Student Inventions Featured on Cover

Brooke Claussen       The Mini Corn Screener
Jayden Scheckel       Four in One Wrench
Jordan Hagedon        Mailbox Marvel
Laura Gillenwater     Background text

Guide design by Benson & Hepker Design
On behalf of Invent Iowa, a program within the Belin-Blank Center at The University of Iowa, I am very happy to present this inventing guide to all educators in Iowa. Invent Iowa has been part of the fabric of Iowa’s education since the 1980s. Invent Iowa has been a tremendously successful program, providing thousands of Iowa’s young inventors the opportunity and recognition to make things better for Iowans through their inventions.

This guide is complimentary from the Belin-Blank Center to all the schools of Iowa. It has been designed and tested to help teachers deliver creative units that will motivate Iowa’s young inventors. It is hoped that through these curriculum units, even more than ever, Iowa’s young inventors will participate and compete in Invent Iowa and thus make their mark in making things better for Iowans.

There are a number of people who deserve recognition in the development and testing of this guide. I wish to thank Clar Baldus, Catherine Blando, Laurie Croft, Jerilyn Fisher, Catherine Hirsch, Debra Johnson, Randy Lange, Jean Kratz, and Lois Roets. They all held significant roles in the development and testing of this guide. I thank Associate Director, Susan Assouline, for her leadership and attention to Invent Iowa and this guide. I wish to thank Rachelle Hansen for her secretarial and production work. I also want to thank the many students who helped us pilot the ideas in this guide.

I wish to thank the Colleges of Engineering of The University of Iowa and Iowa State University for hosting the annual Invent Iowa Invention Convention. My deepest appreciation to all those who have served, and are serving, on the Invent Iowa Advisory Board.

Finally, I want to acknowledge the outstanding leadership and support of U.S. Senator Tom Harkin (D-Iowa) for the Invent Iowa program. Senator Harkin’s support has been instrumental in helping to form Invent Iowa, and he has remained our leading advocate. On behalf of the over 300,000 students to date who have participated in Invent Iowa, thank you.

Nicholas Colangelo, Director
Myron and Jacqueline N. Blank Professor of Gifted Education

Invent Iowa
Belin-Blank Center
College of Education
The University of Iowa
Iowa City, IA
Invent Iowa gratefully acknowledges the outstanding leadership and support of U.S. Senator Tom Harkin (D-Iowa) who has made Invent Iowa possible. Invent Iowa also appreciates the generous support of Mr. Larry Engman. Mr. Engman was an early Board Member and donor to Invent Iowa. Mr. Engman’s financial and personal support provided Invent Iowa the freedom to grow and expand during its early years. Invent Iowa appreciates Mr. Engman’s generosity and creative vision.

Additionally, the following people, who have served as presidents of the Invent Iowa State Board of Directors, are to be thanked for the generous donation of their time and talent:

- Mr. Lee Murrah
- Mr. Ben Schwartz
- Ms. Catherine Blando
- Dr. Juergen Bruckner

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The support from the Colleges of Engineering at The University of Iowa and Iowa State University has been invaluable. We thank Dean P. Barry Butler, College of Engineering at The University of Iowa and Dean Mark J. Kushner, College of Engineering at Iowa State University for their commitment to Invent Iowa.

As well, thanks go to our many community friends, school district partners, and area education agency advocates. The Invent Iowa program is extremely grateful to all who have given financial support, time, and talent for the benefit of Iowa students.
Purpose of Invent Iowa

Invent Iowa is a comprehensive, statewide program developed to assist Iowa’s educators in promoting the invention process as part of their regular K–12 curriculum. Since 1987, Iowa students have had the opportunity to express their inventiveness and solve problems in an educational way. Local schools and AEAs provide opportunities to showcase student inventions at local and regional Invention Conventions. The culminating invention experience for Iowa students in grades 3 through 8 is the Invent Iowa State Invention Convention. Student inventors must receive an official invitation to participate in the state convention. This invitation is issued by an authorized Invent Iowa Area Education Agency coordinator. All inventions at a convention must be a completely new product or significant new application of an existing product. The invention must also be original student work.

At the convention, students are expected to give a brief presentation to the evaluators, identifying the problem the invention addresses, the process of developing the invention, and how the invention works to solve the problem. Student inventors should also be prepared to answer questions concerning the invention, including critical thinking, research, and problem-solving activities. The inventions are evaluated based on the model or prototype, the display, the student inventor, the display, the student inventors presentation and journal, and the discussion of the invention and the invention process.

The Belin-Blank Center Website (http://www.education.uiowa.edu/belinblank) is an excellent resource for more details regarding Invent Iowa, including:

- How to make an invention display board
- What makes a good invention
- The inventor's journal
- A guide for convention evaluators
- A sample Invent Iowa evaluation form
- Invention feedback ideas
- Rules for the convention.

We believe Invent Iowa makes a significant contribution to the education of Iowa students. The invention process teaches many important skills: critical thinking, problem solving, mechanical ability, and communication.

If you would like to serve as an evaluator for the convention, or have questions about the program, please call the Belin-Blank Center at 800/336-6463.

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Prior Knowledge

Purpose
The range of knowledge students bring to the study of invention varies greatly. This unit provides an opportunity to find out what your students already know about invention, including their misconceptions. Much as the process of invention is often collaborative, so too is its study. As a result, activities should foster open discussion. Recording class responses will allow you to revisit and enrich ideas throughout your study. Refer to Appendix A—Web of Invention Sub-Topics for an outline of the topics covered in this Primary (K–2) portion of the guide.

Materials
Chart Paper •
Appendix A—Web of Invention Sub-Topics •
Appendix S—Glossary •

Timeline
45,000 BC
Paint is invented for cave paintings.

“We believe
Invent Iowa makes a significant contribution to the education of Iowa students.”

Nicholas Colangelo,
Director, Belin-Blank Center
1. Let’s begin by creating lists of things found in a home. Have students individually list things found in their kitchen, living or family room, and garage. Be sure that electrical appliances appear on the lists. As a class, categorize items on the lists. Categories may include location in the home, function, or intended user. You may want to prompt students for particular items so that each category contains a particular type of invention (e.g., those that are powered by electricity).

2. What would happen if we didn’t have electricity? Would anything positive (good) happen? Repeat question, using automobiles/cars.

3. In fairy tales, things often happen because of magic (Jack’s beanstalk, Cinderella’s carriage); however, things in the real world, such as electricity and automobiles, did not happen because of magic. How did they happen? Allow the discussion to flow (even if “they were invented” gets mentioned).

4. We are going to study inventions. Develop and post a classroom definition of invention. See Appendix S—Glossary for an official definition.

5. Have students draw a picture of how their house would look if there were nothing inside that required electricity. Be sure students draw what would replace these things. Have students share drawings and mention the inventions that are missing. List inventions as students share. Discuss other inventions that could be added to the list, including those that are not be found in a house).

6. Why are inventions important to people?

Experience #2

1. Let’s try to think of our own inventions. Pretend Jack’s beans did not work. How else could he get to the giant’s castle? Share responses.

2. We are going to talk about five things related to invention. Ask students the following questions and record ideas from the class discussion:

   • Who are some inventors? What things did people invent?
   • What are some very old inventions?
   • What are some problems today that need an invention to solve them?
   • What steps do inventors follow when they invent? (This question could be sent home for student responses to be recorded by parents.)
   • What do you think an inventor puts on paper when he/she works?

