat Belt
Jam	Fence

- Select one item from each list and ask students to tell what might result if they were combined. This is called a "force fit." Identify the pairs randomly.
- Have each child pick one combination from this activity and tell what the new object would be called. Elaborate on how it might be used, who might want to use it, and where it might be sold.

Phenomenon Finding

Steven Caney looks at phenomenon finding as a method for inventing. In this process, you look at how things act or how they fit together. Once you have researched a phenomenon, you look for an application for it. An example of the application of phenomenon finding is the work of Georges de Mestral. He observed a phenomenon – the way that burrs and seeds stuck to his socks. He examined this with a magnifying glass and discovered the secret, tiny hooks that stuck in the fabric of his socks. From that observation he invented Velcro®, which has impacted many fields, from automobile manufacturing to space travel to shoe making.

Activity 10: Junk Inventing using Phenomena

Students are always amazed at the kinds of inventions they are able to make from their collection of junk. The early whines of "You can't invent with this stuff" give way to elaborate plans and impressive inventions.

- Have students collect a variety of junk items. These could include but are not limited to:

Milk Cartons	Thread Spools	Broken Toys	Plexiglas

Paper Clips	Yarn	Ball-point Pens	Cardboard
Hooks	Feathers	Wire	Pantyhose
Magnets	Springs	Fishing Line	Clothespins
Marbles	Straws	Knobs	Scrap Wood
Nuts & Bolts	Beads	Old Jewelry	Balloons
Packing Material	Glue	Foil	Toilet Paper Rolls
Eye Droppers	Pulleys	Paper Plates	Pipes
Plywood	Fabric Scraps	Toothpicks	Coat Hangers

You will need a variety of tools, such as hammers, saws, scissors, screwdrivers and pliers, and supplies like glue, assorted tapes and markers. Safety glasses will also be needed.

- Give each student or small group of students a variety of junk items and ask them to look for phenomena. These are observations about the way things work together or fit together or what they do.
- After 10 to 15 minutes, groups should share the phenomena they have discovered.
- As a class or in small groups, brainstorm possible uses for these phenomena.
- Ask each group to select one use of a phenomenon and make a model of an invention that uses that phenomenon. The group should decide on a name for the invention, and be prepared to describe the problem the invention solves.
- As groups are sharing, ask questions to force them to *stretch* their ideas to be more creative:
    - What else might this invention be for?
    - How might his invention be improved?
    - Who might want to use this invention?
    - Where might you be able to buy this invention?

Activity 11: Finding Phenomena

Looking for phenomena is a very abstract concept and needs to be modeled several times in the classroom before students are expected to do it independently.

- Look around the classroom or on the school grounds for phenomena. List them on the board and ask students to examine some of them (the way a hinge works, magnetism, roller maps, wheels on a dumpster).
- Divide the class into small groups and have each group brainstorm possible uses for one phenomenon from the list. These should be recorded in student journals.
- Each group should share its three most creative ideas.
- For homework, ask students to look for phenomena at home, on the bus, while shopping, and wherever else they might be. These can be listed and described in their invention logs.
- Start a *phenomena collection* on a bulletin board in the classroom. Phenomena might be written, drawn, modeled or posted with samples.
- The phenomena can be used as a source of ideas as students continue the invention process.

Bloom's Taxonomy

Bloom's Taxonomy describes six levels of thinking skills. Schools often ask children to spend their time on tasks requiring the lower level thinking skills of recall, comprehension and application. Teaching the invention process requires the higher level thinking skills of Bloom's Taxonomy. They can be embedded in any of the activities you do and are included in many of the activities located in other parts of this book. They are important because they require students to stretch beyond the recall and application of information.

Analysis

In Bloom's Taxonomy, *analysis* means to take apart or break down a thing or idea into its parts and perceive the interrelationships. Verbs like *analyze, examine, inspect, classify, separate* and *identify parts* often signal that the student will be using the thinking skill of analysis.

Activity 12: Inventions and Inventors

Students may work individually or in small groups. Select one of the activities below for the class to complete or allow each child or group to choose one.

- Examine how an invention has changed over the years. How have the changes affected its popularity and use? Predict how the invention will change in the future.
- Examine an inventor's life. What characteristics or events helped and hindered him/her?
- Make a list of what you feel needs to change in today's world. Give an example of an invention that might solve each problem or improve each situation.
- Respond to the question, "Do the times create the inventor, or does the inventor create the times?" Defend your review by giving examples from history.
- Do you believe that "Necessity is the mother of invention"? What does this saying mean? Give examples.
- Follow a new invention in the news using news programs, newspaper articles, advertisements, interviews, the Internet or surveys. Analyze and evaluate your data.

Have each child or group of children share information with the class. Encourage them to use a creative format for their presentation. Ban oral reports in favor or something more imaginative.

Activity 13: Un-inventing

This activity is a favorite of most students. It can be enjoyable for the teacher, too, but some ground rules must be set. Focus on the fact that students will be un-inventing an invention, or taking it apart to see what its components are, not hammering it into an unrecognizable pile of rubble. It is a good idea to have extra adults available to supervise this activity, especially if the children have no experience with tools.

- Collect inventions that students can take apart. Parents and at the local dump are good sources of materials. The items should be things that will never be used again, because it is easier to take them apart than it is to put them back together! Electronic inventions are not very rewarding to take apart, as the pieces are very small and usually hard to separate from the body of the invention. Watch for warning labels about internal voltage. Mechanical devices such as fans, manual typewriters, rotary telephones, and older filmstrip projectors are more interesting. Ideally there should be one invention for every two or three students.
- Gather an assortment of tools. A large variety of screwdrivers, pliers, small wrenches, a hammer (for tapping difficult screws), a small hand saw, and a pair of goggles for the pieces they produce as they take their invention apart (corrugated cardboard trays are ideal for this).
- Before beginning, explain how each of the tools is used and what it is supposed to be used for. Emphasize that tools should only be used for the purpose for which they are intended. Explain how to walk and move safely with tools. An additional rule might be "No hammering without adult supervision." Explain that goggles are important for eye safety. Put all the tools in a central location so students can get what they need independently.
- After each group has selected or been given an invention to work on, explain to them that they should be taking notes and making sketches of what they discover as they take the invention apart. They should be looking for something specific, such as phenomena, components or simple machines.
- It will take at least an hour for this activity, after all explanations have been completed. After that time, have each group share what they have discovered.
- Save the parts that might be useful for future invention activities.

Synthesis

Synthesis means to use elements or ideas in new and original patterns and relationships. Much of the invention process is a *synthesis* activity. Verbs that indicate that students will be using the thinking skill of synthesis include: *create, invent, make, devise, originate* and *produce.*

Activity 14: Creative Combinations

Select one of these activities, or another that requires synthesis.

- Use SCAMPER techniques to improve an object.
- Combine two objects to make something new.
- If television had never been invented, how might our lives be different today? What might have been invented instead?
- What are many, varied, and unusual ways to use a paper clip?
- Create an invention using the materials given to you. What is it called? How does it work? What will it do?
- Create a grocery cart with multiple functions. What is it made of? How does it work?

Students should share their responses, using a technique they have not used before in this unit.

Activity 15: Inventor's Warm-up

Inventions are often improvements or combinations of other inventions or products.

- Students should select one object from this list:

Bathtub	Ping Pong Table	Grocery Cart
Eraser	Traffic Light	Spaghetti
Bike Rack	Magnet	Shopping Mall
Lunch Tray	Sidewalk	Mailbox

- Students can brainstorm varied or unusual ways to improve the object by combining it with one or more other inventions.
- One combination should be illustrated by each student and shared with the class.

Activity 16: Ready? Get Set! Invent!

Students need several different exercises to get into the inventing mode. The more success they have in the classroom with inventing, the more likely they are to succeed with independent inventions.

- Have students select one item from this list:

Something to save a life
A wasp trap
A foolproof clue to your identity
A way to help people communicate
A teaching aid to help kids understand subtraction

Something a pet owner might need
A way to measure the height of a two-story building
Something to help prepare or serve food

- Using scissors and any kind of paper and tape, students should make an invention.
- Each inventor should record all progress in a journal with sketches, a name, and a description of how the invention works.
- Each inventor should share his/her invention with the class and explain how it works.

Activity 17: Creating Riddles

This riddle recipe© was developed by Mike Thaler, "America's Riddle King." It provides a simple formula for generating volumes of riddles, many of the real "groaners!"

- Have student pick a subject. Something like *pig*, with its single syllable, is easiest to use for beginners. Any subject in the universe will work.
- Make a list of synonyms and related words, such as *hog, swine, oink* and *ham.*
- Take a word from the list and drop the first letter. *Ham* would become *am*.
- List words that begin with "am" such as ambulance, amnesia, and amateur.
- Put the dropped letter (*h* from *ham)* back on to get *hambulance, hamnesia,* and *hamateur.*
- Make up riddle questions using the answer's definition.

  In what do you take a pig to the hospital? A *hambulance.*

  What do you call it when a pig loses its memory? *Hamnesia*

  What do you call a pig that is not a professional? A *hamateur.*
- In some cases it may be necessary to drop more than one letter (as in *snout*). You must droop the *s* and *n* to get a workable word *(out)*.
- Have the class select their favorites and publish them as a book, to share with other classes.

Evaluation

Evaluation requires you to make decisions or judgments based on chosen criteria or standards. *Evaluation* verbs include *decide, choose, rate, evaluate, rank,* and *grade.*

Activity 18: Research Projects

Allow students – individually, in groups, or as a class – to select one of these topics to research.

- Which single inventor has had the greatest impact on the 20th century? Defend your reasons for choosing this person.
- What do you consider to be the five most important inventions during the last 200 years? What criteria did you use for choosing these inventions? Support your choices with examples of explanations from your research.
- Choose one invention and debate its effect on mankind. *Example:* "Television has a beneficiary affect on society."
- What are the three most common characteristics among inventors? Why do you feel these are important? Give examples.

Students should use all available resources to make their decisions and to prepare to defend them.

Group students by common problem statements or, if the entire class worked on the same problem, divide the class into groups of four or five students.

Have each group discuss the results of their research. Within the group, one person should volunteer for each of these jobs: recorder, reporter, mediator, and checker. The recorder takes the notes and the reporter will use those notes to report back to the class. The mediator will be responsible for making sure that all discussion is information-based and does not include inappropriate arguing. The checker will make sure that everyone agrees with the decisions the group makes.

After the groups have reached conclusions on their problem statements, have them present their results, with rationales.

Activity 19: Evaluation using Criteria

Often it is useful to have everyone use the same criteria in the evaluation process. An example is the use of rubrics in education.

- Make a list of criteria for students to use in deciding which of the many ideas they have formulated they will pursue in the invention process. Criteria might include availability of materials, originality, need, production time, and expected success. Make the criteria consistent so that a positive response is always a good thing. This means not having criteria like "Is it too hard to make?" or "Has someone already invented it?"
- On the board make a chart for evaluating ideas. It might look like the one below:

Idea	Useful	Original	I can make it	Have/can get materials	I want to do it

- Have students copy it into their logs.
- In the first column, students should list their ideas.
- In each of the other columns, students should put a "+" for a positive response, a "-" for a negative response and a "?" for ones about which they are unsure.
- Discuss what they will look for in making a decision about which idea to follow up. It should be an idea with more +'s than -'s. It should definitely be one with a + in the "I want to do it" column.

After doing this activity, students can generate their own list of criteria when they are making a decision and use a chart like this one as a rationale for their decision.

Creative Problem Solving

Creative Problem Solving (CPS) was developed by Scott Isaksen and Donald Trefflinger and combines techniques of creative and critical thinking. At each step in the process, ideas are brainstormed and the best are selected, using criteria, to carry on to the next step.

Mess-Finding

Make a list of things that are problems for you. Select the one that seems most interesting to take to the next step, *Data-Finding.*

- Making the bed.
- Feeding the dog.
- Getting all of your homework done.
- Keeping your sister out of your room.

Data-Finding

Make a list of all of the components that contribute to the "mess." Perhaps feeding the dog is a problem because:

- The dog jumps up on you.
- You don't like cleaning up the dirty dishes.
- The food smells gross.
- It takes too long.
- You can't do it when you're on vacation.
- The cat gets into the dog's food.
- Ants get into the food.
- The food gets too warm on hot days.

Decide which of these facts are the most important to you in solving the problem. Go to the next step, *Problem-Finding.*

Problem-Finding

Generate a list of statements that begin with "How might I…"

- How might I keep the dog food from getting warm?
- How might I change the food so that being warm is not a problem?
- How might I refrigerate the food for the dog, but make it accessible?
- How might I preserve the food?
- How might I eliminate the need to feed the dog when it is hot?

Select the one that seems most interesting to you, and go on to *Idea-Finding.*

Idea-Finding

Think of alternative ways to approach the problem. Use *SCAMPER, Bloom's Taxonomy, brainstorming, attribute listing,* or any other technique to come up with a variety of strategies.

- Freeze the food.
- Only feed the dog at night when it is cool.
- Refrigerate the bowl.
- Use blue ice as a coolant.
- Make a doggie door in the refrigerator.
- Use dry food.

Look for your most promising possibilities to carry on to *Solution-Finding.*

Solution-Finding

Generate a list of criteria to help you select which idea you are going to work on. For your best ideas, list their advantages, limitations and unique aspects.

For a refrigerated bowl, using freezer packs:

Advantages:	It could keep the food cool.
	Blue ice is fairly easy to find and freeze.
	It might fit under the dog bowl I already have.
Limitations:	Will it stay cold long enough?
	I must make sure the dog can't eat the freezer packs!
Unique Aspects:	It might discourage the ants too.
	It should help with the odor.

Examine the advantages, limitations and unique aspects of each of the ideas you brought to this step and select the one you are going to take with you to *Acceptance-Finding*.

Acceptance-Finding

Make a list of people and things that will help you and those that will make your task more difficult. Develop a plan of action that describes how you are going to implement your idea.

- Mom might be willing to help me by letting me use the blue ice from the cooler.
- My sister will probably get in the way.
- The dog will be nervous if I am doing something to his bowl.

- ❖ I am going to try freezing the blue ice and putting it in a pan under the dog's dish. After I feed him, I will check the temperature of the food every half hour, rate the smell, and check for ants.

Although CPS sounds very rigid, it shouldn't be. You may jump directly into *Data-Finding*. You will get to *Solution-Finding* and decide you want to go back to your original M*ess-Finding.* Keep a record of everything you consider at each step in your journal, so that you can go back if your idea doesn't work!

Activity 20: Guided CPS

Allow the class to brainstorm "messes" for *Mess-Finding* and list them on chart paper. As a class, select one to take to *Data-Finding*. Have students individually begin the first step of CPS for their invention using the process from the classroom as a model. Allow several days for each step of the process.

Model *Data-Finding* with the class "mess" and identify the important data. Have students do the same with their individual lists.

Continue one step at a time through the process. At the end you will have a class invention idea, and each student will have one of his/her own!

Activity 21: Think Tank

Establish your classroom as a "Think Tank." Encourage fellow staff members, the principal, the custodian, and other students to bring problems to you for your class to solve using CPS.

Document the problem-solving process and share the results with your "clients." Encourage them to share the results of implementing the class's ideas, if they choose to implement them. Celebrate the well-executed problem-solving process, even if your "clients" choose not to use your ideas!

Inventing

Recommended Timeline

The invention unit can be used in a number of easy and through numerous disciplines. It can be done as an after school activity, as an integrated classroom activity, or as a science project. It is up to you how you wish to proceed. Inventing does take time. It is strongly suggested that six weeks (minimum) be allowed for the incubation of ideas, experimentation with form and process, and revision of plans and outcomes. A possible timeline that includes all the aspects discussed in this manual would look something like this:

Weeks One & Two

- Develop creative and thinking skills by using various activities such as Brainstorming, SCAMPER, FFOE, etc. Starting at page 22.
- Center class activities and discussion around the concepts of invention and innovation.