3. Have students invent and draw another mode of transportation that Cinderella could have ridden to the ball.
Why People Invent

Purpose
Fostering an understanding of why people invent is an important first step of encouraging inventiveness. The purpose of this unit is to communicate that inventiveness arises in response to specific problems and needs, usually within one’s own environment. This unit gives students an opportunity to pinpoint and discuss problems in their environment that need inventive solutions. Suggested questions target specific problems that certain people might need to solve. In the process of answering these questions, students can improve their inventive thinking and expand their knowledge of the work an inventor does.

Materials
Chart Paper •

"One who has imagination without learning has wings without feet."

Joseph Joubert

Timeline
10,000 BC
Stone hammer is invented to chip other stones.
Why People Invent

Experience #1

1. Inventors usually invent things that will help them in a place (environment) where they spend a lot of time. Ask the class for places (environments) where they spend a lot of time (e.g., home, school, places where they play). Ask students for places where they do not spend a lot of time (e.g., college classrooms, factories, a space shuttle). Why would it be hard to invent things for places where you don’t spend a lot of time?

2. List two headings: home and school. Ask the class for specific problems related to home and/or school that might benefit from creative inventions. As students share, have them explain how an invention could help.

3. Review the idea that people invent things that solve problems in their environment. Review student-generated lists of problems specific to home and school.

Experience #2

1. Gather and share students responses to the items below. Be sure to stress that you want ideas that are not already invented. (You may need to alter the ideas below depending on the knowledge base of the students.)

   • A new invention a firefighter could use is ____________________________.
   • A new invention a farmer could use is ________________________________.
   • A new invention a basketball player could use is ________________________.
   • A new invention a computer operator could use is ______________________.
   • A new invention a doctor could use is ________________________________.

2. New types of products are invented all the time. List some recent inventions. (Examples include: computer software/hardware, cellular telephones, movie special effects, medicines, and variations of school supplies.)

3. We have talked about problems that you and I have that need to be solved and inventions firefighters, farmers, basketball players, people who work with computers, and doctors could use. Everyone needs inventions. Next we will talk about some very old inventions.
Purpose

Invention is such an ancient practice that one might make a natural connection between inventing and human nature. This unit draws upon this connection by focusing on the vital role inventions have played throughout history. This unit explains that despite refinements to the actual inventing process, the historical motivation to invent has been constant.

“*I never did anything by accident, nor did any of my inventions come by accident; they came by work.*”

Thomas Edison

Materials

Chart Paper •
Activity Sheet 1—Time Line •
Crayons •
Activity Sheet 2—World Map •
Appendix B—History Chart •
Activity Sheet 3—Dialogue Sheet •
Appendix C—List of Inventors •

Timeline

700 BC
False teeth made from gold straps and animal teeth are invented.
Historical Perspective

Note: Individual students’ concepts of history or “long-ago” will most likely vary greatly in a primary classroom. Mastery of this concept should not be expected. Utilizing resources with pictures of ancient inventions helps a great deal.

1. List 5–6 things that did not exist 20 years ago, or when you were much younger (possible ideas: a popular computer game, digital photography, DVDs). Inventing is happening all the time. Some inventions are very old. Ask students for ideas of some very old inventions and record ideas as they are listed. What is an invention a person who lived in a cave did not have? A medieval knight did not have? A pilgrim did not have? Your parents did not have? What solutions might they have used before these things were invented?

2. We are going to talk about three very old inventions: soap, metal money, and fireworks. These are very old inventions, all of which are over a thousand years old. Why would people invent soap? Metal money? Fireworks? Refer to Appendix B—History Chart for more information.

3. Pass out Activity Sheet 1—Time Line and list nine inventions. The list should be scrambled and should not include dates. Ask students to predict where on the timeline the inventions fall. Which invention came first? Have students draw pictures on their timeline to represent the inventions. Run the timeline on both sides of the paper; have students record their predictions on one side and use the other side for Experience #2. (You may want to make the time lines on larger pieces of paper.)

4. Present the class with the following list (without dates and out of order). Which idea do you think happened first in history? Allow students time to work independently and then share with the class.
   A. Soap invented (3000 BC)
   B. Metal money invented (2600 BC)
   C. Fireworks invented (1000 BC)
   D. George Washington becomes President (1789 AD)
   E. First combine harvester built (1838 AD)
   F. Iowa becomes a state (1846 AD)
   G. Thomas Edison researching electric lighting (1878 AD)
   H. Rosa Parks refuses to move to the back of the bus (1955 AD)

   (If this lesson is used in all K–2 grades in your building, revise the list above. Depending on your group, you may make it a whole-class activity or shorten the list.)
1. Review correct answers from Experience #1 with students. Instruct students to use the time line on the back of the activity sheet from Experience #1 to record the correct answers.

2. Distribute the world map activity sheet (Activity Sheet 2). Have students create a key using either pictures/symbols or color for soap, metal money, and fireworks. We are going to talk a little about each ancient (very old) invention. (Appendix B—History Chart is included to help facilitate your discussion.) Discuss the blank world map and encourage responses as to the locations of countries or inventions students know or think they know. (A classroom map or wall map would be an excellent resource.) Activities to facilitate discussion of ancient inventions include: calculating the age of an invention, finding the location of an invention's origin and marking a map, listing the good or bad (positive or negative) outcomes following an invention, or identifying facts related to an invention.

3. Have students complete a dialogue activity sheet (Activity Sheet 3). One speech bubble is provided for the students. Have students create a scene with two characters and some background. Then have them fill in the blank speech bubble. One idea for a speech bubble is: “There must be something better than dead fish that can be used to buy goods.”
Sample of Important Inventors

Purpose
Identifying important inventors requires students to know what makes an invention important. This unit centers student discussion around important inventions, inventors, and the criteria for judging inventions. Coverage should include a diverse sample of inventors and inventions. Because credit for an idea depends upon recognition, this unit also draws a connection between the paperwork process of inventing and receiving credit.

“‘The identification of the problem is more important than the solution, which may merely be a matter of mathematical or experimental skills.’”

Albert Einstein

Materials
Chart Paper •
Drawing Paper •
Activity Sheet 2—World Map •
Activity Sheet 4—Research Guide A •
Activity Sheet 5—Survey: Value of Inventions •
Appendix H—Patent, Trademark, and Copyright Information •

Timeline
1090 AD
Magnetic compass is invented in China.
Sample of Important Inventors

1. The light bulb is an example of an important invention. There are many important inventions. The wheel, the knife, and glue are all important inventions, too. As a class, list at least 4–5 reasons why each of the four inventions above are considered important inventions. (We will focus more on developing criteria for judging inventions in future lessons).

2. We know Thomas Edison invented the light bulb, but we may not know who invented many other things that we often use. This is especially true if the invention was developed long, long ago. How might you feel if you invented something and fifty years from now nobody knew you invented it? How would you feel if someone took your great invention idea and got all the credit? How can people today be sure that other people know that they invented something? How can an inventor be sure that no one else could take the idea?

3. We know who is credited for inventing the light bulb because Thomas Edison filled out the proper papers from the United States Patent and Trade Office. What information might be on these papers? See Appendix H—Patent, Trademark, and Copyright Information for more information.

4. We are going to talk about four important inventors and what they invented. However, we can’t talk about who invented the wheel, the knife, or glue because no one knows for sure. Have students draw what they think is the most important invention in history. Encourage students to supply at least two reasons why they believe this invention is the most important one in history. Have students share their drawings of important inventions.
1. As a class, discuss and list possible reasons that some inventions are “bad inventions” (e.g., medicines that resulted in health problems, household items that were unsafe, or inventions that pollute, make too much noise, or serve little or no purpose).

2. The next activity focuses on a small sample of inventors. Start with four inventors and one invention for each.

   - Thomas Alva Edison  
   - Garrett A. Morgan  
   - Bette Nesmith Graham  
   - John Deere

<table>
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<tr>
<th>Invention</th>
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<td>1879</td>
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<td>safety hood for firefighters</td>
<td>1912</td>
</tr>
<tr>
<td>Liquid Paper™</td>
<td>1950</td>
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<tr>
<td>steel plow</td>
<td>1837</td>
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   An activity sheet for research is included (Activity Sheet 4—Research Guide A). Modifications should be made to this activity according to your students’ needs. Once the initial four inventors and their inventions are covered as a whole group, additional inventors could be researched. Volunteers (parents, community members, and retirees) are a good resource to facilitate research efforts by younger students. This is an excellent opportunity to invite a local inventor to visit a class. Individuals or groups of students may report to the class on their research. Classrooms should add these inventors and their inventions to the time line created in the previous section.

   [Notes: Primary students may only be expected to draw the invention on the activity sheet. Revise the suggested four inventors to match specific curriculum, interest, and available resources.]

3. Because this section of the guide focuses on research, students will further research skills by conducting a survey (Activity Sheet 5—Survey: Value of Inventions). Graph or chart the collected findings as a culminating activity for this unit. For example, students may be given a sticky note to record where their inventor was born and then position it on Activity Sheet 2—World Map.
Inventive Thinking Practice

Purpose
Inventing is a creative and collaborative process. The purpose of this unit is to practice creative thinking processes. Through practice activities students can learn to think about the processes surrounding invention. The creation and utilization of an “Inventor’s Toolbox” can serve as a vehicle to transfer these skills during future student work.

“Getting an idea should be like sitting down on a pin. It should make you jump up and do something.”

E.L. Simpson

Materials
Chart Paper •
Appendix D—Creativity and the Creative Thinking Process •
Appendix E—Description of Problem Solving •
Appendix F—Inventor’s Toolbox •
Appendix Q—Resource List •

Timeline
1509 AD
Wallpaper is invented in England.
Experience #1

1. In the last unit, when you asked other people about inventions for your survey, they probably thought of many inventions and then chose one to share. This process of thinking of many ideas at one time is an important skill in inventing. This process is called “brainstorming” (or fluency), coming up with many ideas or answers, and is part of being a creative thinker. Inventors are creative thinkers.

2. We’re going to practice brainstorming as a group. List names of boys (girls). List colors. List toys students enjoy. List things that grow. Present the following guidelines for brainstorming to the students.

   - try to come up with as many ideas as possible
   - encourage unusual ideas (people probably thought the telephone and automobile were unusual and would never work at first)
   - think of new ideas from other people’s ideas (someone may think of Mars because someone else said Earth)
   - do not judge other people’s answers

3. Besides brainstorming (fluency), inventors also think of things in new and different ways (flexibility), add details or missing parts (elaboration), and make things or ideas that are original (originality). For further detail, refer to Appendix D—Creativity.
4. Students should practice these four creative thinking processes (brainstorming/fluency, flexibility, elaboration, and originality). Inventive thinking is not mastered with one or two lessons. Teachers committed to encouraging students to practice authentic inventive thinking should provide opportunities throughout an invention unit and school year. This section should be viewed as the initial exposure to a thinking process that will be ongoing. Some suggestions for inventive thinking practice centered on the last three processes are listed below.

1 Thinking in new and different ways:
• What else could Jack have done with the cow to earn money?
• How could Cinderella have gotten a dress on very short notice?
• You’ve lost your crayons, what else could you use to color a picture?
• All you have is the checkerboard and six black checkers. What can you do with this?
• Pass out a piece of paper, paperclips, or a pencil. Aside from their usual function, what can these be used for?

1 Add details or missing parts:
• Draw a square; have students turn it into a picture.
• Pretend Jack moves into the giant’s castle. What does he add to make it more fun?
• Make a paper airplane. Using crayons or markers (or some craft objects), make the plane more interesting.
• Write the sentence “A man gives his dog a toy,” on the board. Have students rewrite the sentence using words to describe the man, the dog, and the toy.
• Read a simple story. Have the class analyze which portions could have better details.

1 Make things or ideas that are original:
• Pretend Jack meets Cinderella. What would they say?
• Collect 5–6 objects. Have students glue them together and add details to invent an original creature.
• Write a poem about inventing.
• Create a new cake you think other kids would love. Draw it and label the parts.

5. Create an Inventor’s Toolbox (Appendix F) to introduce and practice the four steps of creative thinking. A cardboard lightning bolt symbolizes the quick generation of ideas (fluency/brainstorming). A huge rubber band symbolizes thinking in new and different ways (flexibility). A cardboard pencil symbolizes adding details or missing parts (elaboration). A cardboard lightbulb symbolizes generating things or ideas that are new (originality). Keep a folder or box in the room to store these symbols. Use them as props during discussion as students share some examples of their practice with the creative thinking processes. You can also have students create their own Inventor’s Toolbox.
Inventive Thinking Practice

1. Review the origin of inventions. Inventions usually result because someone needed something in a place where he/she spent a lot of time, we call these places our environments.

2. This experience asks students to apply some of the steps of problem solving to a school situation. A description of problem solving is in Appendix E.

3. Review the four creative thinking processes (brainstorming/fluency, flexibility, elaboration, and originality). We will build from these to try to solve some possible problems at school. Solving problems as a class helps students to develop skills necessary for class invention and, eventually, for independent inventing.

4. Introduce a new symbol for the toolbox, a magnifying glass. We’ll use the magnifying glass to look for all of the facts in a library problem. What if the school library books are being returned with many torn pages? Have the class use the “5W’s and 1H” (see Appendix F—Inventor’s Toolbox) questions to investigate this problem. Have students generate many ideas for each question while you record responses. Review the answers to the questions using the lightning bolt, rubberband, and lightbulb as props.

5. Think of many new and different ways to solve the problem. Record the possible solutions that students list. Have students pick one way to solve the problem and give at least one reason why that is the best solution. (Classrooms needing more sophisticated solution-finding steps should refer to the intermediate portion of this guide.)

6. The class can continue to practice these steps by using problems at home or school that were generated earlier in the unit or the class can create a new list of problems to solve.

Note: See Appendix Q—Resource List for additional resources relating to creative thinking and problem solving.
Inventive Thinking Process

Purpose

Experience in creative problem solving opens the door to the inventive mind. The steps of the process used in this unit utilize traditional creative and critical thinking skills and introduce students to the importance of problem solving methodology. This unit emphasizes the necessity of keeping an inventor’s journal. The students should have a sufficient knowledge base regarding invention prior to this unit and its recommended exercises.