Homework: Have your students go through their kitchen "gadget" drawer and select an item they feel is unique or very unusual. Ask them to find one they think no one else will have and bring it to class.

Focus activities and discussion on strange and unusual inventions. Discuss the gadgets students have brought in and identify their purposes.

Share the invention stories of real inventors, as well as student inventors. Starting at pages 69.

Steven Caney's Invention Book and Barbara Taylor's *Be an Inventor* are excellent resources. See Resource Section on page 114.

Homework: Have students choose two inventions to combine into one new invention.

Share how these new inventions work. Center the discussion on how the invention could work, its purpose, and the problem it solves.

Week Three

Introduce *Journal keeping*. See page44

Homework: Have students complete "Problems All Around Me," conduct a survey, make a list of personal problems, or make a list of problems found when engaging in a favorite activity. See *Identifying Problems,* page 48.

A favorite creative activity is *Junk Inventing*. See page 29.

Week Four

Establish "work groups" in order for each student to have a group to work with during this unit. It will help the inventor who gets stuck, allow for peer interaction, and take the pressure off the teacher. If you have time and wish to extend this unit, now is a good time for research, timeline construction, and/or introducing Rube Goldberg™. See *Additional Activities* on pages 65.

Have students examine their *Identifying Problems* journal entries. Create a class activity around a focused problem: Have your students think about their problems, then brainstorm possible solutions and ways to apply these solutions to the creation of an invention. See *Finding Solutions to Problems.* (This could be done in their work groups.) See page 50.

Homework: Ask your students to decide which invention idea they want to use. Have them try to determine if this invention already exists. See *Starting to Make Plans,* page 52.

Many inventors feel this is the time to name their invention. See page 53.

Week Five

After discussing their plan with their work group, the student should file an "Intent to Invent" form with the teacher. See page 54.

Have students make drawings of their inventions to show how they work. See *Completing an "Intent to Invent" Form and Drawing a Diagram,* page54.

Have several journal and invention check-ins. Students' progress on inventions should be checked and problems they may be having should be examined. Class or work group brainstorming can be very helpful to those students who get stuck.

Homework: Students should begin serious work on their breadboard model. See *Constructing a Breadboard Model,* page 56.

Encourage students to test their invention and redesign it if it really isn't working. Help them understand that it is appropriate to make changes and start over. Focus on the parts that do work.

If a name hasn't been selected, now is the time – it must be done! See *Naming Your Invention*, page 53.

Week Six

Have each student prepare an invention display and practice his/her presentation. This display will be used to share each student's invention with the class, grade, or school in an "Young Inventors' Program." See *Marketing an Invention*, page 57.

Introduce the concepts of marketing, product naming, and advertisement jingles. See page 53. Discuss the concept of patents and how they work. See page 63.

Process of Inventing

There is no "correct" way to invent. However, there are identifiable components in the problem-solving process. The following process is just one of many possible models. Perhaps teachers should view their roles as not "teaching" the invention process, but as "providing an opportunity" for students to engage themselves in the "process of inventing."

One Possible Process Model

***The Inventor's Journal* (Page 44)**

Inventors need to keep a journal to document all their ideas.

Identifying Problems (Page 48)

There are many ways for students to become more aware of problems around them.

Finding Solutions to Problems (Page 50)

Creativity is the ability to generate many options and select the best.

Starting to Make Plans (Page 52)

Inventors need to take time to check to see if their particular idea has already been invented.

Completing an "Intent to Invent" Form and Drawing a Diagram/Picture (Page 54)

Getting an idea down on paper will help as the student inventor begins to construct his/her invention.

Constructing a Breadboard Model (Page 56)

There are three physical stages an invention must go through. Student inventors usually stop with the breadboard model, which is designed to prove that the invention idea works.

Marketing an Invention (Page 27)

Inventors will plan a display for their local Young Inventors' Program School Invention Convention, and learn about marketing strategies and the patent process.

The Inventor's Journal

An Inventor's Journal is "an official record of the process of your invention…[It] is an ongoing record of all the events, actions, experiments, and observations during the entire development of the invention." (*Steven Caney's Invention Book*) Neatness is not the priority. Creativity is messy!

Suggestions to follow:

- Write in ink and do not erase.
- Leave no empty spaces.
- Use a bound notebook.
- Date your notes.
- Begin your journal with all your problem ideas and the results of your survey.
- Record your invention ideas and describe how you got them. Also, record all changes as time goes by.
- Explain what your invention does.
- Explain why your idea is new and original (an invention) or that it is an improvement on an already existing invention (an innovation). List places you have checked to be sure your idea is new.
- Write about the problems you found and how you solved them.
- Tell how your invention works.
- Make a diagram of your ideas whenever possible.
- Tell what you changed and why.
- Describe all materials and parts you use. List your costs.
- Diagram and describe the tests you run. Include the results of each test.
- Describe your search for a catchy name.
- Sign and date all entries at the time they are made and have them witnessed at least once a week.

Invention Journal

Inventor Name:	
Date:	Hours Worked:

Drawings or Photos:	
Inventor's Signature:	**Date:**
Witness:	**Date:**

How Your Invention Journal Protects You

If you ever want to patent your invention, a journal is essential to protect your rights. Here's a story of one inventor who was very sorry because he didn't keep a log.

Daniel Drawbaugh was a talented mechanic who invented a crude telephone long before Alexander Graham Bell, but he did not have witnessed notebooks describing his device. Even though Drawbaugh was able to produce hundreds of witnesses to testify he had talked over a crude telephone long before Alexander Graham Bell filed a patent application in 1875, he had not a scrap of paper dating and describing his invention. Without this proof, the Supreme Court rejected his claim in 1888, and Bell has become famous for the telephone while few people have ever heard of Daniel Drawbaugh. Similar disputes have raged over who invented the automobile, the electric light, and the laser. In all cases the records- or lack of them – played a deciding role in the patenting decision.

Identifying Problems

Inventors are people who solve problems. Inventors figure out new and easier ways to do things. Be a detective and look for problems to solve. Problems are everywhere…if you learn to recognize them. There are several ways to go about this process:

What "Bugs" You?

It really bugs me when…What bugs you about taking care of your pet? What bugs your mother most in the kitchen? Ask others what "bugs" them. Record their answers. Asking questions and recording the answers is called *doing a survey*. Surveys are increasingly important in the development of new products and services and are part of the marketing process, which involves the selling, advertising, and packaging of a product.

Problems All Around You

Ask other people what problems they have around their homes, neighborhoods, or jobs that could be solved by a new invention.

Family _____

_____

Friends_____

_____

Neighbors _____

_____

Yourself _____

_____

To pick the best idea, ask yourself which idea is most interesting to you, most needed, most original, and one you think you can make using the materials around your home.

Best Idea _____

Things I Like To Do

Another way to tackle identifying problems is to make a list of personal problems. Start by listing all the things you like to do. Sporting activities – Reading - Listening to music – Shopping. Once you have this list, *write down the chief problems or annoyances you run into during this activity*.

Problem List

Another way to identify problems to solve is to start by listing all the tools you use in your daily life. Your list may include a toothbrush, pencil sharpeners and water bottle. *Then, think of the difficulties of using each of them*. If you can solve one problem of a common tool, you may have a useful invention.

Begin your journal with all your problem ideas, and the results of your surveys.

Finding Solutions To Problems

Let your imagination run wild and list all your ideas. List as many solutions as you can, in order to have a big list from which to choose. Let your ideas grow.

Brainstorming Journal

Examples of Problems

- Applying paint to a ball
- Heating a meal in a lifeboat
- Communicating with a person who cannot talk
- Improving student lockers
- Finding a way for short people to reach a rod with a hanger

Procedure

Brainstorm ways to solve the problems in your journal. Remember, to brainstorm –

- Think up a large number of ideas
- Do not judge your ideas
- List all your ideas, even "crazy" ones

In your journal, be sure to –

- Write down all your ideas for solving the many problems you have listed
- Underline the three ideas that you think are best
- Circle your favorite idea
- Tell why this is your favorite idea

Picking The Best

From all your brainstorming, pick the problem and your idea for a solution that is the most promising to work on for your invention project. *The only one worth doing is the one you are excited about!*

If you really get stuck, do "combination inventing." Look through mail catalogs and combine two products and see what happens.

Be sure to record all your problem-solving ideas in your journal.

Starting To Make Plans

Now that you have an idea for your invention, you must determine if it meets certain standards. Some criteria, necessary for evaluation, are included in the chart below.

Make your own chart, including any criteria you feel are important.

Is My Idea...	Yes	No	Needs Improvement
Going to work?			
New and original, or an improvement on an existing invention? (Do research by asking parents, neighbors, and teachers, checking catalogs and books in the library, and calling stores that would sell your product.)			
Creative and unusual?			
Useful to all age groups?			
Cleverly named?			
Too complex?			
Too simple?			
Designed to improve the environment?			
Able to be mass-produced?			
Easily damaged?			
Made from recycled materials?			

Comments and suggested changes: _____

_____

_____

What else might it be used for?: _____

_____

_____

Record the results of your criteria in your journal, as well as the results from your research. Record your thoughts as you begin to plan your invention.

Naming Your Invention

Many inventors like to name their inventions as soon as they choose an idea. You should like the name, and it should help you talk about your invention. If you decide to market your invention, a good name will help you. Think about the names of products you like.

Whatever else the name is, it should be easy to remember. George Eastman, inventor of the Kodak camera, said that invention names should be, "short, vigorous, and incapable of being misspelled." Try your name ideas out on your friends and family until you find something you like.

Examples

- Rhyming names: yo-yo, Piggly Wiggly, tutti-frutti
- Names using the inventor's name: Levi jeans, Goodyear tires, Ford automobiles, Heinz ketchup
- Repeating sounds: Kit Kat, Silly String, Tinker Toys, Beanie Babies
- Descriptive Names: cotton ball, Rice Krispies, Dustbuster, toothbrush, Walkman
- Technical Names: television, submersible, aqualung, airfoil
- Named for ingredients: Corn Flakes, steel-belted radials, ice cream, peanut butter, soap suds
- Names with initials or acronym: Laser, VCR, SST, MRI, Scuba
- Named for its FUNCTION, for the way it works: sunglasses, doghouse, squirt gun, toothbrush, post-it notes
- Named with funny and clever words: Silly Putty, Cool Whip, Flip Flops

Be sure to record your possible names in your journal.

Intent to Invent – Drawing a Diagram/Picture

It is time to file this form with your teacher so she or he knows that you have identified a problem and a solution to that problem.

Student Inventor:	**Grade:**
Teacher:	**Date:**
I intend to invent:	
The problem it will solve is:	
I have determined to the best of my ability that my invention will be original by taking these steps:	
I will use the following materials in my invention:	

Draw a diagram of your proposed invention. Explain how it will work.

All inventors make drawings of their inventions to show how they work. Draw some quick sketches of your idea in your journal and pick what you think will look and work the best. All diagrams should be labeled, dated, and briefly explained.

This diagram will help you as you begin to list the materials you need to collect to begin your breadboard model.

Draw all parts of your invention in your journal and label them clearly, neatly, and correctly so that others will be able to understand how your invention works and looks.

Constructing a Breadboard Model

"There are three physical stages an invention must go through to get from an idea to completed product: first, the *breadboard*, which proves that the invention idea works; then the *model*, which takes into consideration who is going to use the invention, as well as how it will be used; and finally a prototype of the invention, which looks and functions exactly like the manufactured version would, except that the prototype is a one-of-a-kind, handmade sample." (*Steve Caney's Invention Book*)

Breadboard models are quick and easy and can be made from any materials that are handy. It is okay to make several breadboards, as they are only experiments. Each breadboard will probably be better than the last.

Don't be afraid to make changes or start over. Sometimes this is all for the better.

You may decide to make a model. You will need to make a list of supplies and tools you think will be necessary. You may want to consult with your teacher or parent if you progress to this stage. In your journal, construct a chart to keep track of the information about materials and prices.

Be sure to record all the materials you used to make your model and photos of your model making in your journal.

Marketing An Invention

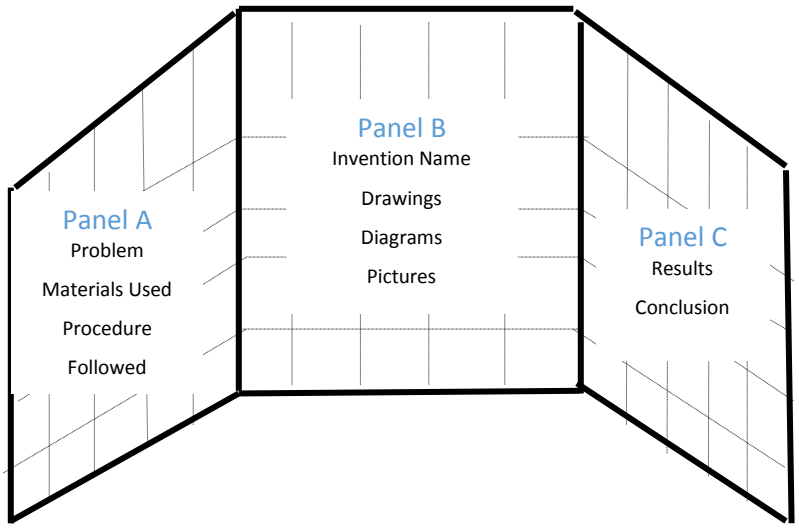
Invention Displays

Your display may include many items, such as:

- How you thought up your idea
- How you researched whether such an invention already exists
- A statement of the problem solved
- Other brainstormed idea solutions which were unsuccessful and/or improvements
- Other people's impressions about the usefulness of the invention
- Personal testimonies of your own uses
- A short autobiography
- Photographs and/or diagrams

Older students often use tri-fold poster board or multiple panels joined at the edges. Ghostline® foam board panels can be found to make a particularly neat and orderly display as suggested in the following example.