Materials

Appendix E—Description of Problem Solving •
Appendix F—Inventor’s Toolbox •
Appendix G—Fire Escape Invention •
Drawing Paper •
Community Pile •

“When you believe in an idea, there is a way of succeeding. Never be afraid of jumping in. That’s what life is, a series of problems to be solved.”

Rebecca Schroeder

Timeline

1700 AD
The piano is invented by a harpsichord maker in Italy.
Inventive Thinking Process

1. Review “tools” in the Inventor’s Toolbox and discuss how we have used them.

2. Inventors use the following steps when inventing:
   - Inventors begin by identifying or finding a problem that might be solved or lessened with an invention.
   - An inventor then gathers information about related inventions.
   - Before an inventor begins creating, he/she needs to explore the idea in-depth. Inventors use the “5W’s and 1H” questions to do this (e.g., Who will use it? Where will it be used?).
   - Finally, inventors imagine their invention idea and begin creating it.

   The above steps of the inventive process are an adaptation of Edward Schlesinger’s steps of inventing. (See Appendix E—Description of Problem Solving). These steps are covered more fully in the Grades 3–5 portion of this guide. Be sure to relate the above steps to the corresponding “tools” in the Toolbox.

3. Reinforce that inventors keep very detailed notes in an inventor’s journal. These notes are necessary if inventors want to protect their idea with a government patent.

4. This is a perfect time to invite an inventor or patent attorney into your classroom. It may be a good idea to share the inventive-thinking process covered here with your guest speaker prior to his/her visit. This ensures cohesiveness between your classroom discussion and his/her presentation.

[Editor’s Note: The following scenario was developed prior to the events of September 11, 2001. Some students may be sensitive to this example; please use discretion when sharing this scenario.]

5. Discuss the following situation with your students. Over 150 years ago, people began building buildings taller than ever before. What possible problems are created with very tall buildings? We’ll pick one problem: escaping from fire. The next step we will do as inventors is to research inventions related to fire escape. One inventor, Benjamin Oppenheimer, wanted to invent things a person could wear in the event of a building fire. Let’s ask the 5W questions to learn all we can about a possible invention. (Who would wear it? What would it be made of?) This step ensures we have learned all we can about the invention idea. Have students refer to the recorded 5W questions and draw new garments for fire escape. Have students share their fire escape drawings. After the students have time to sketch a drawing and share, show them one fifth-grade student’s idea (Appendix G—Fire Escape Invention). Oppenheimer’s idea can be found in Weird & Wacky Inventions by Jim Murphy. This resource includes many other examples of unusual inventions that you can use with students. Reinforce that both drawings and questions are things an inventor might keep in an inventor’s journal.
Experience #2

1. Students will enjoy making inventions at this point. Remind students of the inventing process so that they are cognizant of true inventing rather than just unstructured creative thinking. Send a letter home at least a week prior to this activity to collect consumable items for the community pile.

The community pile might include: cardboard cylinders, cloth scraps, nuts, bolts, pipe cleaners, paper scraps, cardboard boxes, clean plastic, tin cans, toothpicks, pins, paper clips, lids, glue, tape, foil, wood scraps, film canisters, popsicle sticks, paper plates, rubber bands, and yarn.

Based on the following problems, have students work through the inventive process. Work can be done independently, with partners, or in small groups. Have students share completed inventions.

A. A group of brothers and sisters are bored with all their toys. Mom and Dad refuse to buy them more. Use the community pile to build a new toy.

B. A teacher has run out of new ideas to teach a particular skill. The teacher decides to make a game. Use the community pile to make a game.

C. A student loves bananas, but every day the banana she brings for lunch gets bruised. The student decides to invent something that will protect the banana as it gets transported to lunch. Use the community pile to build the protector.
Class Invention Project

Purpose
In the end, inventing can be a fun process. This unit of the K–2 guide is both a culmination of all that has been learned and a celebration of invention. As a class, the students will apply what they know about the inventive process to inventing a game.

“Eureka! Eureka!
[I have found it!
I have found it!]”

Archimedes, upon discovering a new scientific principle

Materials
Chart Paper •
Drawing Paper •
Appendix F—Inventor’s Toolbox •
Various games •
Various materials to construct a game •

Timeline
1792 AD
The ambulance is invented.
1. At this point, students should be following the inventive process. Even though the focus is on the process, refer to the Inventor’s Toolbox as well.

2. Review why things are invented. Describe a scenario in which students seem unmotivated. They do not view learning as fun. Explain how inventing a classroom game could make learning about inventors and inventions more fun for these students. We need to invent something that will help students learn about inventors or inventions in a fun way. Ask students to discuss various things that have made learning fun for them.

3. This unit describes the process of inventing a game as a whole-class activity. However, it can be adapted for use as a small-group activity when appropriate for a particular class.

4. Create a large journal (using chart paper). Review the importance of writing down ideas as the class works. This will eventually become the classroom inventor’s journal. Be sure to record information in the classroom inventor’s journal after each session spent on inventing the game. While you may do most of the writing, have students create drawings to include in the classroom inventor’s journal. Some students also may benefit from simply witnessing the writing and illustrating process. As a class, we have already completed the first step: finding a problem. Once you model the use of the journal by entering the problem or need that has been identified (to make learning fun) the inventive thinking process should be reviewed.

5. In order to find out about other inventions, have students gather information about current games appropriate for their age group. Games can be brought in to discuss. Students can look at games at home. A survey can be created to ask other classrooms of students about games they know and find fun. Students will discover that other games they play are colorful, have short directions, require skill or knowledge, have moving parts, use dice, have cards, have a winner, and/or require more than one player.

6. Review with students the next step, learning about the invention idea. At this level, it is suggested that you generate the questions prior to the discussion. Since inventors focus on the 5W’s and 1H, possible questions include:
   - Who will play this game?
   - What type of game will it be?
   - When will the teacher use this game?
   - Why will the teacher use this game?
   - How will someone win?

There are many possible questions that will focus students on the organization, structure, and appearance of the game. Students should be encouraged to come up with their own questions in addition to the ones you have created. Discuss possible answers to each question. Be sure to record all answers to the questions.
1. Students are now ready for the final step: imagining the invention. During the brainstorming portions of this experience, be sure to be open to all ideas. Have students create sketches of their ideas and label them for clarification. Encourage students to draw more than one possible game. Undoubtedly, some sketches will include things that are not feasible; include these ideas (and the problems associated with them) in the inventor’s journal. Have students share their sketches. As a class, discuss the sketches and review what has been learned about the invention idea (through the list of possible questions above), and narrow down the organization of the game.

2. Have students draw new sketches based on organization determined in step 1. Discuss and determine the content of the game and how the game will look. Create a final sketch and clearly label it. Be sure to name the game.

3. The class is now ready to invent the game. The creation of the rules and what appears on playing cards (if cards are used) are two possible activities in which the whole class can participate. Be sure to make entries in the journal as the game prototype is being developed.

4. This activity could be extended to include other classrooms. Visit another classroom to explain what you have done, market the game, create a commercial, apply for a “patent” with the principal, or create an invention display for the library that explains the game and invention process.
Preserving Ideas

Purpose
This unit supplements and applies material covered previously in the K–2 curriculum. First, this unit builds upon the groundwork laid for an inventor’s journal. Students are exposed to a simulated journal experience (complete with hints as to what a real inventor’s journal might include). Second, a brief introduction to the patent process is included to continue the theme of careful documentation introduced by the inventor’s journal activities.

“Minds are like parachutes. They only function when open.”

Anonymous

Materials
Drawing Paper •
Appendix H—Patent, Trademark, and Copyright Information •

Timeline
1811 AD
Canned food is invented for the French Army.
Preserving Ideas

Experience #1

1. Tell the class that you have a real problem regarding the game you have invented. Another school has heard about our idea for a teaching game and is now saying it’s their idea. What should we do? How can we prove it’s our idea? One reason why an inventor keeps a journal is to protect his/her ideas. Inventors write down everything they do and everything that has to do with the invention. Besides protecting an invention idea, keeping a journal also helps inventors to think about their ideas.

2. Share hints on keeping an inventor’s journal. Use the journal created during the last unit as a reference tool to model various aspects of an inventor’s journal.
   • Write down all ideas as soon possible, so they are not forgotten.
   • Record problems with inventions.
   • Record how problems are solved.
   • Keep drawings of ideas.
   • Keep a “scrapbook” of stories, pictures, and/or receipts.
   • Do not erase.
   • Sign and date all entries.
   • Get a witness to sign entries.

3. As a group, discuss invention ideas for Cinderella. She has to carry two metal buckets full of milk twice a day. She wants to invent something to make this easier. Draw some possibilities.

   Have students draw sketches that would be in Cinderella’s journal of an invention to make cleaning the fireplace less messy. Share the students’ drawings of Cinderella’s inventions

Experience #2

1. Review why inventors want to protect their ideas. Reinforce that keeping an inventor’s journal helps the inventor to protect ideas and think more carefully about the invention itself.

2. Appendix H provides some background on patents. Students should know:
   • A patent is an official document from the U. S. Government giving you the rights to your invention.
   • Applying for a patent is complex and expensive.
   • The U. S. Government has a special office called the Patent Office to work with inventors who want patents.
   • It may take two or three years to get a patent.
   • Only the inventor or inventors can apply for a patent.
   • Inventors usually have to include drawings of how their invention is made and how it works.
**Purpose**

Knowledge of basic invention concepts should precede more advanced study and application. The activities in this unit provide an opportunity to assess students’ existing knowledge, so that the curriculum can be tailored to classroom needs. This portion of the guide builds upon knowledge developed in the K–2 guide, and may be used either to reintroduce students to key ideas (such as an inventor’s journal) or determine student readiness for more advanced units. Consequently, portions of this unit may be omitted, depending on an assessment of students’ prior exposure.

**Materials**

Activity Sheet 6—Inventor’s Journal • Chart paper •

**“Invent Iowa supports educators in teaching creative thinking and problem solving skills associated with the invention process.”**

*Nicholas Colangelo*

*Director, Belin-Blank Center*

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**Timeline**

1843 AD

The first Christmas card is invented in England.
1. As an introductory activity, we are going to talk about the origin of some present-day words. What present-day word do you think comes from the French language and means “to shine”? Allow students to share ideas of words that they think may mean “to shine.” Continue the questioning with the following: Latin word for “pleasing,” Latin word for “on the outside,” Greek word for “of letters,” and Greek word for “to find.” (Answers: to shine=brilliant, pleasing=delicious, on the outside=foreign, of letters=grammar, and to find=invent.) We are going to begin studying the concept of invention. Some of you may have studied invention before. In our study this year, our end goal will be for everyone to create an invention following the procedure “real” inventors might use. We are going to keep an inventor’s journal during our study of invention. Journals do not need to be very sophisticated or expensive. Spiral notebooks work well. The teacher should model the use of an inventor’s journal throughout this study.

2. The first activity I would like you to do is to create a web of all you know about inventing, inventors, and inventions. Draw this web in your journal. Students should place “INVENTION” in the center of their web, and have a minimum of three spokes (e.g., inventing, inventors, and inventions). After working independently, students should team with a partner and pair-share. They should note similar as well as unique responses. Create a class web on larger paper as the whole class shares. All responses should be recorded. Students should be encouraged to add ideas to their personal webs during this time. Keep the class web for future use.

3. We will have time to explore and research ideas that interest you about the concept of invention. In your journal, I’d like each of you to list at least five things, or ideas, that you’d like to know more about related to the concept of invention.

4. This would be an excellent time to invite a local inventor or patent attorney into the classroom. If possible, have the guest speaker return to the classroom during the presentations of individual inventions that students will create later.

Purpose
People invent for many reasons. This unit covers these reasons in more detail than the K–2 guide. This unit also expands upon the connection made between why people invent and the needs of their environment. In addition, students will share their own ideas about why people invent through discussion and persuasive essay.

“Just because something doesn’t do what you planned it to do doesn’t mean it is useless.”

Thomas Edison

Materials
Activity Sheet 6—Inventor’s Journal •

Timeline
1853 AD
Charles Pravaz invents the hypodermic syringe.
Why People Invent

1. Review ideas that the students have recorded in their inventor’s journals relating to inventing, inventors, and inventions. Possible questions to set the tone include:
   - What would the world be like without inventing?
   - Do you think all inventors have to take classes on how to invent something?
   - Not all inventions make people rich, so why do people still invent?
   - Turning an idea into something is very hard work; why would people be willing to invent?
   - If the number of patent/invention ideas dropped drastically, should America care?

2. Thinking about why people invent is an excellent place to start studying invention. Why do people invent? Record student responses. Using this discussion, have students write a persuasive essay that best answers the question “Why do people invent?” Have students share completed essays in small groups. Survey the class and chart what has been shared. Essays and charts should be included in the journals.

   Note: The Intermediate (grades 3–5) portion of this guide includes an emphasis on persuasive writing. It may be beneficial to begin the early essays as whole-group activities, and then transition to individually written pieces.

3. We have the saying “Necessity is the mother of invention,” because inventors usually invent things that will improve their environments. What does this saying mean? Students should be encouraged to think of examples of inventions that probably stemmed from a particular need or problem. Catherine Diener invented the rolling pin. What do you assume about her need and environment? Bette Nesmith Graham invented Liquid Paper™. What do you assume about her need and environment?

4. According to Harvey Weiss’ book (How To Be an Inventor), there are four reasons people invent. This list includes:
   - To become rich and famous.
   - Inventing is their professional job (these are usually research jobs found in large companies or science labs).
   - They find the idea and process of inventing fascinating.
   - They have a love of building.

5. In their journals, students should be challenged to answer the following questions: If necessity is the mother of invention, what is the mother of sportsmanship? Of crime? Of good behavior? Of patriotism?
Historical Perspective

Purpose
The human needs that motivate invention vary with place and time. This unit focuses on the historical contexts that drive invention. Small groups of students will research an ancient civilization and discuss their civilization’s adaptations and contributions. A thoughtful analysis of changing needs in past civilizations will help students relate to present day inventiveness.

“Imagination is more important than knowledge. Knowledge is limited. Imagination encircles the world.”