An Example of a Three-Panel Display Board for Older Students

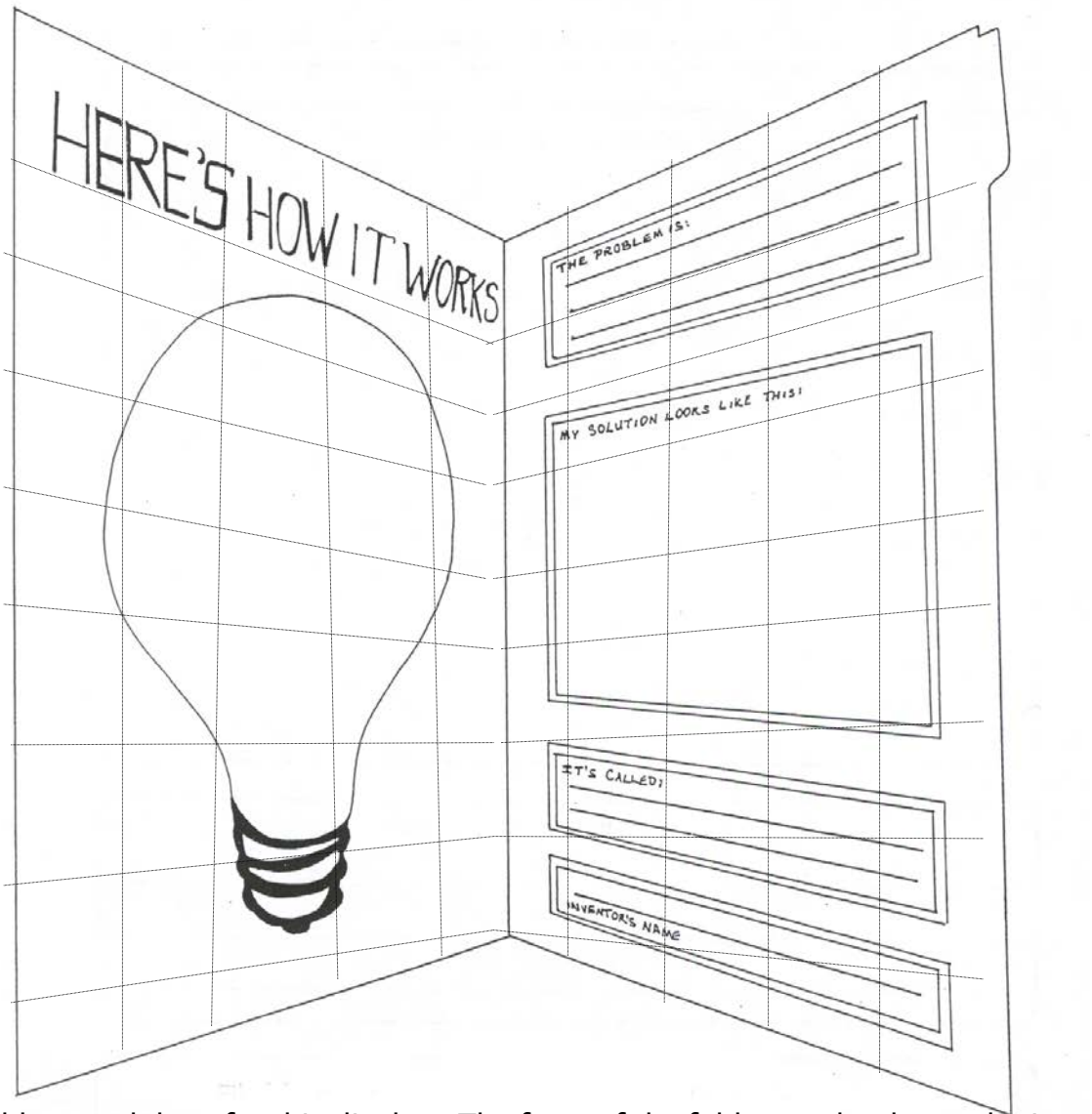


Ghostline® foam boards (22" x 28") can be used by connecting the foam boards with stick-on Velcro® tabs (hook and loop fasteners are available in notions department of most stores.) The measuring and marking are already done on Ghostline® products and the lines are only visible at a working distance. This makes it easier to create a neat looking

project and, if a mistake is made only one section has to be replaced. Also, individual sheets are easier for students to work with than the tri-fold boards.

Two small 'hook' tabs should be wrapped around the inside edge of each side board at the top and the bottom. Four small 'loop' tabs should be attached at top and bottom on each side of the center board to correspond with tabs on side boards.

A Display Model for Younger Students



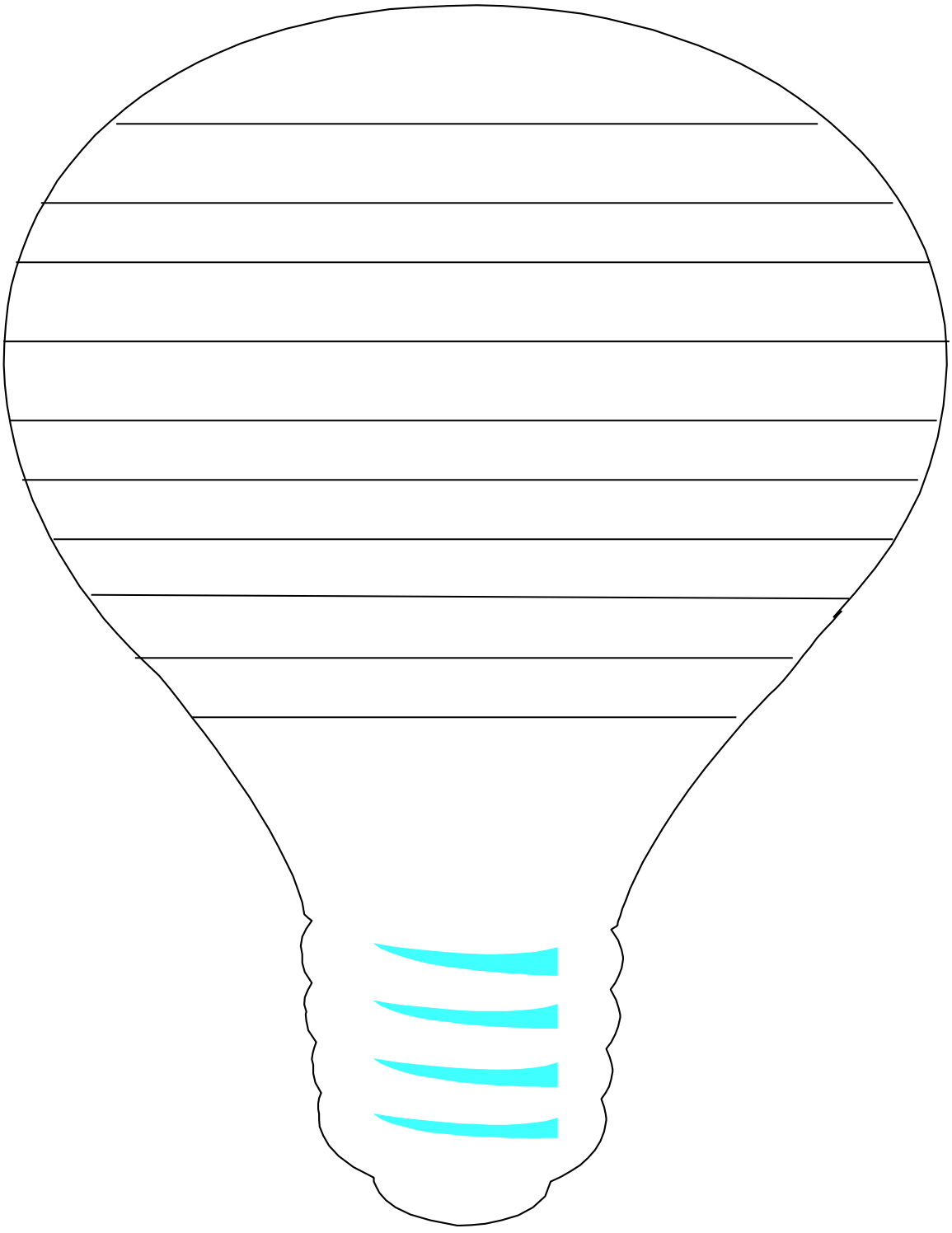
File folders work best for this display. The front of the folder can be the marketing design and the Patent Certificate can be attached to the back.

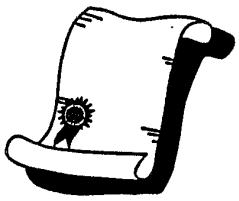
For a simple presentation, regular file folders can be used. However, students may find that two sheets of Ghostline® foam board (11" x 14") connected with stick-on Velcro® tabs

work best for this display. Students can work on each sheet separately and connect them together when the project is completed. If one sheet is soiled, the remaining sheet is still useable. Ghostline® also offers a tri-fold board in 11" x 14" size. The Ghostline® grid makes neat projects possible, even for young children. The back of the left side can be the marketing design and the Patent Certificate can be attached to the back of the right side.

The problem is:
The solution looks like this:
It is called:
Inventor's Name:

Here's How It Works!





Patent Certificate

Issued to

_____

inventor's name

for creating a unique invention called

_____

name of invention

that can

_____

what invention does

_____ _____

Teacher Date

Other Marketing Strategies

If you are inventing for yourself, you don't need to consider costs or marketing. If you want to sell your invention, you have to ensure that people want to buy it. The first thing you should do is to determine if people need or want your invention. Ask your friends, neighbors and family. Find out if they would be interested in buying your invention if it was available.

You need to set a reasonable price for your invention. It must be enough for you to make a profit but not so much that nobody will buy it. Calculate how much it costs to produce your invention, then add enough to make it worth your time to produce it.

To sell your invention, you need to convince someone that they need it. Advertisers use slogans and jingles to attract buyers and help them remember the name of the product they are trying to sell. Look at a variety of advertisements. Which ones do you enjoy? Which ones do you remember? Which one made you want to buy the product? Make a list of the techniques advertisers use to convince you to buy their products. Use this list to prepare your own advertisement or sales pitch for your invention.

Once you have prepared an advertisement for your invention, try it out on someone. See if it would convince them to buy your product. They can give you some suggestions. When you are comfortable with your sales pitch, try it out on a potential customer. Don't be discouraged if you're not successful at first. Many famous inventors have had trouble selling their ideas.

Most inventions never make money for their inventors. Only a few patented inventions out of hundreds earn a profit. But if you are convinced that you have a money-making invention, here are some things you could do.

Protecting Your Idea

Here's where your *Invention Journal* is useful. You had witnesses sign it as you recorded your progress. Having a "notary public" sign your journal is also a good idea if you are serious about protecting your idea. You may want to talk to a patent attorney. For a fee, an attorney can tell you about patents, copyrights, and trademarks; how much each will cost; and how long it will take.

Caution: In the United States you have one year after publicly showing your invention (i.e., at an Young Inventors' Program or competition) in which to have a patent application on file at the United States Patent and Trademark Office. If you wait more than a year, you lose your right to a patent. See a patent attorney before you show your invention in public to preserve your right to patent abroad. Once you show, it may be too late to get foreign patent protection.

Selling Your Idea

Identify some companies that make the product you have invented or improved. These companies will be the ones most interested in your new/improved product. An alternative approach is to use an agent. You can ask the patent attorney how to find an agent.

Making It Yourself

In most cases, becoming a manufacturer yourself is not a good idea. This will require considerable thought and money.

The Patent Process

If you have ever looked on the bottom of some objects around your house, you might have noticed a patent number or a patent pending number. Do you know what that means?

A patent is a document issued by the Patent and Trademark Office for the federal government. It gives the inventor rights to his or her invention for 20 years from the date of filing the patent application. The patent gives the inventor the right to prevent anyone else from making, using, or selling the invention without his or her permission. When a patent expires, anyone can produce the product without paying the inventor.

In 1790, the Patent Act was passed. It stated that "any useful art, manufacture, engine, machine, or device or any improvement thereon not before known or used" could be patented.

Patents are issued for any new invention or any improvement on an old invention. To apply for a patent, the inventor must have a description of the invention and drawings that show how it works. The inventor must also tell why he or she believes the invention is new and different from inventions that have been patented before. This information is sent to the United States Patent and Trademark Office in Washington, D.C. It takes about two years to get a patent. "Patent Pending" or "Patent Applied for" means that the inventor has applied for a patent, but has not yet received it.

An inventor who has received a patent may market and sell the invention. He or she may prefer to sell the rights to the invention to a company. In this case, the company pays a fee to the inventor for the right to produce and sell the invention.

For more information on patenting, write to: Commissioner of Patents and Trademarks, Washington, DC 20231 Toll Free 1-800-PTO-9199 (1-800-786-9199)

Patent Activities

- Look for a variety of items with patent numbers. Write down the numbers and the names of the inventions. Did you find any foreign patent numbers?
- Set up a "patent office" in your classroom. Issue "patents" to each student who produces an original invention.
- Invite a patent attorney or an inventor to the classroom to discuss his or her job.
- Find the section of the United States Constitution that establishes the Patent Office.
- Make a timeline of some interesting inventions that have been patented in the U.S. since 1787.
- Make a list of inventions created by individual inventors – not by inventors who work for large companies.

Be sure to record these last thoughts in your journal.

Additional Activities

Researching

The following stories about "Great Thinkers and Inventors" will help motivate students and enhance their appreciation of the contributions of Inventors to the American way of life. As students hear about these people, they will also realize that "inventors" are male or female, old or young, any race or creed. They are ordinary people who follow through on their creative ideas to make their dreams a reality.

Band-Aid

At the turn of the century, Mrs. Earl Dickson, an inexperienced cook, often burned and cut herself. Mr. Dickson, a Johnson & Johnson employee, got plenty of practice in hand bandaging. Out of concern for his wife's safety, he began to prepare bandages ahead of time so that his wife could apply them herself. By combining a piece of surgical tape and a piece of gauze, he fashioned the first crude adhesive strip bandage!

Life Savers Candy

During the hot summer of 1913, Clarence Crane, a chocolate candy manufacturer, found himself facing a dilemma. When he tried to ship his chocolates to candy shops in other cities, they melted into gooey blobs. To avoid dealing with the "mess", his customers were deferring their orders until cool weather. To retain his customers, Crane needed to find a substitute for the melted chocolates. He experimented with hard candy that wouldn't melt during shipment. Using a machine designed for making medicine pills, Crane produced small, circular candies with a hole in the middle. This was the birth of *Life Savers*!

Frisbee

The term *Frisbee* did not always refer to the familiar plastic disks we visualize flying through the air. Over 100 years ago in Bridgeport, Connecticut, William Russell Frisbie owned the Frisbie Pie Company and delivered his pies locally. All of his pies were baked in 10" round tins with raised edges, wide brims, six small holes in the bottom, and "Frisbies Pies" stamped on the bottom. Playing catch with tins soon became a popular local sport. It became the Yale custom to yell "Frisbie" when throwing a pie tin. In the 40's when plastic emerged, the pie-tin game was recognized as a manufacturable and marketable product.

Edible Pet Food Server

Suzanna Goodin was a six year-old girl with a problem. She had to feed her cat every day and wash the spoon she used. Suzanna did not like having to wash a dirty spoon. Suzanna went to her grandmother for help. Together they mixed up some dough and baked it in the shape of a spoon. It worked to scrape the food out of the can! Suzanna broke the spoon into pieces and added it to the food for her cat. Unfortunately, the cat didn't like the biscuit. Suzanna added a "secret" ingredient she knew her cat liked. The result was a spoon that would get the food out of the can, and could even be fed to the cat. Suzanna won the National Weekly Reader Invention Contest with her invention.

Machine to Fold and Glue Paper Bags

Margaret Knight, remembered as "the female Edison," received some 26 patents for such diverse items as a window frame and sash, machinery for cutting shoe soles, and improvements to internal combustion engines. Her most significant patent was for machinery that would automatically fold and glue paper bags to create square bottoms, an invention that dramatically changed shopping habits.

Liquid Paper

Bette Graham hoped to be an artist, but circumstances led her into secretarial work. Graham was not, however, an accurate typist. Fortunately, she recalled that artists could correct their mistakes by painting over them with gesso, so she invented a quick drying "paint" to cover her typing mistakes. Graham first prepared the secret formula in her kitchen using a hand mixer, and her young son helped to pour the mixture into little bottles. In 1980, the Liquid Paper Corporation that Graham built was sold for over $47 million.

Steve Caney - Vignette

As far back as I can remember, I was inventing something. At first it was because of necessity. You see, I usually got underwear for my birthday. My parents were not mean spirited, just somewhat overly practical. If I wanted something to play with, I usually just found it or made it myself. My materials were the discards of everyday life – the usual paper plates, drinking straws and empty boxes, plus the weird assortment of parts my father kept in coffee cans under the basement steps, several broken appliances stored in the garage, and a kitchen drawer stuffed full with twine, rubber bands, jar lids, and lots of strange caps, clips and containers that at some time my mother must have thought valuable enough to save.

Wow! What a collection of nifty stuff. Maybe that's why I never seemed to mind creating many of my own toys. I rather enjoyed planning and executing the project, and then playing with my invention. I didn't even mind fixing it or improving on the design when it broke or didn't work just right. But what now seems most important and satisfying was the praise I got for being inventive and the encouragement, help, and lessons I received from my many mentors.

About the time I was five, I discovered my grandfather's basement workshop. Above a long wooden work bench there were shelves that held stacks of old cigar boxes, and each cigar box contained a giant array of metal, rubber and plastic parts – parts taken from door locks and hinges, faucets and drains, kitchen appliances, but mostly unknown sources. Junk. The kind of broken stuff that gets saved just in case someday you need to replace a missing part. But to me, this magical stuff was the inspiration for invention. There were things I could take apart, put together, bend, hammer, and even break – if that's what I wanted to do.

By age eight, I was the builder, inventor and fixer of things among my peers. Over the next few years I invented a bedspring suspension system and brakes for my roller-skate-clad soapbox racer, a remote shutter release for my Brownie camera (to take candid pictures of backyard birds), a mailbox that kept the rain out, and a whole bunch of things that propelled themselves or shot something through the air. And if someone wanted to pull a practical joke on a friend, I was the one kid in my neighborhood who could invent the booby trap.

This inventing thing was my ticket to getting recognition just like the real smart kids in class. I was smart at inventing and that was fine with me. By being an inventor I could figure out how something worked by just inventing several ways it might work until I believed my idea as the right answer. By being an inventor, I practiced and learned how to do a project from the conception of an idea to the demonstration of the end results. In fact, I learned a lot of everything I was supposed to learn in school through the process of invention. Developing a clear definition or description of what I was going to invent. Figuring out how to make it. Looking for the right parts and materials. Measuring and calculating. Experimenting with solutions and refinements until it did work. And presenting the results to others.

While I was practicing and improving my inventing skills, I was also learning ways to solve problems. Rather than just trying to think of a good solution, I would look for solutions. If I needed a way to attach two parts together in a certain way, I would just look at all the things around me to discover how those things were attached to something. Out of all these "suggestions" would come just the right way I needed to do it. I was giving myself options and choosing the one I liked best. The more options to choose from, the better chance I would find the best solution, and the more products or solutions they will imply. I was looking for an interesting phenomenon and then playing with it to see what it wanted to do, what it wanted to be, what problem it wanted to solve. And I learned that bringing problems to these found solutions worked best. Keeping a mental list of invention ideas in search of solutions made every day an invention scavenger hunt.

It is these and other lessons of my invention experience that I have tried to pass on to others. I have also always been a teacher in spirit and practice. Or at least I can say I have always enjoyed taking the time to tell others of my experiences and revelations, especially about invention. Like so many other common interests that unite otherwise dissimilar peoples, invention is a common bond among practitioners. Anyone showing the slightest interest in inventing or inventions will immediately get my ear as well as my ideas. As I spent more time in classrooms of all grades, as I spent more time working with inspired teachers, I have revised and fine tuned my version of teaching the process of invention. This is a process based on my experience as an inventor.

I certainly appreciate that no one approach to invention may work best for all kids, but my way of looking at invention will be the inspiration and tools for some. Others will exercise their inventiveness using whatever methods and techniques they find rewarding. And for all, the invention process will become at least one way they can apply critical thinking skills, solve problems, have fun, and just maybe become a very successful Inventor.

Inventors and Their Inventions

Rines, Robert	High Resolution Sonar and Radar and Founder of the Academy of Applied Science
Anderson, Mary	windshield wiper
Armstrong, Edwin	FM radio
Baekeland, Leo Hendrik	bakelite (first plastic)
Bentz, Melitta	coffee filter
Boon, Sarah	ironing board
Braille, Louis	Braille
Burbank, Luther	variety of peach
Bushnell, David	submarine
Carlson, Chester	Xerox machine
Carothers, Wallace Hume	nylon
Chatham, Alice	space helmet, space bed
Daimler, Gottleib	automobile engine
Darrow, Charles	Monopoly
Davenport, Thomas	electric motor
Dickson, Earl	band-aid
Diesel, Rudolf	internal combustion engine
Donovan, Marion	disposable diapers
Dunlop, John	pneumatic tire
Einthoven, Willem	electrocardiograph
Elion, Gertrude	leukemia-fighting drug
Feuchtwanger, Anton	hot dog bun
Focke, Heinrich	helicopter
Franklin, Benjamin	bifocals, lightning rod
Gatline, Richard	machine gun
Geer, Letitia	medical syringes
Goddard, Robert	liquid fuel rocket
Goodyear, Charles	vulcanized rubber
Grant, George	golf tee

Greatbatch, Wilson	cardiac pacemaker
Greenwood, Chester	ear muffs
Hamwi, E.A.	ice cream cone
Handler, Ruth	Barbie doll
Hollingshead, Richard	drive-in movie
Joliot-Curie, Irene	radiotherapy
Judson, Whitcomb L.	zipper
Kellog, John	corn flakes
Knight, Margaret	square-bottom paper-bag machine
Landman, Eva	umbrella
Maiman, Theodore	laser
Marconi, Guglielmo	radio
McCormick, Cyrus	mechanical reaper
Montgolfier, Jacques & Joseph	man-carrying hot air balloon
Morgan, Garrett	gas mask
Morrison, Walter Frederick	Frisbee
Naismith, James	game of basketball
Newton, Sir Isaac	reflecting telescope
Nisson, George	trampoline
Nobel, Alfred	dynamite
Plunkett, Roy	Teflon
Reno, Jesse W.	escalator
Samuelson, Ralph	water skis
Sholes, Christopher	typewriter
Stone, Marvin	drinking straw
Sullivan, Thomas	tea bag
Svòchak, Jan B.	bifocal contact lens & method for making the lens
Tate, Henry	sugar cube
Tracy, Harriett	fire escape
Volta, Alessandr	electric battery
Wakefield, Ruth	chocolate chip cookie
Walton, Mary	elevated railway
Whittle, Frank	jet engine

Examples of Student Inventions

"*I can't think of anything to invent!*" is a complaint teachers sometimes hear when students begin the inventing process. You can encourage students by discussing some of these student inventions:

- Electric rug to warm feet in cold weather
- Artificial ocean reef made of polyvinyl chloride
- Device to buzz when someone tips back in chair
- Bright red salt that allows you to more carefully flavor food
- Solar-heated winter bird house
- Flex mailbox that will not rust and will bounce back if hit
- Washing machine that deposits clothes directly into the dryer
- Device for a bird cage to allow for easy cleaning
- Solar-powered penlight collar for dogs and cats
- Lunch box alarm that indicates its contents are being stolen
- Long-armed apple picker
- A "line leader" for teachers of very young children to walk "the straight and narrow" with safety
- Peppermint dentist gloves
- Electric jump rope turner
- Jar that opens on both ends
- Water-cooled lawn chair
- Tall hanger for short people
- Portable hopscotch mat
- Automatic switch to turn on the light without getting out of bed
- Lock to prevent loss of necklaces
- Contraption designed to fit into the front seat of car or truck to fling rolled newspapers out the window onto porches or yards
- Buzzer that indicates to a bus driver when a child is out of his/her seat
- Skateboard break
- Spoon-shaped cracker for spooning out pet food, which can be crumbled up for the pet to eat
- Nose-wipe glove to carry tissues in cold weather
- Umbrella with a flashlight attached to handle
- Toothpaste cap to prevent the cap from going down the drain
- Metal tips for shoelaces that cling to magnets on the shoes
- Edible pet food server
- Sleeve stopper to help people put on coats without bunching up their sleeves
- Wheelbarrow brake
- Mouthpiece that snaps into the slot where the top is pulled off a not-so-clean can

Activity 22: Choose a Famous Inventor

Research to discover:

- What did this person invent?
- When did this person live?
- What else was happening in the world during this inventor's life?
- Give details about one selected invention.

Make:

- A model of your selected invention.
- A timeline listing major events during the inventor's lifetime.
- A list of at least three sources from which you gathered information about the inventor, his or her inventions, and world events during the inventor's lifetime.

Present to the class:

- Your model
- Your timeline
- Information about your inventor/invention

Hand in:

- Model
- Timeline
- List of sources

Science Research Project

Select a male or female scientist, inventor or mathematician (ancient or modern, living or dead) or a specific invention or discovery.

Utilize the following research and writing skills: note-taking, outlining or mapping, organizing, drafting, editing, finishing.

Use the *Content Checklist* to be sure you have done a thorough job researching. There are places for you and a friend or parent to check your work before you turn it in for grading.

The paper should include an introductory paragraph, a main body of several paragraphs, and a concluding paragraph.

Prepare a presentation (approved by your teacher). It may include any of the written information but must demonstrate or explain the theory, invention or discovery that you have researched. It is very important that your presentation have both a visual and an oral component. You might become that scientist, inventor, or mathematician.

Have some fun with this. The object is to learn about someone or something that you are interested in, but don't know much about. Educate us all!

Science Research Checklist (Person)

Name:	Self		Peer		Teacher	
Peer:	Yes	Not Yet	Yes	Not Yet	Yes	Not Yet
Teacher/Mentor:						
Introduction, including						
Why you chose this person						
Why we should learn about this person						
Complete name of scientist						
Date and place of birth and death						
Country where work was done						
Branch of science studied						
Early life (if available)						
Education						
Family						
Special events that may have had influence						
Major accomplishments:						
Invention, theory, discovery						
How these accomplishments helped our world						
Scientific methods or instruments used						
Visuals to support research:						
Pictures, timelines, diagrams, drawings						
Conclusion, including:						
If he/she were alive today, what would you ask?						
How did this person affect history (what would our lives be like without this person's work)?						

Science Research Checklist (Invention, Discovery)

Name:	Self		Peer		Teacher	
Peer:	Yes	Not Yet	Yes	Not Yet	Yes	Not Yet
Teacher/Mentor:						
Introduction, including why you shoes this topic						
Date of invention or discovery						
Country where work was done						
Branch of science it applied to						
History of invention or discovery, including						
Earlier related inventions or discoveries						
Scientists who may have contributed						
Events/circumstances that helped or caused						
Complete and thorough explanation:						
Invention needs written plus diagrams						
Discovery needs written plus diagrams						
Has this invention been used positively and/or negatively in our society?						

Scientific methods or instruments used						
Visuals to support research:						
Pictures, timelines, diagrams, drawings						
Conclusion, including:						
What would the world be like without it?						
What are the pros and/or cons of this invention or discovery?						
A prediction for the future						

Rube Goldberg® Machines

Rube Goldberg®

Reuben Lucius Goldberg (Rube Goldberg®) was born in San Francisco in 1883. His father, a practical man, insisted he go to college to become an engineer. After graduating from the University of California, Rube did a short stay with the City of San Francisco Water and Sewers Department. He continued drawing and soon got a job as a sports cartoonist for a San Francisco newspaper. An outstanding success, he soon moved to New York, drawing daily cartoons for the *Evening Mail*.

Through his inventions, Rube Goldberg® discovered harder ways to achieve easy results. His cartoons compressed time and were as he said, symbols of man's capacity for exerting maximum effort to accomplish minimal results. Rube believed that there are two ways to do things, the simple way and the hard way, and that a surprisingly large number of people preferred doing things the hard way.

Rube Goldberg's® work will endure because he gave priority to simple human needs and treasured basic human values. He was sometimes skeptical about advanced technology and big science. While most machines work to make difficult tasks simple, his inventions made simple tasks amazingly complex. Dozens of arms, wheels, gears, handles, cups, and rods were put in motion by balls, canary cages, pails, boots, bathtubs, and paddles.

Goldberg's drawings of absurdly-connected machines accomplishing a simple task in an extremely roundabout way, has meant that his name, Rube Goldberg™, has become associated with any convoluted solution to perform a simple task.

Rube Goldberg® Machine Contest

The Rube Goldberg® Machine Contest brings Goldberg's cartoons to life in a way that pulls students away from traditional ways of looking at problems and sends them spinning into the intuitive, chaotic realm of imagination. The resulting inventions are collections of bits and pieces, parts of now useless machines, pieced together to achieve an innovative, imaginative, yet somehow logical contraption to conquer the job at hand. The contest shows us all the need for simplicity and the pitfalls of complexity.

In 1949, at the peak of the Goldberg era, the two engineering fraternities at Purdue University, Theta Tau and Triangle, developed their own version of the Rube Goldberg® Machine Contest. The contest was held as part of Purdue's Engineer's Week. The contest ran off and on until revived in 1988 with a national contest that brought together regional university winners from throughout the USA.

The Rube Goldberg® Machine Contest is now hosted by the Phi Chapter of Theta Tau who helps choose the national challenge and hosts the National each year at Purdue University, attracting teams from universities throughout North America. High schools are now holding their own regional contests and the winning team goes to the National on a non-competitive basis to demonstrate their Rube Goldberg® Invention Machines.

How to Build a Rube Goldberg® Machine

Welcome to the wacky world of Rube Goldberg® Invention Machines. Take a few steps back from reality, gain a new perspective on how things work, and have fun by making a device that uses a complicated, roundabout process to complete a simple task.

Rube Goldberg® Machines are different from the machines people are used to seeing. A good "Rube" incorporates everyday devices, but the innovators connect and use them in ways that may seem idiotic, ingenious, or even creative. The machine must use a certain number of individual steps to complete an assigned task, which is predetermined. It may take some time to put together, and may undergo months of strategy and planning; others are put together in a few days.

Over the years, the machines that have worked the best seem to be those that are built in sections, as opposed to pieces. The less work to assemble the machine, the better. A platform for the machine, with a simple and secure way to fasten it together, works well. Typical platforms are made of plywood and two-by-fours, with sections that are easy to connect.

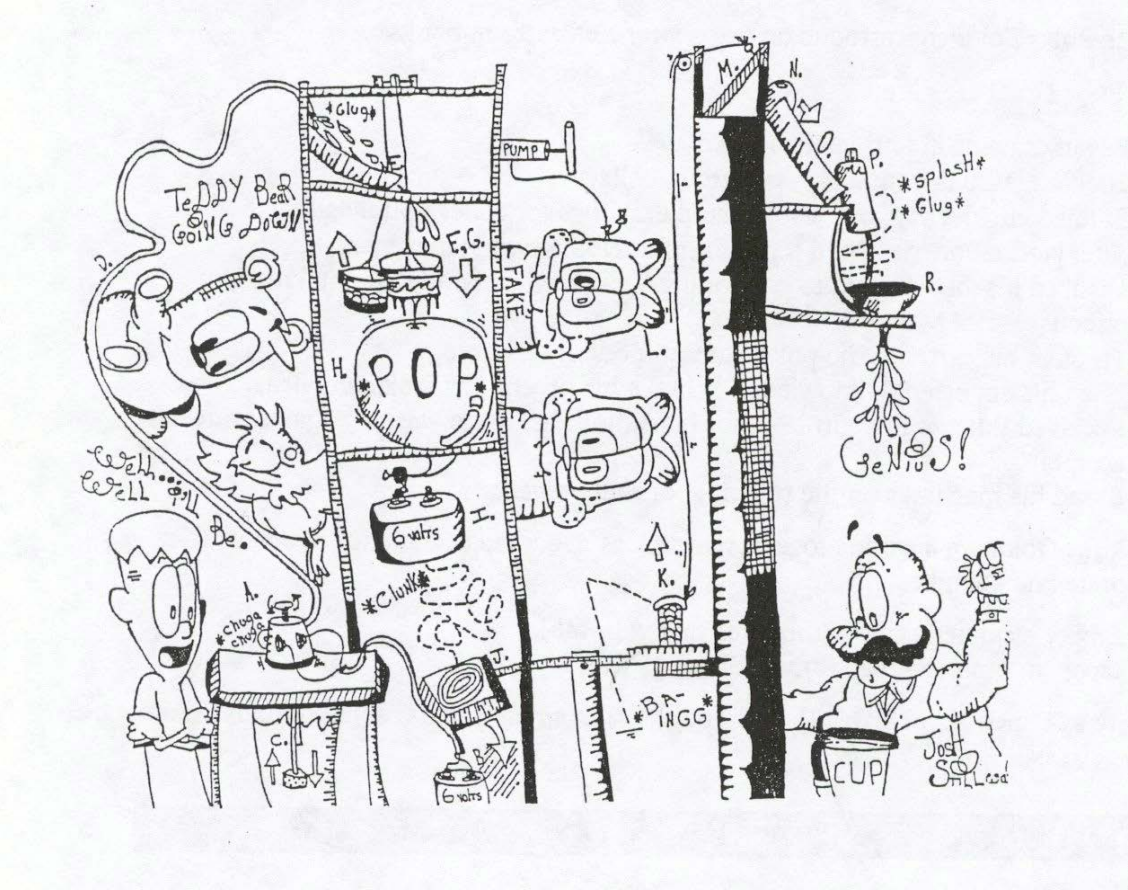
Each machine is designed in its own way. Some machines are planned before the building takes place; others are assembled spontaneously. Maybe the best way is to use a little of both approaches. In the end, a numbered, detailed description of each step is needed.