Albert Einstein

Materials
- Civilization resources
- Activity Sheet 6—Inventor’s Journal
- Chart paper
- Activity Sheet 1—Time Line

Timeline
1860 AD
Linoleum flooring is invented by an Englishman.
Experience #1

Historical Perspective

1. In order to give students a greater understanding of invention, the class should spend time on historical perspective. Compile a list of ancient civilizations that can be researched in your school’s library. (Possible civilizations include: Mayans, Egyptians, Mesopotamians, African tribes, Chinese, Native American tribes, Greeks, and Eskimos.) Research notes and information should be kept in the Inventor’s Journal. We have discussed how environmental needs can result in inventions. Throughout history, groups of people (and individuals) have been faced with needs and problems. We are going to research various ancient civilizations and learn about the things they invented. It may be helpful for students to draw pictures of the inventions to serve as visuals. Students should also be encouraged to find additional interesting facts about a civilization.

2. Have groups of students work together in research teams. Research teams will report to the class. Have the students include dates in their work. Research teams should address which inventions are no longer needed (and explain why). Research teams should also address inventions still in use, including those that may have a different use today. (For example, soap was not initially used as a cleansing agent.) Create a class time line so that students will see points where the simultaneous inventing of the same thing happens in different places in the world.
Purpose
The study of inventors helps students recognize the qualities associated with creating good inventions. The activities in this unit provide students the opportunity to develop skills in research, analysis, and assimilation. The processes developed involve establishing criteria for good invention (including consequences), developing a presentation based on research, and independently assimilating details from the presentations into a description of a good inventor.

Materials
Activity Sheet 6—Inventor’s Journal •
Activity Sheet 7—Research Guide B •
Appendix C—List of Inventors •
Chart paper •
Activity Sheet 8—What Do Inventors Do? •

“\textit{The innovation point is the pivotal moment when talented and motivated people seek the opportunity to act on their ideas and dreams.}”

\textit{W. Arthur Porter}

Sample of Important Inventors

1862 AD
The first milking machine is invented.
Sample of Important Inventors

1. Before students begin looking at inventors, have them evaluate some past inventions. Have students work in groups and assign each group a topic. (Possible topics include: the most important invention of all time is..., the most important invention to a family today is..., the worst invention is..., the worst invention for a family is...) Spend some time discussing your topic. When the group reaches consensus (agreement) write a paper supporting your group’s decision. Have groups share their written ideas.

2. The inventors used for the next activity are left to the discretion of the teacher or students. See Appendix C—List of Inventors for possible inventors to assign. You should allow at least three class periods for this activity. Each student is going to have the opportunity to research an important inventor. I will provide each of you with a guide sheet (Activity Sheet 7) for your research. Your final product will be a dramatization of your inventor. You will pretend that you are this person and make a presentation to the class. Your presentation is to include information you learn about your inventor. Be sure to include minorities and women when assigning inventors.

3. We are going to develop criteria (guidelines) for a good dramatization. I’d like each of you to list three things that you think I should look for in an excellent presentation. The criteria should be set and given to the students prior to the start of the research. Possible criteria include presentation of key points in the inventor’s life, demonstration of good speaking skills, communication of the idea behind the invention, and discussion of the invention itself.

4. Have students research, prepare, and present their dramatizations individually.

5. Now that we have heard from all of our inventors, I’d like you to list the top five characteristics of an inventor in your inventor’s journal. Once students have had time to list these characteristics, distribute Activity Sheet 8—What Do Inventors Do? Have students complete this page independently. Discuss responses and then have students make posters based on the characteristics of an inventor.

How adult inventors responded to questions on Activity Sheet 8: 1T, 2?, 3T, 4?, 5F, 6?, 7?, 8T, 9T, 10F, 11F, 12T, 13T, 14T, 15F, 16?, 17F, 18T.

Women & Minority Inventors

Purpose

Although the ability to invent is present in everyone, many obstacles have excluded women and minority inventors from the process of inventing. Proper recognition for their contributions was often lacking. The purpose of this unit is to accurately portray the process of invention as one that is open to everyone. Activities in this unit serve to help students discuss obstacles and recognize the truly great accomplishments of those who were able to rise above difficulties. The intent of this unit is to provide inspiration for all students to overcome any obstacles they might encounter in trying to achieve their goals.

Materials

Inclusive collection of inventor autobiographies • and/or biographies
Appendix D—Creativity •

“"If someone says it can’t be done, take it as a challenge, not a discouragement. It’s the only way to make inventions.”

Patsy Sherman

Timeline

1872 AD
The first sticks of chewing gum are invented.
Women & Minority Inventors

1. Prior to the beginning of this unit have students take a survey of their family members to learn what inventors they can name.

2. As a class, list the inventors resulting from family surveys. Spend some time discussing how a survey taken from the majority culture often results in more male names. In addition, encourage the class to think about the reasons why they were or were not successful in generating a diverse list (e.g., prior classroom attention to diversity, particular qualities of the area, or the particular qualities of the students).

3. Remind students to avoid stereotypes or prejudicial remarks in the following discussion. For a long time, people who were not white males struggled to be inventors. Can you think of obstacles that women and minority groups have faced that have limited their success as inventors? (Some ideas include: societal views, limited educational opportunities, voting laws, segregation laws, lack of money, and others taking credit for the ideas of women/minorities.) Have these things changed today? What still needs to change? Encourage students to use the creative thinking processes in Appendix D to discuss these problems. Such discussion will help students practice these processes. This activity provides background for the next unit.

4. Share some brief biographical information about women and minority inventors. When possible, highlight obstacles they had to face. A goal of this lesson is to introduce the idea that all people invent: young and old, men and women, all backgrounds.

5. What do you think our school does to encourage all students to achieve? What do I do as a teacher to promote success for everyone in this class? (Again, the process used to answer these questions could be linked to the creative thinking process in order to provide practice.)
Inventive Thinking Practice

Purpose

The development of creative and critical thinking prepares students for the processes associated with invention. This unit focuses on problem-solving. It builds upon Torrance’s creative thinking processes with the use of the Inventor’s Toolbox. Students learn six steps of problem-solving and apply them to the life of a real inventor. This method will help students to see how the use of these skills corresponds with the practice of inventive thinking.

“I was thinking that I wanted to play a game with my friends and this sounds like fun but it doesn’t exist so maybe I could make it. The best inventions come out of that situation.”

Patty Brandetsas

Timeline

1855 AD
The automobile is invented.

Materials

Activity Sheet 6—Inventor’s Journal
Appendix D—Creativity
Appendix E—Description of Problem Solving
Appendix F—Inventor’s Toolbox
Appendix J—Lydia’s Story
Appendix K—Solution-Finding Grid
Appendix L—Calvin Taylor’s Model
Inventive Thinking Practice

1. Review with students the four steps in the creative thinking process (brainstorming/fluency, flexibility, elaboration, and originality [Appendix D—Creativity]). Refer to the “Inventive Thinking Practice” plan in the K–2 portion of this guide (Unit 5, p. 13). The use of an Inventor’s Toolbox is also suggested. (This Toolbox is also detailed in the K–2 portion [Unit 5, p. 13].)

2. One problem-solving model is described in Appendix E. Another model for the steps of problem solving is:

A. Identify a problem or concern.
B. Find the facts.
C. Find the underlying problem(s).
D. Find ideas.
E. Find a potential solution.
F. Develop a plan of action.