The materials that are used are the most important components of the machine. Use what you find around the house, raid old toy chests, pick up all those broken appliances that never got repaired, and use them. Anything goes when you are building a Rube Goldberg® Machine! Goldberg knew no bounds when he created his machines, and that same attitude still applies. Follow the adage *nothing is impossible if you try*. Your imagination is your only limit! To achieve the best score possible, be sure you understand the rules and the judging form as presented. The *Young Inventor's Form* is included as a suggested guide.

Example of a Rube Goldberg® Machine

Designed by: Josh Stillwagon, Barrington Middle School, Barrington, NH

Simple, Self-Sustaining, Semi-Automatic Liquid Dispenser



A) Turn the variable speed on/off switch (not too bright, but it actually activates the machine). B) The electrons from the battery start the motor, C) converting the electrons to mechanical energy, as motors usually do, pumping the pistons, and using a check valve to D) force the water up the tube and E) down the inclined plane, F) filling the container. G) The weight of the water lowers the container. H) The pins puncture the balloon, I) releasing the lantern battery, J) hitting the effort arm of the first class lever, K) launching the case of pennies, L) pulling on the string, using a first class pulley to change the direction of the force, M) pulling the third class lever, N) hitting the ball, O) down the inclined plane, P) hitting the jar on a rod, which flips over. Q) The elastic band absorbs the force, stopping the pendulum motion, stopping the water from spilling on the floor (a mess I'd rather not clean up). Instead, R) it spits out of the top of the jar and through the funnel, S) into a cup, dish, or bowl. Oh, my – how simple!

Possible Rube Goldberg® Machine Lessons

Day 1

Introduce Rube Goldberg® cartoons on transparencies/cartoon books.

Review Rube Goldberg's life:

Began drawing at four years old.

Took art lessons from a sign painter in college.

Studied engineering, but also created drawings for college publications.

After graduation, designed pipes for municipal sewer department.

Disliked his job – turned to cartooning – a career that ended up making him famous.

Through his cartoons, he poked fun at modern technology.

Used his engineering knowledge to make his inventions look complicated.

Received Pulitzer Prize in 1948 for his editorial cartoon warning against nuclear weapons.

Based his machines on the principle of chain reactions.

Plan a Rube Goldberg® machine together as a class. Develop a sequence of events that is elaborate and complicated:

Empty a cafeteria tray without leaving your table

Open an umbrella the Rube Goldberg® way

Complete a "Lunch Tray Labyrinth" (See page 82) in small groups or individually. Share with the class.

Day 2

Discuss simple machine tie-ins by showing the Automatic Balloon Popper (resource: *Inventor's Workshop* by Alan J. McCormick).

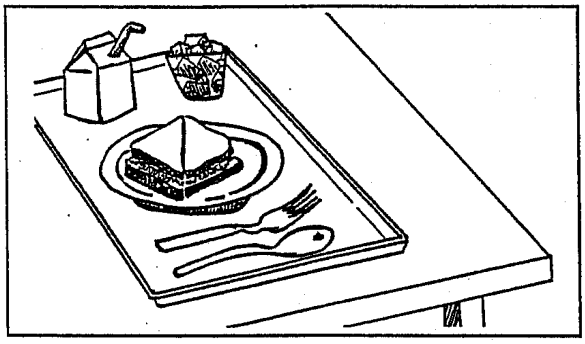
Day 3

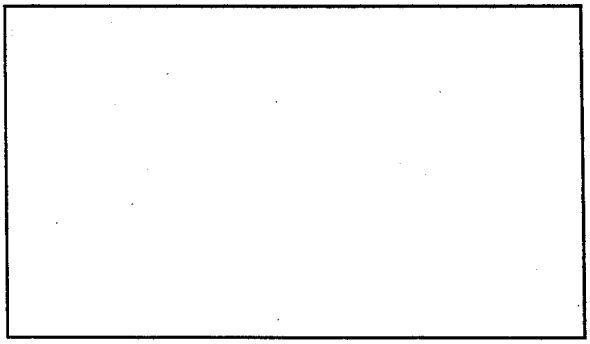
Start students thinking about simple "tasks": make a sandwich, open a window, turn on the television, flip a coin, light a candle.

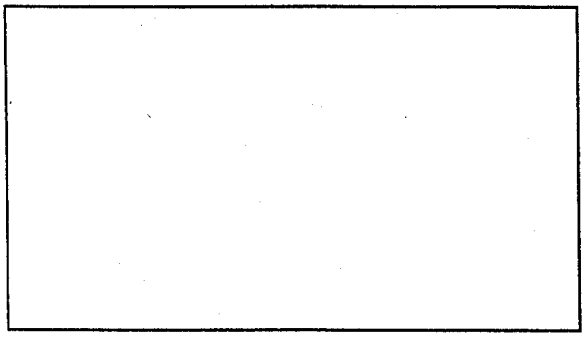
Establish guidelines for school Rube Goldberg® Machines. See page 85 for Judging Form for one possible design.

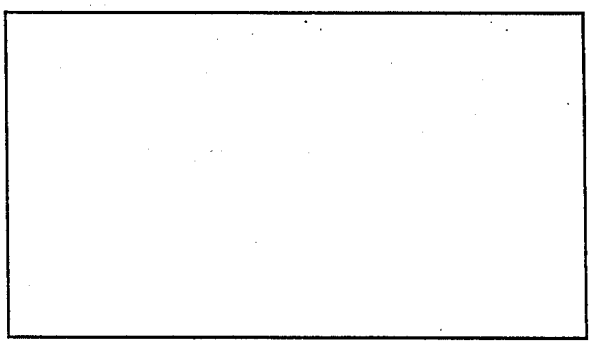
Lunch Tray Labyrinth

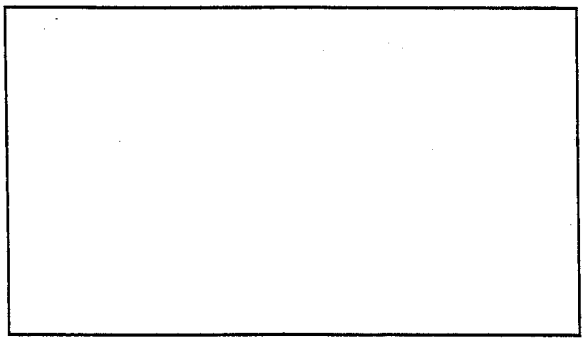
In the most complicated way you can think of, get the cafeteria tray from Box A into the cafeteria window in Box F. Draw an action picture of each device or gadget that moves the tray toward the window without your leaving the lunch table. Describe the action on the line under each box.

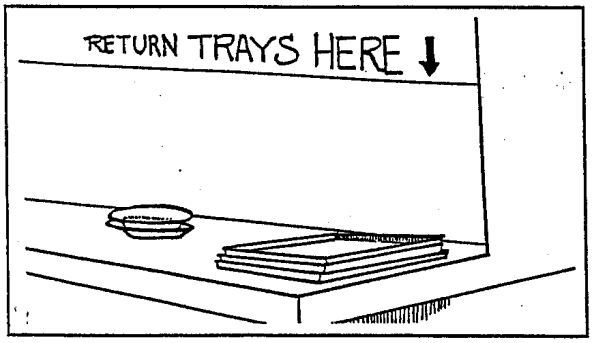












Student Rube Goldberg® Entry Form

YOUNG INVENTORS' PROGRAM® REGIONAL INVENTION CONVENTION

IMPORTANT: Bring this form with your invention on _____. Do Not Mail!

The definition of a Rube Goldberg® is a device using the most extraordinary means to accomplish an ordinary task with simple machines. The working construction of a Rube Goldberg® device must be considered safe to operate and must not cause damage. It must use 4 simple machines at least once: wheel & axle, inclined plane, lever and pulley or screw. A minimum of 6 steps is required to complete the task. The demonstration of the device can be creative or dramatic, and the student may trigger the beginning action.

Student Name:	**Grade:**
School:	**Teacher:**
Name of invention/device:	
What ordinary task does your device accomplish?	
Describe how your device works by listing the steps (at least six), and what happens at each step:	
1.	
2.	
3.	
4.	
5.	
6.	
List the simple machines used and the number of times they are used (at least four):	

Drawing of Rube Goldberg® Machine

Be sure to draw and label each step, which will match your "list of steps" on the front of this sheet.

Rube Goldberg® Machine Judging Form

YOUNG INVENTORS' PROGRAM® SCHOOL INVENTION CONVENTION

(Total of 100 points for each invention.)

Inventor's Name:	
Invention/Task:	
Simple Machines (20 Points)	**Points**
Is there evidence of: _____ Pulley (5) _____ Wheel (5) _____ Inclined Plane (5) *(Includes screw or wedge)* _____ Lever (5)	
Construction/Complexity (25 Points)	**Points**
_____ Does it match design? (5) _____ Is it safe and reasonably well constructed? (10) _____ Does the task use at least 6 steps? (10) 1. _____ 2. _____ 3._____ 4._____ 5. _____ 6. _____ 7. _____ 8._____ 9._____ 10. _____	
Written/Oral Presentation (45 Points)	**Points**
_____ Detailed diagram with tasks described at each step. (15) *(At least 6 steps labeled neatly and in order.)* _____ Oral description of steps and knowledge of the mechanics of simple machines. (15) _____ Successful completion of task in one or two tries. (15)	
Creativity (10 Points)	**Points**
Creativity and overall appearance of the completed contraption and the task it accomplishes. (Extra complexities)	
Judge's Signature:	**Total Points**

Assessment Model

Assessment For Inventing

Assigned tasks such as performances, presentations and projects that are close to real life activities need to have a different form of assessment. The tasks are complex (involving a group of learning behaviors), open-minded (permitting more than one solution), and coherent (resulting in a single product). Rubrics are an appropriate method for assessing authentic tasks.

Rubrics are a set of criteria or standards that describe levels of performances or understanding. More specifically, a scoring rubric consists of a fixed scale and a list of characteristics describing performances for each of the points on the scale. Rubrics promote learning by offering clear targets to students for agreed upon standards. If a task is designed to measure three standards the teacher produces three sets of rubrics. Rubrics are presented to students along with the performance task. The standards set should be appropriate for each specific grade level of children.

Rubrics provide students with expectations about what will be assessed as well as standards that need to be met. Rubrics increase consistency in the rating of performances, presentations and projects. Students have access to the standards by which finished work will be judged; therefore they provide students with "road sign" information about where they are in relation to where they need to be.

Generalized Scoring Rubric

4	Exemplary achievement/commendable. Demonstrates a **thorough understanding** of the generalizations, concepts and facts specific to the task or situation. **Provides new insights** into some aspect of that information.
3	Adequate achievement/evidence of achievement **Displays a complete and accurate understanding** of the generalizations, concepts and facts specific to the task or situation.
2	Limited evidence of achievement. **Displays an incomplete understanding** of the generalizations, concepts and facts specific to the task or situation
1	Minimal evidence of achievement Demonstrates severe misconception in understanding of the generalizations, concepts and facts specific to the task or situation.
0	No response

Model of Task with Standards for Students - Sample

Invention Process and Model

Student will identify a problem to be solved or improved; identify criteria the invention will meet and create a model of the invention. Student will also develop, revise and polish the process until it reaches a completed level.

Rubrics for the Invention Process

3	Identifies a problem and proposes an invention with a unique solution, reflects high level of creativity, high quality of work, uses only the highest standards for an acceptable outcome, revises with attention to detail.
3	Identifies a problem and proposes an invention with an appropriate set of criteria, meets all standards, the model successfully serves the purpose, revises to meet set criteria.
1	Identifies a problem and proposes an invention that will not adequately solve the problem stated, criteria may not be appropriate for the product, only minimum standards are met, attempt to revise only most obvious problems.
0	Identifies a problem and proposes an invention that has little or no relation to the problem stated, criteria fails to address the purpose of the invention, student makes no attempt to revise, is satisfied with initial invention, obvious problems remain.

Rubrics for Log or Journal

Student will keep a dated working log or journal. This should include the thinking behind the invention, tests conducted, modifications, research documentation, intent to invent, notes from class, sketches and diagrams. Work should be complete and neatly done.

4	Log/journal exceeds required standards, ideas are thoroughly documented, extensive research with results well stated, diagrams highly informative and detailed.
3	Log/journal clearly meet required standards, ideas documented, research is documented, and diagrams are of good quality.
2	Log/journal does not meet required standards, documentation is incomplete, little research documentation, and diagrams lack information and quality.
1	Log/journal lacks effort and does not meet required standards, vital information is missing.

Display Board

Student will construct a display board for presentation. The display board should include: name of invention, description of problem solved, diagram of invention with parts labeled, explanation of how the invention works, and the name of the inventor.

Rubrics for Display Board

4	Display board exceeds the required standards and is done creatively with high quality. Additional information of invention procedure through pictures and diagrams. Details of model production included.
3	Display board clearly meets the required standards; information complete and diagrams are good quality
2	Display board does not meet required standards; not all components present and lacks quality.
1	Display board lacks effort and does not meet required standards, vital information missing.

Oral Presentation

Student will give an oral presentation to the class and will be able to communicate with visitors at the Young Inventors' Program School Invention Convention. Student presentation will be organized and informative. Communication with visitors will be clear and detailed information given.

Rubric for Effective Communicator

4	Communicates information effectively with rich, vivid and powerful details, creatively uses diverse methods of communication.
3	Communicates information clearly with sufficient support and detail, uses effective methods of communication.
2	Communicates information, sometimes unclear and lacking detail, restricts method of communication by responding to questions from audience.
1	Communicates information in an unorganized manner, unclear and lacking any details.

Checklists, forms and "How To's"

The YIP School Invention Convention is a natural showcase for your students' inventions. It provides an opportunity for students to share their inventions and to receive recognition for their efforts. Parents, teachers, and the community can gather to view student's creativity and provide encouragement to students as they continue inventing.

It is advisable to form a committee to plan and implement a YIP School Invention Convention. Program planning is the most important ingredient of a successful event. The committee can be comprised of teachers, administrators, parents, and local business people.

School-wide YIP Invention Conventions should offer recognition to all students who participate, with a Certificate of Participation. Winners from a class or grade level could then go on to the Regional Invention Convention competition. Prizes and recognition can be powerful incentives for students to become involved in the invention process.

Once a planning committee has been organized, the following list of tasks should be considered as you plan your school program.

- Meet with your building principal to describe the Young Inventors' Program (YIP) Invention Convention and receive permission to sponsor this event.
- Select a date for your school's YIP Invention Convention.
- Decide on the judging criteria and invention categories.
- Schedule judges for your competition. Local inventors, engineers, science coordinators, school administrators, teachers, and business people are often happy to act as judges.
- Contact local business for prizes and other donations.
- Prepare a news release for your school or PTO newsletter, local newspaper, and radio or television station. Be brief but enthusiastic. Answer *who, what, where, when, and why* questions in the first paragraph. Include the name and telephone number of a person to contact for additional information.
- Reserve space for the Young Inventors' Program Invention Convention (a school gym or multipurpose room). Prepare a list of materials that will be needed – electrical outlets, cords, table space, etc. On the day of the convention, students should be responsible for setting up their own inventions.
- A judges' orientation room should be set up. Assign student representatives to greet the judges on the day of the convention and escort them to the judges' room. Review judging criteria and forms, and answer any question the judges

may have. During the convention, student inventors should be standing next to their inventions to explain them and answer judges' questions.

- After the convention, send a letter of appreciation to each judge, and each business that contributed prizes. Prepare a press release noting those inventors who received recognition in specific categories.
- Have a wrap-up meeting of the planning committee. Review the day – what worked, where the problems were. Congratulate yourselves on a job well done!
- Examine ways to make the competition more interesting or more enriching for the next year.
- For those who do not want to have a judging competition, inventions and the process can be graded using the assessment model and then displayed at an Exhibition or Student Expo.

Regional Young Inventors' Program Invention Convention

The Regional Young Inventors' Program Invention Convention is the natural progression of a school program. It allows students to take their invention one step further and receive additional recognition for their work. Schools that participate in the program can send their top inventors to this level.

YIP School Invention Convention Checklist

Here is a checklist to remind you of important tasks as you plan your YIP School Invention Convention:

6 Months Before

- Set the date for the convention
- Reserve space

4 Months Before

- Invite schools to participate
- Meet with teachers and principals to explain the program and encourage participation

6 Weeks Before

- Contact potential judges

- Send a letter to the judges with specifics about their role
- Take a count of schools that intend to participate
- Student registrations should be received by now

1 Month Before

- Send information materials home to parents
- Order ribbons and other awards
- Contact local businesses for donations
- Visit classrooms to discuss the convention

2 Weeks Before

- Awards should be delivered
- Send out press releases to radio and television stations

1 Week Before

- Meet with students for set-up information
- Arrange inventions according to grade level and category

Day of YIP Invention Convention

- Preparation of convention site: signs, registration area
- Student registration and set-up of convention
- Judges' orientation and briefing
- Invention judging
- Student and public viewing of inventions
- Awards ceremony

Following the Convention

- Send a press release to newspapers and radio or television stations listing winners of the competition
- Send judges thank-you notes
- Send thank-you notes to businesses which donated awards
- Evaluate the program and note changes for next year

Forms for Regional Invention Convention - Samples

Announcement Sample

Young Inventors' Program

February 2015
Registration Bulletin

Academy of Applied Science
24 Warren St.
Concord, NH 03301
(603) 228-4530
fax: (603) 228-4730
www.aas-world.org

young inventors' PROGRAM

Teacher Guide

The teacher's guide, is undergoing revision and will be available this Spring. The guide, written by the NHYIP Consortium, will enhance your ability to integrate a unit on invention into your curriculum. The price of the guide is $30.00 plus shipping and handling.

~ Special Offer ~

$25.00 plus $3.00 s/h is available to all teachers who participate in the 2016 Young Inventors' Program. Please call 228-4530 for ordering information.

Annual Young Inventors' Celebration

March 28, 2015

The Academy of Applied Science and the New Hampshire Young Inventors' Consortium are in the process of planning the 2015 Celebration

It will take place on Saturday, March 28from 8am to approximately 2:00 pm at Merrimack Valley High School in Penacook, New Hampshire.

Included with this bulletin are the official school registration and student registration forms, and pertinent information regarding the number of students allowed per school, judging criteria and the day's events.

The deadline for registration this year is Friday, Feb.13th.

The 2014 Celebration brought together over 300 inventors who were classroom level winners and represented 68 New Hampshire schools.

Each year families, friends and teachers join in to make it a true celebration of creativity and inventive problem-solving. The inventions emphasize the variety and diversity in the imaginations of young New Hampshire students.

Teams of Judges work hard to make their selections and express admiration for the many fine inventions on display as well as. the wacky Rube Goldbergs.

Celebrate creativity and invention with New Hampshire student inventors

Everyone has the potential to be creative and innovative.

Saturday, May 12, 2013 – Merrimack Valley High School

• Student Inventions • Awards Ceremony

• Rube Goldberg Inventions

Official School Entry Form due by April 13th

The New Hampshire Young Inventors' Program is funded by the Academy of Applied Science and private donations. It is available at no cost to all students, K-8.

School Instructions - Sample

General Categories

Judges select one invention from each grade level for the following awards:

- Most Outstanding
- Environmental
- Special Needs
- Fun and Leisure Time
- Practical and Useful
- Original and Unique
- Most Marketable

In addition to the above, there is an **Inventors' Choice Award**. Inventors are asked to view all the other inventions (but must remain with their invention during the judging period). With ballots they receive at registration, they may vote for their favorite invention in each grade level. Each inventor receives a Certificate of Participation.

Special Award Categories

Student inventions are not limited to the general category and may be judged in the following special award categories as well. Please encourage your students to consider these areas when brainstorming a problem to solve.

Electric Award - Recognizing interest in and use of electrical phenomenon and technology.

1st Place	$100 Savings Bond
2nd Place	$75 Savings Bond
3rd Place	$50 Savings Bond

Groundwater and Drinking Water Award - Recognizing an understanding of groundwater and/or drinking water and issues affecting the use, protection, and stewardship of same.

1st Place	$100 Savings Bond
2nd Place	$50 Savings Bond
3rd Place	$50 Savings Bond

Medical Award - Invention that solves a health-related problem.

1st Place	$50 Savings Bond
2nd Place	$50 Savings Bond
3rd Place	$50 Savings Bond

RUBE GOLDBERGS

The late cartoonist Reuben Lucius Goldberg's award-winning cartoons satirized the needless use of machines and gadgets which he saw as an excessive complication of everyone's life. Rube Goldberg machines are different from the inventions people are used to seeing. A good Rube incorporates everyday devices, but the innovators connect and use them in ways that may seem idiotic, ingenious, or even creative. The machine must use a certain number of individual steps to complete an assigned task. Rubes may take some time to put together, and may undergo months of strategy and planning; others are put together in a few days.

The materials that are used are the most important components of the machine. Encourage students to use what they find around the house, raid old toy chests, pick up all those broken appliances that never got repaired, and use them. Anything goes when you are building a Rube Goldberg Machine!

Rube Goldbergs are divided into two groups:

- individual projects
- team projects (team projects are limited to 3 students per team.

Judging criteria includes evidence of the following:

- at least four simple machines;
- construction;
- written/oral presentation; and
- creativity.

Entries in each group will be considered for: Best Working Device, Original and Unique, Best Design Using Simple Machines, Best Effort, and Judges Choice.

School Instructions - Sample

GENERAL

Participation in the Young Inventors' Celebration has grown steadily since the program started in 1987. Currently, there are over 6,000 students inventing in New Hampshire. Because of this, the following guidelines are strictly followed:

Inventions - One grade level entry per 100 student participants with an additional entry allowed if student participants from a particular grade level exceed 100.

Students can compete in special award categories (see section on Judging Information), can compete in more than one special category, and all inventions are eligible for grade level awards.

Rube Goldberg - Rube inventions are limited to three (3) students per team. One grade level Rube invention entry per 100 participants with an additional entry allowed if student participants from a particular grade level exceed 100.

TIMELINE

- Conduct a classroom or school invention program
- Select inventions to represent each grade (K-8) in your school
- Have each inventor complete the official student entry form which they will being with them on May 12, 2001
- Send school entry form by April 13th to:

NHYIP
Academy of Applied Science
24 Warren Street
Concord, NH 03301

A confirmation will be sent to participating schools. Please call the Academy if you don't receive a confirmation by May 4, 2001.

STUDENT GUIDELINES

Please share this information with the student winners who will be attending the May Celebration.

- Students should complete the Student Entry Form and bring it with them to the Celebration.
- Students should do research using stores, catalogues or interviews to ensure their inventions are unique.
- Students should be prepared to make an oral presentation and answer any questions the judges may have.

JUDGING

How it works

The judging process is an important component of the May Celebration. Three judges are assigned to each grade level to evaluate each invention and to ask pertinent questions of the inventor. During this time other students in the room are invited to listen to each presentation. Parents and friends are asked to leave the room while judging is underway.

Inventions are judged on the following criteria:

- originality
- written description/presentation
- model/illustration
- research performed
- usefulness

After they view all the inventions, the judges return to the judges' room and make difficult decisions regarding their observations.

School Entry Form - Sample

YOUNG INVENTORS' PROGRAM® REGIONAL INVENTION CONVENTION

Return by _____ to: **Academy of Applied Science, 24 Warren Street, Concord NH 03301 (603) 228-4530 Fax: (603) 228-4730** www.aas-world.org

ENTRY REQUIREMENTS: One grade level entry per 100 student participants, with an additional entry allowed if student participants from a particular grade level exceed 100. Rube Goldberg® may be entered separately. **TIES WILL NOT BE ACCEPTED.** Students must bring inventions and completed entry forms with them on the day of the event.

School: _____ ***SAU:*** _____.

Address: _____

Contact Person: _____ ***Daytime Telephone:*** _____

E-Mail: _____

IMPORTANT: List grade, student name(s), and invention name for each entry. If a student would like to be judged in the **M**edical, **E**lectrical, **G**round**w**ater or **R**ube **G**oldberg® categories, please indicate with an ***M, E, GW*** or an ***R***. **Be sure to print each name clearly and spell it correctly.** This list will be used to prepare the program and certificates and to send information home to parents about the YIP Regional Invention Convention event. Consortium members wish to pronounce students' names and the titles of their inventions correctly and cannot be responsible for errors. *Attach an extra sheet if necessary to list all entries.*

Grade	Student Name and Home Address	Invention	Category Award

Total Number of student participants in your school program: _____ *Contact Person: _____ I would like to become more involved in the Young Inventors' Program™.

Student Entry Form - Sample

YOUNG INVENTORS' PROGRAM® REGIONAL INVENTION CONVENTION

Do Not Mail! Bring this form with your invention on _____.

Name _____Grade _____

School_____Teacher _____

1. Name of invention _____
2. Where did you get the idea for your invention? _____

_____

_____

3. Explain how your invention works. _____

_____

_____

_____

4. Who will benefit from your invention?_____

_____

_____

_____

5. Why do you think your invention is new and original? _____

_____

_____

_____

MODEL OF INVENTION:

Your model does not need to actually work, but it has to represent your invention idea. Use everyday materials from around your home or school. Please mark your model clearly with YOUR NAME and the INVENTION NAME.

DRAWING OF INVENTION:

Be sure to draw and label all parts in the space below. You may use pencils, pens, crayons or magic markers.

Parent Information Letter - Sample

Dear Parents,

Your child will be participating in a special school project called the Young Inventors' Program School Invention Convention (YIP School Invention Convention) that will combine many of the skills that s/he has been learning in the areas of science, social studies, language, writing, art and math. The Inventive Thinking Project is a school activity, which promotes analytical and creative thinking and problem solving. Each student will develop an original idea for an invention and take it from an idea, to a completed project. Parents can enjoy this project at home with their children by encouraging creative ideas and letting them share ideas with the family, and by assisting them with making models of their inventive ideas.

Each student will design an invention and build a working model of it. This project is important because it gives each student an opportunity to solve a real problem. Perhaps you are always complaining about cotton balls sticking in the aspirin bottle when first opened, or your child is tired of losing sneakers, pencils, or mittens. These are all problems solved by students.

There are things you can do at home to help your child:

Set Criteria – A successful invention must meet several criteria. Students often have trouble verbalizing these. Ask your child to list all of the things that have to be true for the invention to be useful. Examples might include: Can I make it work? Can I make a model of it? Is it safe? Would other people want to use and buy it?

Questioning – Instead of giving your child answers to all of his/her questions, ask him/her questions that help him/her focus on the problem s/he is having. For example, if she/he asks "What should I build it out of?" or "I don't know what to build it out of." You can respond with your own questions. Ask him/her, "What do you think you could use? What materials are available to you? What do you know how to use? What do other people use to make inventions that do similar things?" Using this procedure helps each child retain ownership in the inventive process.

Construction – Encourage your child to use materials that are available at home or to recycle materials. Each student should build his/her own model. At times this is not reasonable. If your child want to build a model out of wood, but cannot safely cut the wood, you can do it for him/her. You should have him/her first decide how long it should be and mark where it should be cut. Each child can decorate his/her own model.

Journal Keeping – All inventors keep a log to record their thoughts. Not only is it a wise thing to do, it will prove that they had the idea first and will help plan the invention. You will be asked to sign your child's log as a witness to prove the work and ideas are his or her own.

The evaluation will be based on what the student does, not on how flashy the model might be. Each child will share his/her invention with the class. When your child presents his/her invention s/he will be asked to describe who has done what on his/her model. All student inventors will receive recognition for their efforts. Several students will be invited to share their inventions, and Rube Goldberg® Machines at the Young Inventors' Program® Regional Invention Convention in the spring.

On _____[date], the school will hold our YIP School Invention Convention, a special event to display the student's creative efforts. You will be surprised and delighted by the many new and creative inventions and Rube Goldberg® contraptions the students develop. We will remind you of this event, and we hope you will join us to celebrate the student's effort.

This is a timeline for the invention process:

Week One	Identify problems that might be solved with an invention.
	Pick a problem to work on.
	Look for similar inventions.
Week Two	Plan how to solve the problem.
	Begin working on a model.
Week Three	Test the model and improve as needed.
Week Four	Complete the model and prepare a presentation.
Week Five	Final model is due.
	Present invention to classes.

I hope that you and your child enjoy the invention process. Please return the bottom portion of this letter to the school indicating you have discussed this Inventive Thinking Project with your child. If you have any questions, please feel free to call me.

Sincerely,

✂_____

Please sign and return to school.

I have seen and discussed this Inventive Thinking Project and timeline with my child.

_____

Child's Name

_____

Parent's Signature ***Date***

Parent Information Letter - Sample

TO: Young Inventor Parent(s)

FROM:

DATE:

SUBJECT: **YOUNG INVENTORS' PROGRAM REGIONAL INVENTION CONVENTION DAY**

Congratulations on your child's success in the local school invention program. We welcome his/her participation at the YIP Regional Invention Convention on [DATE]. This event provides a forum for your child to display his/her inventiveness and is the culminating celebration for the [YEAR] school year.

The celebration will take place at [LOCATION]. Following is the schedule for the day:

INSERT SCHEDULE HERE

Be sure to bring the Student Entry Form (given to the student inventor at his/her school) and the authorization form (enclosed) with you on [DATE]. Additionally, if your child has a Rube Goldberg® Machine, and an extension cord or a table for set up is required, please bring one with you.

Each inventor is grouped with his/her grade and given a room assignment at registration. After registration, please go to the assigned room and help to arrange the desks in a horseshoe pattern. This makes judging easier. Parents are not allowed in the room while their child's invention is being judged. Also, when packing up inventions to go home, your help in putting the room back the way it was would be greatly appreciated.

Coffee, snacks and lunch will be available in the school cafeteria for a nominal cost. Picnic lunches are welcomed.

Awards will be given in the following categories:

- Most Outstanding (Best in Grade)
- Special Needs
- Practical and Useful
- Most Marketable
- Environmental
- Fun and Leisure Time
- Most Original and Unique
- Inventor's Choice

Special awards will be given for the following:

LIST ANY SPECIAL AWARDS HERE.

Rube Goldberg Awards will be given for the following:

- Best Team Effort
- Most Complex

- Best Individual Effort
- Most Original and Unique
- Judge's Choice
- Inventor's Choice

Each inventor receives a Certificate of Participation. **Please note your child's name, invention title, and any special category located on your address label. (Not all inventions fall into a special category.)** If the spelling of either of these is incorrect, or if your child's invention fits into one of the special awards category, please call the Academy of Applied Science at 603 228-4530 as soon as possible. We do our best to make sure everyone's name is spelled correctly. However, if a mistake is made, we will be happy to correct the certificate after the YIP Regional Invention Convention.

CC: Student's Teacher

Judging Guidelines

The experience of being evaluated at a Young Inventors' Program Regional Invention Convention is the culmination of months of effort on the part of student inventors. This experience should be a rewarding, enjoyable and significant one for all participants. Following are the recommended guidelines. Whatever guidelines are used, the accomplishments of the young inventors should be stressed and students are encouraged to continue inventing.

At the YIP Regional Invention Convention, you will be asked to judge inventions of area students. As you review the inventions, please keep the following in mind.