3. Ideally, it would be best to practice this model in a role play activity. By using the story of Lydia O’Leary, you can lead your class through the steps of problem solving. I’m going to read you a story of a woman named Lydia O’Leary. After I have finished reading the story, I would like us to discuss your initial reactions to what you hear. (See Appendix J for the story.) Discussion should result in a class agreement that there is a situation where something is wrong. Some problem-solving models refer to this step as “identifying a problem or concern.” In your Inventor’s Journal, please list the facts from the story that you think best answer the questions: Who, What, When, Where, and Why. This is the second step in creative problem solving. (Students may remember that this is similar to one of the steps in the inventive thinking process presented in the K–2 portion. By answering the 5W’s, inventors are able to learn all they can about related inventions and their invention ideas.) Have students share their answers to the 5W questions. Before we continue working with Lydia and her big problem, I would like us to practice a little with the more advanced steps of problem solving.

4. The next step in trying to solve a problem is being able to decide on the real problem. Many serious problems or “messes” are actually a series of related problems. Let’s look at an imaginary problem of someone who is not doing well in reading class. What could be some problems “inside” the reading trouble that could help us discover what the “real” problem is? (Inside problems may include: the student may work too much at a job outside of school, the student may not understand the material in class, the student may be afraid to ask the teacher questions, the student may forget his/her reading homework at school, or the student may have to babysit a younger sibling after school.) After you have done one problem analysis as a group, have students do one individually in their inventor’s journal (e.g., the fish in the classroom fish tank are dying or the family grocery bill is too high). Share some examples.
5. **Finding a problem is essential to developing an invention idea.** An inventor allows plenty of time for research during this step. Problem statements are usually written as questions. These questions can begin as either “How might...” or “In what ways might...” Looking back at our reading class problem, we could restate the inside problems as questions: How might the student find time to work on reading? In what ways might the student better understand the reading homework? I’d like you to rephrase your inside problems from your notebook to question statements. (It might help to write the problem statement stems on the board for the students.) As a group, list inside problems that may relate to Lydia’s problem. Decide which reading problem is the real problem that needs to be solved. List this problem on the board and star it.

6. **In your Inventor’s Journal, I’d like you to list as many possible solutions as you can think of to the real problem we identified.** The more possibilities you can think of, the better chance you have of solving the problem. This step is called “finding ideas.” Idea finding is an extension of our creative thinking. Inventors use the skill of developing as many possibilities as they can quite often during the invention process. Students should share their possible solutions. Explain to the students that the task is to find the best solution, and that some ideas, while creative, may not be the best choice. As a class, choose the 6–8 best possible solutions to evaluate more carefully.

7. **Now that we have our possible solution ideas, we need to evaluate them. How could we narrow our choices down to just one?** Encourage the class to do more than just randomly pick one solution. There should be a more systematic approach. Our next step in problem solving is to find a potential solution. We will create a grid that includes both the possible solutions and the criteria chosen to evaluate them. To help students better understand the use of criteria, give them various problems to solve. Pretend your parents are having difficulty finding a babysitter. What might be some things to look for in a good babysitter? Have students generate the qualities of a good babysitter. (Possible answers: The sitter should act responsibly in all situations, can supervise children, has authority with children, is respected by children, and has general babysitting knowledge.) **These are the possible criteria for a good babysitter.** (Other things to evaluate include a work of art, a puppy, or a bicycle.)

8. **An example grid can be found in Appendix K—Solution-Finding Grid.** The example relates to the reading-trouble scenario. Have the class develop at least five criteria. In this example, the possible ideas are rated with “6” being the best on a particular criterion and “1” being the weakest. You may find that another system of rating works better for your situation. The goal here should be to establish the criteria and raise awareness that not all solutions are equally strong. Apply the criteria the class has created to the reading problem and based on the criteria, determine the best solution.
9. Now that we have evaluated the possible solutions and have chosen one to try, we need to think about how we can implement or carry out the solution. This step is called “developing a plan of action.” By doing this, we can see if it will be a worthwhile attempt. What seems to be an excellent possible solution may fall short once we analyze it further. An action plan helps us to realize any limitations an idea may have. Action plans should stem from the 5W’s and 1H questions. Possible questions include: Who will be responsible? Who can assist with this solution? What has to be done first? What are possible problems that may arise? When will I see signs of improvement? How will I carry out the solution? Where will this take place? With this type of thinking, inventors can begin to invent and know the limitations of their inventions. Depending on the needs of the group, action plans may or may not be individually created. Students should complete and share their action plans.

10. The problem-solving model provides us with a useful introduction to how an inventor thinks during the inventing process. Just as we connected our lesson today to real-life problems, you will use similar skills as you try to solve real-life problems with your own inventions.

11. As a class, review the six steps of problem solving. Let’s now return to Lydia’s Story. What facts did we discover about her situation? Review and discuss the problem statements relating to Lydia that were drafted in step 5. Continue the problem-solving process using the story of Lydia. This can be done individually or as whole-class activity. Students are not expected to have mastered problem solving at this point. The process of inventive or creative thinking should be revisited and practiced throughout the school year.

12. In addition to steps of creative thinking and problem solving, Calvin Taylor's invention model is presented in Appendix L. Many different thinking-skills models exist. It is important to remember that there are some similarities between models. The Taylor Model encompasses both creative and critical thinking processes. Once students begin using an inventive-thinking model, they will see that it provides an opportunity to demonstrate key thinking skills already discussed.
Purpose
As students have learned, inventions do not just happen, they are the result of creative thinking and careful analysis. This unit allows students to learn the importance of method prior to “jumping in” and solving a problem. Students will examine a series of steps inventors can use as a guide. The inventive-thinking processes outlined in this unit include use of the Inventor’s Journal and the work of Edward Shlesinger, an educator and inventor.

“The best way to have a good idea is to have lots of ideas.”

Linus Pauling

Materials
Activity Sheet 6—Inventor’s Journal • Appendix E—Description of Problem Solving • Community pile •
Inventive Process & Inventor’s Journal

1. The focus of this lesson is on the procedures inventors follow. These steps are based on Edward Shlesinger’s steps for inventing (Appendix E—Description of Problem Solving). Before instruction begins on the steps of invention, students will have an opportunity to invent something. To facilitate this activity, it is best to send a letter home requesting items for a “community pile.” Send this letter at least a week in advance. (Suggestions for a community pile can be found in the K–2 portion of this guide, Unit 6, p. 19)

2. Allow students to create an invention using items from the community pile. After a 45-minute building session, have students introduce their inventions to the class. They should identify one problem they experienced in the invention process. Record the identified problems. It is a mistake to think that inventing just means building something. Inventors go through a variety of steps during the process of invention. There are crucial steps that must be accomplished before actual constructing begins. Even before we talk about the steps of inventing, we need to be sure we’re keeping a record of everything we do. We need an Inventor’s Journal to keep track of our ideas and to prove that our ideas are our own.

3. One good thing about an Inventor’s Journal is that it can be messy (but it must include all the messes we make). We have been keeping a journal throughout our study. Let’s look at some key points in keeping an Inventor’s Journal. Be sure to write this list in your journal. In an Inventor’s Journal, an inventor:
   • Writes down all ideas immediately.
   • Records problems he/she is having.
   • Records how he/she solved the problem.
   • Keeps drawings of his/her ideas.
   • Keeps all ideas, without erasing.
   • Signs and dates all entries.
   • Gets a witness to sign his/her entries.