- All participants are winners, having already won at their local level.
- The participants include some first-time inventors. Keep in mind that they may be nervous and may need gentle encouragement.
- Please end the judging process with a positive statement about the invention or the student's idea.
- We are encouraging the process of inventing. Please make this experience a pleasant and meaningful one that will encourage the inventors to invent again.

You will be viewing inventions in a team of judges. It is important that you stay with your group. Different judges may ask questions that will give varying perspectives of the inventions.

Judging Circle

The Judging Circle is a unique and continually evolving concept that seeks to involve all the young inventors. The purpose of the judging circle is to give students a forum to discuss their ideas with adults, to share ideas with their peers, and to field questions or consider alternatives to their invention idea as presented by other interested inventors.

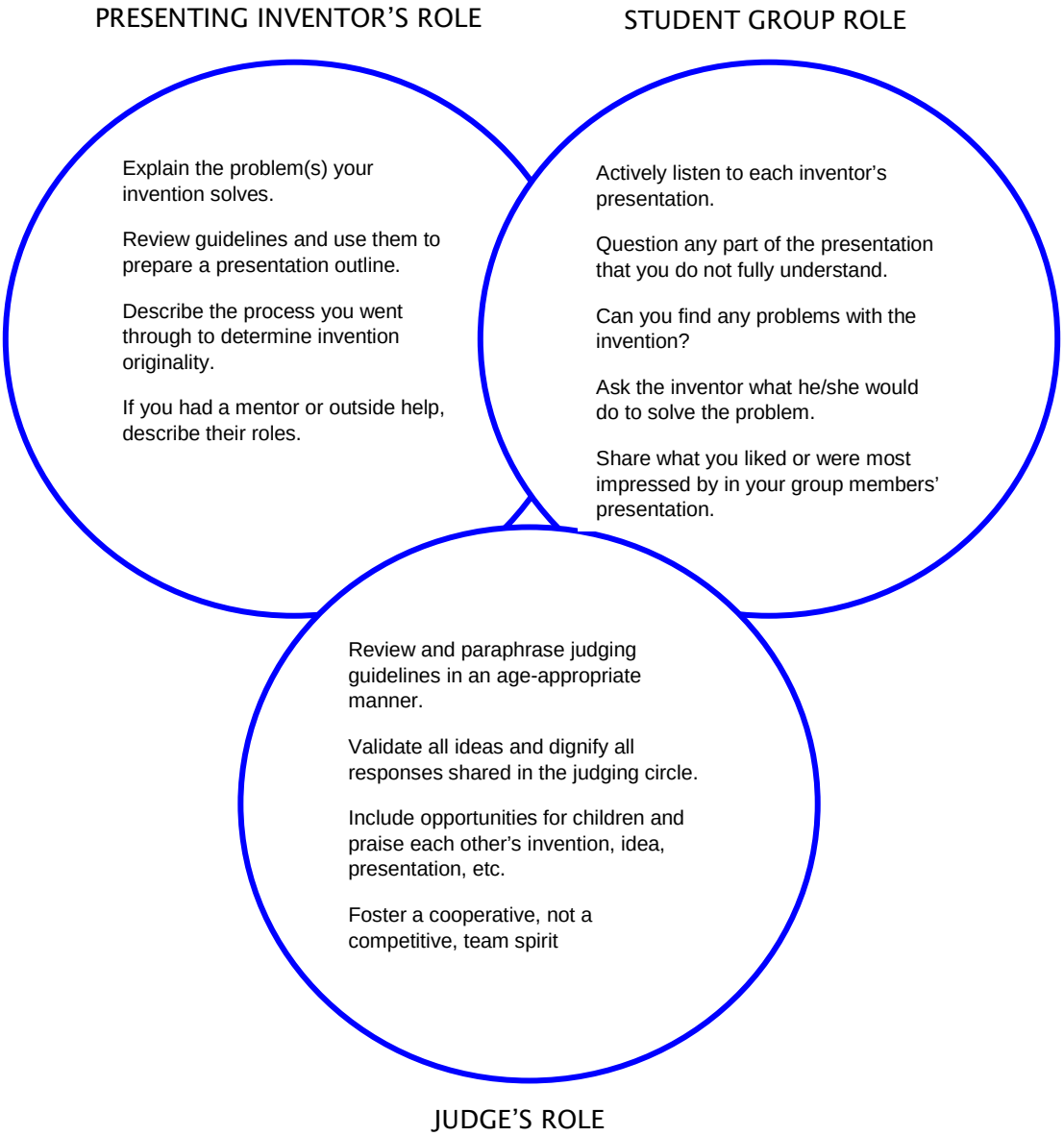
The students are grouped according to grade levels. Each judging circle has two judges assigned to lead the group. The responsibility of the judges is to promote an understanding of each child's invention not only for him/herself, but also for the entire group.

Each inventor is expected to be the spotlight for approximately 5 – 10 minutes with all inventors in the group listening and discussing the invention under consideration at the time. (Judges speak to the individual inventor while the others wait their turn.)

The judges ask questions to guide the student who is describing his/her invention. They encourage other students to question what they may not understand, to see if they can find

any other uses for the invention or to state what they liked or were most impressed with regarding the invention under discussion.

To facilitate this process, the number of students in each judging circle is limited to ten. This allows time for all students to have the opportunity to feel proud of their invention efforts. The formal judging circle lasts approximately an hour and a half. Ultimately, the judges select three students from the group to recognize for excellence. If all students were led in a supportive and productive discussion, they would be better able to focus upon the reasons why a particular invention was selected for special recognition.



This chart describes what is expected from each of the participants in the judging circle.

Excerpted from Connecticut Invention Convention ©1992

Inventions are Judged on the Following Criteria

- Originality
- Written Description/Presentation
- Model/Illustration
- Research Performed
- Usefulness

Rube Goldberg® Machines are Judged on the Following Criteria

- Understanding and demonstration of simple machines (pulley, inclined plane, wheel and axle, lever)
- Construction/Complexity
- Written/Oral Presentation
- Creativity

Questions judges can ask student inventors

- How did you come up with your invention idea?
- Did you work on the first idea you thought of?
- What disappointments/hurdles did you have while working on your invention?
- Did you build any prototypes before this invention?
- What was more fun for you – Thinking up your invention or building it and making it work?
- Where did you get your materials/supplies?
- Have you thought of ways to make your invention even better?
- If you could have this invention built using any material, what would you choose to make it even better?
- Did you have fun inventing?
- What else would you like to tell us about your invention?

Questions judges can ask other students in group

- How might this invention help you or the people you know?
- What are the similarities between your invention and this one?
- Can you find any problems with this invention?
- What did you like most about this presentation?
- Was there any part of the presentation you did not understand?

Judging Procedure

It is recommended that a Judge's Orientation be planned for the morning of the Invention Convention. This is a time to review the judging process and answer any questions your judges may have. Some items to consider:

Recruiting Judges and Setting Up Judging Teams

- Local inventors, science teachers, school administrators, teachers, business people, past student inventors, college students and patent attorneys make great judges and are usually happy to do so.
- Teams of three judges work best.
- Try to make sure that one judge understands the age group (educator), one is experienced, and one is a rookie.
- Try to mix judges: educators with business/engineer types, males with females, experienced with inexperienced.
- Try to give judges different age groups each year, unless they express a preference.
- Don't be afraid to keep a good team together (especially if they need to work quickly.)

Ideally, one team judges all inventions in a single grade or category and judges should be able to spend four to five minutes with each inventor.

Room Set-Up for Judge's Orientation

- One table per judging group, i.e., single grade or category
- Have the following available: Name tags, programs, maps of school and location of inventions, pencil, clip boards for judging sheets, information on judging criteria and categories of awards.

Directions to Judges

The Judging Coordinator reviews the following with the Judging Teams.

- Review the judging guidelines on page 103.
- Review categories and special awards.
- Go over score sheets and map of school.
- Explain color/number coding on inventions and scoring sheets.
- Choose a team leader and direct him/her to close the door and put up JUDGING - DO NOT ENTER sign. (Team leader also needs to watch time.)
- Suggest that judges travel as a group – they learn from each other – work into a routine. (i.e., Same judge explains procedure to inventor, each judge asks certain questions, etc.)
- Ask judges to end on a positive note each time they finish judging.
- Give judges time to walk around before students arrive to familiarize themselves with inventions and locations.
- Give judges a private area for deliberations.
- Always ask for suggestions for improving the process.
- Always give a great big thank you!

Judging Form - Sample

Circle the appropriate rating for each item, 5 being Superior and 1 being Unsatisfactory:
(Total of 50 points for each invention.)

ORIGINALITY (15 points) **POINTS**

1. The invention represents original, creative thought.

   5 4 3 2 1 _____

2. The invention is a novel or unique solution to an identified problem.

   5 4 3 2 1 _____

3. Overall presentation of entire invention reflects creative or original work.

   5 4 3 2 1 _____

USEFULNESS (10 points)

4. The invention solves a problem or need.

   5 4 3 2 1 _____

5. The invention has marketable value.

   5 4 3 2 1 _____

WRITTEN DESCRIPTION/PRESENTATION (10 points)

6. The content of the written description clearly expresses the purpose of the invention and how it accomplishes its purpose.

   5 4 3 2 1 _____

7. The written description is complete and appropriate for the inventor's grade level (includes the name of the invention, its function, operation and a list of materials used for construction).

   5 4 3 2 1 _____

MODEL/ILLUSTRATION (10 points)

8. The illustration is complete, with all parts neatly labeled, and is a clear, attractive, visual explanation of the invention.

   5 4 3 2 1 _____

9. The model is an accurate replica of the idea.

   5 4 3 2 1 _____

RESEARCH PERFORMED (5 points)

10. Time and effort was given to see if this invention had already been invented.

    5 4 3 2 1 _____

Judge's Signature _____ **Total Points** _____

Judging Scoring Sheet - Sample

Inventions are judged by grade level. The students should be with their inventions to answer any questions. If you have time, look over all the inventions before judging.

ORIGINALITY:	15 points	Does the invention represent original, creative thought? Is it a novel or unique solution to an identified problem? Does the overall presentation reflect creative or original work?
USEFULNESS:	10 points	Does the invention solve a problem or need? Does it have marketable value:
WRITTEN DESCRIPTION/ PRESENTATION:	10 points	Does the content of the written description clearly express the purpose of the invention and bow it accomplishes its purpose? Is it complete and appropriate for the inventor's grade level, including the name of the invention, its function, operation, applications, and a list of materials used for construction?
MODEL/ILLUSTRATION:	5 points	Is the illustration complete, with all parts labeled, and is it a clear, attractive, visual explanation of the invention?
RESEARCH PERFORMED:	10 points	How much time and effort was put into seeing if this invention had already been invented? Does the research demonstrate thoroughness and comprehensiveness?

Grade 2 - Room 114 - 9:15 - 9:45			Originality (15)	Usefulness (10)	Written Description or Presentation (10)	Model or Illustration (5)	Research (10)	TOTAL
Allen, Debbie	Portable Ball Rack	Reeds Ferry School, Merrimack	14	9	9	5	10	47
Berger, Paul	Zipper Upper	Eastman School, Concord	13	9	10	5	9	46
Davis, Susan	Doggie Pull	Dewey School, Northwood	14	8	10	5	10	47
Ferris, Jane	Neat Bed	Central School, Manchester	14	8	9	4	8	43
Tower, Benno	Book Bright	Davis Elementary School, Keene	15	10	10	4	9	48
Vinsky, Allie	Math-o-Game	Richards Elementary School, Nashua	15	9	10	5	10	49

Grade Level Award Winners Form - Sample

Grade level awards will be given in the following categories:

1. **Best in Grade** – For the invention that scores the highest in each grade.

Inventor's Name	Invention	School

2. **Environmental Invention** – For the invention that best helps the environment.

Inventor's Name	Invention	School

3. **Special Needs Invention** – For the invention that best addresses the special needs of a disabled person.

Inventor's Name	Invention	School

4. **Fun and Leisure Time** – For the best invention dealing with leisure activities.

Inventor's Name	Invention	School

5. **Practical and Useful** – For the most marketable invention everyone could use.

Inventor's Name	Invention	School

6. **Original and Unique** – For the most creative, never-before-seen invention.

Inventor's Name	Invention	School

7. **Rube Goldberg®** – For the invention using the most extraordinary means of performing an ordinary task.

Inventor's Name	Invention	School

8. **Judge's Choice** – For the invention that deserves special recognition but does not fit into any other category.

Inventor's Name	Invention	School

9. **Medical Award** – For the invention that solves a medical problem in a unique way.

Inventor's Name	Invention	School

10. **Inventors' Choice** – For the invention that student inventors like the best.

Inventor's Name	Invention	School

Certificate of Participation – Sample

THE ACADEMY OF APPLIED SCIENCE

certifies that

____

is a problem-solver and creative thinker
and presented the invention

____

at the Annual
Young Inventors' Regional Invention Convention

____

Academy of Applied Science

Program Evaluation Form - Sample

Young Inventors' Program® Regional Invention Convention Evaluation

Please complete this form. Your comments are important to us and will help us plan future celebrations.

1. I am a: Student in Grade _____

Teacher of Grade _____

Parent _____ Child in Grade _____

Judge _____

Other _____

2. Is this the first Young Inventors' Program (YIP) Regional Invention Convention you have attended?

[ ] Yes [ ] No – This is the 2nd 3rd 4th 5th 6th time to attend. (Please circle)

3. The best part of the YIP Regional Invention Convention is:

4. What would like to see done differently, and why?

5. Do you think you will participate next year?

[ ] Yes [ ] No – Why?

6. Would you recommend the YIP Regional Invention Convention to other children?

[ ] Yes [ ] No – Why?

Would you like to volunteer to work at the YIP Regional Invention Convention?

Name_____

Phone_____Best days/times_____

Fiction Books

Alistair's Time Machine (1992) by Marilyn Sadler. Published by Simon and Schuster - $15.00/$5.95 (preschool-up)

Almost Famous (1995) by David Getz. Published by Henry Holt Company, 115 West 18th Street, New York, NY 10011 - $13.95 (grades 4-7)

Ben and Me (1939) by Robert Lawson. Published by Little, Brown & Co. – A Time Warner Co., Time-Life Bldg., 1271 Avenue of the Americas, New York, NY 10020 - $15.95/$5.95 (grades 7-10)

Bravo Minski (1988) by Arthur Yorinks. Published by Farrar, Straus & Giroux, 19 Union Square West, New York, NY 10003 - $15.00 (preschool-up)

Captain Snap and the Children of Vinegar Lane (1989) by Roni Schotter. Published by Orchard Books, 95 Madison Ave., New York, NY 10016 -$15.95/$5.95 (preschool-3)

Chitty Chitty Bang Bang: The Magical Car (1964, 1989) by Ian Fleming. Published by Alfred Knopf Books for Young Readers – a division of Random House, 201 E. 50th Street, New York, NY 01122 - $3.99 (grades 4-6)

Dreamland (1996) by Roni Schotter. Published by Orchard Books - $15.95 (K-3)
Ruby Mae Has Something to Say (1992) by David Small. Published by Crown, 201 East 50th Street, New York, NY 10022 - $15.00 (preschool-4)

The Flying Dragon Room (1996) by Audrey Wood. Published by Scholastic, Inc., 555 Broadway, New York, NY 10012-3999 - $19.99 (preschool-4)

The Gadget War (1994) by Betsy Duffey. Published by Penguin Books - $9.19/$3.99 (grades 2-7)

I Gave Thomas Edison My Sandwich (1995) by Floyd Moore. Published by Albert Whitman & Co., 6340 Oakton Street, Morton Grove, IL 60053-2723 - $14.95 (grades 1-5)

No Problem (1993) by Eileen Browne. Published by Candlewick Press. Distributed by Penguin Books, 375 Hudson Street, New York, NY 10014-3657 - $14.99/$7.99 (preschool – up)

Samuel Todd's Book of Great Inventions (1991) by E.L. Konigsburg. Published by Atheneum Books, 1230 Avenue of the Americas, New York, NY 10020 - $13.95 (preschool-2)

Twenty-One Balloons (1986) by William P. DuBois. A Puffin Book – a division of Penguin Books - $10.09 (grades 2-7)

Ugh! (1990) by Arthur Yorinks. Published by Farrar, Straus & Giroux - $13.95/$4.95 (preschool-3)

Non-Fiction Books

Absolutely Mad Inventions (original title, *Beware of Imitations*) (1970) by A.E. Brown and H.A. Jeffcott. Published by Dover Publications, Inc., 31 E. Second Street, Mineola, NY 11501 - $3.95

Accidents May Happen: 50 Inventions Discovered by Mistake (1996) by Charlotte F. Jones. Published by Delacorte, 1540 Broadway, New York, NY 10036-4094 - $16.95 (grades3-up)

African-American Inventors (Scientists & Inventors Series) (1996) by Fred Amram. Published by Capstone Press, PO Box 669, Mankato, MN 56002-0669 - $19.00 (grades 3-7)

A Head Full of Notions: A Story About Robert Fulton (1996) by Andy R. Bowen. Published by Lerner Publishing - $19.95

Alexander Graham Bell (1999) by Leonard E. Fisher. Published by S&S Trade - $16.00 (gr. 1-7)

American Inventors of the 20th Century (1996) (Collective Biographies Series) by Laura Jeffrey. Published by Enslow Publishing - $19.95 (gr. 6 up)

Biography Today –Scientists & Inventors Series Volume 2: Profiles of People of Interest to Young Readers (1998) edited by Laurie L. Harris. Published by Omnigraphics Incorporated - $36.00 (gr. 4-12)

Black Inventors (1997) by Nathan Aaseng. American Profiles Series - $19.95 (gr.5-12)

Black Pioneers of Science and Invention (1992) by Louis Haber. Published by Harcourt Brace and Co., 525 B Street, Suite 1900, San Diego, CA 92101 - $6.00 (grades 5-up)

Brilliant and Crazy Inventions (1999) Megascope Series. Published by Barron Publishing - $6.95 (gr. 5 up)

Charles Ginsburg: Video Wizard (1993) (Masters of Invention Series) by Barbara Taylor. Published by Rouke Entertainment - $21.27 (gr. 4-8)

The Clock and How It Changed the World (History and Invention Series) (1995) by Michael Pollard. Published by Facts on File - $14.95 (ages 9-up)
Communications: Sending the Message (1997) (Innovators Series) by Thomas Streissguth. Published by Oliver Printing - $16.95 (gr. 5 up)

Connections (1995) by James Burke. Published by Little, Brown & Co. - $22.95

Edwin Land: Photographic Pioneer (1993) (Masters of Invention Series) by Scott McPartland. Published by Rourke Entertainment - $21.60 (gr. 4-8)

Extraordinary Origins of Everyday Things (1987) by Charles Panati. Published by Harper & Row - $10.95

Extraordinary Stories: Behind Inventions of Ordinary Things (1991) by Don. L. Wulffson. Published by Avon Books, 1350 Avenue of the Americas, New York, NY 10019 - $3.50 (grades 3-7)

Feminine Ingenuity: How Women Inventors Changed America (1994) by Anne L. MacDonald. Published by Ballantine Books, a division of Random House, 201 East 50th Street, New York, NY 10022 - $14.00 (ages 16-up)

Five Notable Inventors (1995) (Great Black Heroes Series) by Wade Hudson. Published by Demco Publishing - $9.19

From Patent to Profit (1998) by Bob DeMatteis. Published by Avery Publishing Group. $29.95

George Westinghouse: A Genius for Invention (1997) (Innovative Minds Series) by Barbara Ravage. Published by Raintree Steck-V - $27.11

Great Black Heroes: Five Notable Inventors (1995) by Wade Hudson. Published by Scholastic Inc. - $3.99 (grades 2-4)

Great American Inventors (1997) by Harry Knill. Published by Bellerphon Books - $4.95 (gr. 1-9)

Great Inventions (1995) edited by Richard Wood. Published by Time-Life – A Time Warner Co., 777 Duke St., Alexandria, VA 22314 - $16.00 (grades 3-up)

Great Inventors & Inventions by Bruce LaFontaine. Published by Dover Publishing - $2.95

Great Lives: Invention and Technology (1991) by Milton Lomask. Published by Scribners, Charles Sons Books for Young Readers. Distributed by Simon & Schuster Children, 200 Tappan Rd., Old Tappan, NJ 07675 - $23.00 (grades 4-6)

Historical Inventions on File (1994) by the Diagram Group Staff. Published by Facts on File - $165.00 (grades 5-10)

The History of Invention: From Stone Axes to Silicon Chips (1987) by Dr. Trevor I. Williams. Published by Facts on File - $40.00 (ages 12-up)
How Things Work (1996) by Ian Graham. Published by Time- Life - $17.95 (grades 3-up)
I Wonder Why Zippers Have Teeth and Other Questions About Inventions (1996) by Barbara Taylor. Published by Larousse Kingfisher Chambers. Distributed by Raintree Steck-Vaughn - $9.95 (K-3)

Incredible Cross-Sections (1992) by Richard Platt. Published by Alfred A. Knopf, 201 East 50th Street, New York, NY 10022 - $22.00 (ages 8-up)

Invention (Eyewitness Books - #26) (1991) by Lionnel Bender. Published by Alfred A. Knopf - $19.00 (grades 5-up)

Inventions (DK Pocket Series) (1995) by Eryl Davies. Published by DK Publishing, Inc. Distributed by Houghton Mifflin, 222 Berkeley Street, Boston, MA 02116 - $6.95 (grades 7-up)

Invention in America (1995) by Russell Bourne. Published by Fulcrum Publishing, 350 Indiana Street, Suit 350, Golden, CO 80401-5093 - $32.95 (ages 10-up)

Inventions and Discoveries (from Brain Booster series – Book comes with a decoder) (1989) by Tina Harris, et al. Published by Educational Insights, 16941 Keegan Avenue, Carson, CA 90746 - $6.95 (grades 4-8)

Inventions: Inventors and Ingenious Ideas (1994) by Peter Turvey. Published by Frankin Watts, P.O.Box 1331, Danbury, CT 06813-1331 - $7.95 (grades 5-8)

Inventions That Changed Modern Life (1993) by Lois Markham. Published by Raintree Steck-Vaughn - $16.98 (grades 5-7)

Inventors (1996) by Martin W. Sandler. Published by HarperCollins, 10 East 53rd St., New York, NY 10022 - $21.95 (grades 3-up)

Inventors and Discoverers: Changing Our World (1994) edited by Elizabeth L. Newhouse. Published by National Geographic Society, 1145 17th St. NW. Washington D.C., 20036 - $35.00

Inventors and Inventions: A Supplement to Childcraft – The How &Why Library (1993) edited by World Book editors. Published by World Book, Inc., 525 W. Monroe, Chicago, IL 60661 - $18.95 (grades 6-up)

*John Ericson & the Inventions of War (*1990) by Ann Brophy. Published by Silver Burdett Pr. - $7.95 (gr. 5 up)

Laser – The Inventor, The Nobel Laureate, and The Thirty-year Patent War (2000) by Nick Taylor. Published by Simon & Schuster.

Levi Strauss: The Blue Jeans Man (1988) by Elizabeth Van Steenwyk. Published by Walker & Company - $13.95 (gr. 6-9)

Machines: How They Work (1994) by David Burnie. Published by DK Publishing, Inc. Distributed by Houghton Mifflin - $14.95 (grades 3-up)
Marconi's Battle for Radio (1996) by Beverly Birch. Published by Forest House - $14.95 (gr. 2-4)

Mistakes That Worked (1998) by Charlotte F. Jones. Published by Doubleday, 1540 Broadway, New York, NY 10036 – $11.00 (grades6-12)

*Mr. Blue Jeans: A Story about Levi Strauss (*1990) (Creative Minds Series) by Maryann N. Weidt. - $19.95 (gr. 3-4)

Nature Got There First: Inventions Inspired by Nature (1995) by Phil Gates. Published by Kingfisher Books - $17.95 (grades 5-9)

100 Inventions That Shaped World History (1993) by Bill Yenne. Published by Bluewood Books. Distributed by Login Pubs. Consortium, 143 N. Randolph St., Chicago, IL 60607 - $7.95 (grades 5-up)

Outward Dreams: Black Inventors and Their Inventions (1991) by Jim Haskins. Published by Walker and Co., 435 Hudson St., New York, NY 10014 - $14.85 (grades 7-up)

Patent it Yourself (2000) by David Pressman. Published by Nolo Press $29.95

The Picture History of Great Inventors (1994) by Gillian Clements. Published by Alfred A. Knopf - $13.00 (grades 5-7)

The Poetry of African-American Invention Volumes 1-4: When One Door Closes, Another Opens (1996) by Wina Marchi. Published by Reklaw Prodns. - $17.95 (gr. 3 up)

The Random House Book of How Things Work (1991) by Steve Parker. Published by Random House - $19.99 (grades 3-7)

The Real McCoy, the Life of an African-American Inventor (1993) by Wendy Towle. Published by Demco - $10.15

Small Inventions That Made a Big Difference (1984) edited by Donald J. Crump. Published by Lerner Publications - $12.50 (grades 5-up)

Smithsonian Visual Timeline of Inventions (1994) by Richard Platt. Published by DK Publishing Inc., Distributed by Houghten Mifflin - $16.95 (grades 3-up)

Stand Alone Inventor! (1997) by Robert G. Merrick. Lee Publishing Company $19.95

Steven Jobs (1993) (Masters of Invention Series) by Laurie Rozakis. Published by Rourke Corporation - $11.95 (gr. 5 up)

The Story of Things (1991) by Kate Morgan. Published by Walker & Co. - $15.85/$14.95 (grades 3-7)

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The Timetables of Technology – A Chronology of the Most Important People and Events in the History of Technology (1994) by Bryan Bunch and Alexander Hellemans. Published by Simon & Schuster – A Touchstone Book $20.00

Twentieth Century Inventors (American Profiles Series) (1991) by Nathan Aaseng. Published by Facts on File - $17.95 (grades 7-12)

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Women Inventors and Their Discoveries (1993) by Ethie Vare and Greg Ptacek. Published by Oliver Press, 5707 W. 36th St., Minneapolis, MN 55416 - $16.95 (grades 5-12)

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Young Thomas Edison: Great Inventor (1995) (First-Start Biography Series) edited by Claire Nemes. Published by Troll Communications - $3.50 (k-12)

Activity Books, Handbooks, and Kits

Be An Inventor (1987) by Barbara Taylor. Published by Harcourt, Brace, and Co. - $12.00 (grades 3-7)

BipQuiz: Inventions (1995) by Sterling Staff. Published by Sterling - $2.95

Brainstorm! The Stories of Twenty American Kid Inventors (1995) by Tom Tucker. Published by Farrar, Straus & Giroux - $15.00 (grades 4-7)

Girls & Young Women Inventing: Twenty True Stories About Inventors, Plus How You Can Be One Yourself (1995) by Frances Karnes and Suzanne M. Bean. Published by Free Spirit Publishing, 400 First Avenue North, Suite 616, Minneapolis, MN 55401-1730 - $12.95 (grades 4-up)

How To Be An Inventor (1993) by Murray Suid. Published by Monday Morning Books, 1111 Greenwood Ave., Palo Alto, CA 94301 - $9.95 (grades 3-6)

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Inventing Stuff (1995) by Ed Sobey. Published by Dale Seymour, P.O. Box 5026, White Plains, NY 10602-5026 - $11.95 (grades 5-10)

The Inventor's Notebook (1996) by Fred Grissom and David Pressman. Published by Nolo Press, 950 Parker St., Berkeley, CA 94710-9867 - $19.95

Inventor's Workshop (1981) by Alan McCormack. Published by Fearon Teacher Aids, 4350 Equity Drive, Columbus, OH 43216 - $11.99 (ages 8-up)

Lucky Science: Accidental Discoveries from Gravity to Velcro, with Experiments (1994) by Royston M. and Jeanie Roberts. Published by John Wiley and Sons - $12.95 (ages 10-15)

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Put a Fan In Your Hat! Inventions, Contraptions, and Gadgets Kids Can Build (1996) by Robert S. Carrow. Published by McGraw-Hill. Available from A.W. Peller & Assoc., Inc., 210 6th Ave., P.O. Box 106, Hawthorne, NY 07507-0106 - $14.95 (grades 5-up)

Steven Caney's Invention Book (1985) by Steven Caney. Published by Workman Publishing - $10.95 (ages 8-14)

The Thomas Edison Book of Easy and Incredible Experiments: Activities, Projects, and Science Fun For All Ages (1988) by the Thomas Alva Edison Foundation. Published by John Wiley and Sons - $14.95 (grades 3-8)

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Focus on Inventors (1994) by Mary Ellen Sterling and Karen Goldfuss. Published by Teacher Created Materials, Inc., 6421 Industry Way, Westminster CA 92683 - $12.95 (grades 4-8)

From Indian Corn to Outer Space: Women Invent In America (1995) by Ellen H. Showell and Fred M. B. Amram. Published by Cobblestone Publishing, 7 School St., Peterborough, NH 03458-1454- $19.50 (grades 4-9)

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Inventioneering; Nurturing Intellectual Talent in the Classroom (1987) by Bob Standish and Carol Singletary. Published by Good Apple, 4350 Equity Drive, Columbus, OH 43216 - $8.99 (grades 3-9)

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Untrapping Your Inventiveness: Lessons in Creative Thinking and the Inventive Process (1992) by Janet Disilvestro and Judy Riley. Published by Creative Learning Press, P.O. Box 320, Mansfield Center, CT 06250 - $19.95 (grades 5-12)

Videos

Be An Inventor (1994) Published by United Learning. 20 min. (grades 3-6)

From Dreams to Reality: A Tribute to Minority Inventors. Available from a local Patent and Trademark Depository Library or the Office of Civil Rights, U.S. Patent and Trademark Office, Washington, D.C. 20231. Free (grades 3-12)

Inventors and Inventions (1995) Published by National Geographic Society, Educational Services, 1145 17th St. N.W., Washington, D.C. 20036-4688 - $99.00 22 minutes (grades 4-9)

CD Roms

Bumptz Science Carnival. Published by Theatrix Interactive. Format: Macintosh and Windows CD-ROM (grades 1-5). Mr. Wizard meets Rube Goldberg™

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The Even More Incredible Machine. Published by Sierra On-Line. Phone: (800) 757-7707. $24.95 Format: Macintosh and Windows CD-ROM (ages 8-up)

Ideas That Changed the World: The Greatest Discoveries and Inventions of Human History. Published by ICE (Integrated Communications & Entertainment, Inc.) Phone: (416) 868-6423. $49.95 Format: Mac and Windows CD-ROM (ages 8-up)

Invention Studio. Published by Discovery Channel Multimedia. Phone: (800) 678-3343 $39.95 Format: Mac and Windows CD-ROM. $26.99 from ELECK-TEK, 7350 North Linder Ave., Skokie IL 60097 (ages 9-up)

Inventor Labs. Published by Houghton Mifflin Interactive. Phone: (800) 225-3362. $49.95 Format: Mac and Windows CD-ROM (ages 10-up)

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Leonardo da Vinci. Published by Corbis. Phone: (800) 246-2065. $49.95 Format: Mac and Windows CD-ROM. $29.99 from ELEK-TEK (ages 12-up)

The Way Things Work, 2.0. Published by Dorling Kindersley Multimedia. Phone: (800) 225-3362. $39.95 Format: Mac and Windows CD-ROM (grades 3-12)

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Web Sites

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http://www.aas-world.org
An Overview of Intellectual Property
http://www.aipla.org
Copyright Office
http://www.loc.gov/copyright/
Forgotten Inventors, The American Experience from PBS
http://www.pbs.org/wgbh/amex/telephone/sfeature/index.html
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