4. When you begin your invention process, I will expect you to have these points in your journal. We will use five steps for inventing: identification, foundation, data, imagination, and limitations. Once an inventor recognizes a need or problem (identification), he/she should acquire necessary background (foundation). This background should relate to the invention, including a history and classifications that exist relating to invention. The U.S. Patent Office publishes a manual that identifies various classifications. This information tells an inventor what has already been invented. The data step answers important questions about the invention. The fourth step, imagination, is when an inventor uses the preliminary information gathered thus far and begins to invent something new. Keep in mind that inventions begin as drawings and sketches in the journal. An inventor keeps a very open mind and accepts that invention ideas will grow and change. In the end, inventors must think about limitations. Inventions have to be able to be produced and sold. Therefore, inventors must ask themselves questions to ensure that the invention is possible and worthwhile.
Purpose

The process of invention does not stop with the generation of a new idea; inventors must patent their idea and keep up with current needs for further innovation. This unit reviews some creative processes, details the process of patenting ideas that are generated, and discusses the continuation of the inventive process through innovation. Students will learn to distinguish different patents for different purposes. At the same time they will learn to distinguish innovation from invention.

"Invention breeds invention."

Ralph Waldo Emerson

Materials

Activity Sheet 6—Inventor’s Journal • Appendix M—Web Model • Appendix H—Patent, Trademark, and Copyright Information • Activity Sheet 9—Invention Record • Appendix N—True Story of the Telephone •

Timeline

1910 AD
The seaplane is invented.
Patents: Invention vs. Innovation

1. Now would be an ideal point to check for understanding thus far. Split the class into four groups. Assign each of the groups one of the following: a) why people invent and a historical look at invention, b) important inventors, c) women and minority inventors, d) inventive (and related) thinking. Have each group work together to prepare a review for the class regarding their topic. Encourage students to use their Inventor’s Journals. Give students at least 15–20 minutes to draft and practice their presentations.

2. Display the web found in Appendix M—Web Model. Add key ideas to the web. (Ideas that have not been covered so far in the unit appear on the web.) Compare/contrast this web to the one made when the invention study began initially.

3. We have been keeping an Inventor’s Journal. Why have we done this? (We are able to keep all of our work in one place, keep a record of our ideas, and practice keeping a journal as an inventor would.) Careful notes, such as those contained within the journal, are one necessity in applying for a patent. The patent process is complex and costly and good notes help a lot. Let’s take a look at this process. Discuss why people apply for patents. Have students share their knowledge about patents. Appendix H provides information on patents, trademarks, and copyrights. Classrooms may vary in the depth with which this topic is covered. Regardless of the extent to which this topic is covered, students should be aware of the three types of patents: utility patents, plant patents, and design patents.

4. An overview of the patent process is also important. This process involves:
   A. Researching whether your invention already exists.
   B. Speaking to a patent attorney.
   C. Filing a patent application with the U.S. Patent Office.
   D. Waiting while a patent officer examines your application.
   E. Receiving notification of a decision made by the patent officer.

5. An example of an invention record for student use can be found on Activity Sheet 9. Students can experience completing something similar to a patent application with this invention record. Students should use the invention they made from the community pile for this activity.

6. To emphasize the importance of obtaining a patent, read the students the True Story of the Telephone, found in Appendix N. After reading the story, discuss as a class how the story illustrated the importance of a patent and how things may have changed for Meucci if he had been able to obtain a patent.
7. Discuss with students a definition of invention. Have students list all the types of telephones they can think of in their journal (e.g., cordless, cellular, rotary, push-button, pay phones, etc.). Create a list of student responses. Are all of these considered inventions? Why or why not? Why was a cordless phone manufactured? In this guide, ideas to improve existing inventions are called innovations. Discuss some innovations made to chairs or toothbrushes. Review the terms invention and innovation. Patents that are granted for innovations are called design patents. Students should have these two terms in their journals.

8. Share with the students one or two items you would like improved. Be sure to tell them why you feel they need improving. I’d like for you to write a persuasive essay on a current invention that you feel needs to be improved. (The idea you have already shared cannot be used.) In addition, students may draw a sketch of a possible prototype for an innovation that would improve the existing invention.
Invention Analysis

Purpose

Students who have acquired a solid foundation in the fundamentals of invention will be ready to develop critical thinking skills about invention. This unit teaches students how to classify inventions as part of an analysis process. Students will look at invention sketches, categorize them, and analyze them based on various criteria. By practicing these skills, students will develop an ability to conceptualize different types of invention and apply their critical thinking skills. These skills will be useful for the last three units of this guide.

Materials

Appendix I—Inventor Sketches •

“Invention is a combination of brains and material. The more brains you use the less material you need.”

Charles F. Kettering

Timeline

1944 AD

Plastic artificial eyes are produced.
Invention Analysis

1. We are going to look at some work of inventors. Based on the sketches and short description of each, we’re going to analyze the inventions. As I present each sketch and description, I’d like you to write down your first impressions in your inventor’s journal. Discuss initial reactions the class has to these inventions. (Use Appendix I—Inventor Sketches.)

2. Inform students that the U.S. Patent Office classifies inventions in a manual they publish. All inventors applying for a patent must have an invention that fits into one of these categories. Discuss the meaning of classification and the benefits of classifying inventions. Use the inventor sketches (possibly as transparencies) to discuss how each item might be classified.

3. As a group, analyze one invention more closely. Possible questions include: What materials are necessary for this invention? What are some possible negative consequences of using these materials? Is this easy to manufacture? Why or why not? Who would buy this product? What will it cost? Will it work? Repeat this process by assigning other sketches to groups of students. Once students have had time to evaluate the inventions, they should share responses and discuss why this type of evaluation process is important for an inventor to undertake.

4. As a class, try to decide how you would classify each of the inventions. One categorization breakdown for inventions comes from the Belin-Blank Center. The categories are: organizational, convenience, kitchen/bathroom, sports/recreation, games/entertainment, medical, pets, clothes/accessories, baby/baby safety, automotive, mailbox, lawn/garden/shop, and farm/farm safety. The “Young Inventors and Creators Competition” uses the following categories: agriculture, business/office use, environmental, health, household/food, leisure/entertainment, new technology, and transportation/travel.

5. List several of the invention categories. Have students identify existing inventions that correspond to each category. Include some ideas for possible inventions that need to be created in a category. (Students will have to consider possible problems or needs relating to a category in order to develop possible invention ideas.)
Student Inventing Practice

Purpose
At this point, students will synthesize ideas from discussions and activities thus far to begin inventing. This unit includes an in-class inventing experience and an individual idea that is worked on in school and at home.

“Originality is simply a fresh pair of eyes.”

Woodrow Wilson

Materials
Activity Sheet 6—Inventor’s Journal •
Appendix E—Description of Problem Solving •
Appendix O—Invent Iowa Program Information •
Appendix P—Evaluation Rubric •
Appendix R—Information for Parents of Inventors •

Timeline
1946 AD
The first microwave oven is patented.
Student Inventing Practice

1. To set the tone for inventing, review Shlesinger’s steps of inventing (Appendix E—Description of Problem Solving). Be sure that the steps are listed in the Inventor’s Journals, so that students can refer to them as they invent. The first activity can either be whole-class or small-group. Organizing into small groups allows for a mini competition. I’d like us to think about problems that relate to eggs. Have students brainstorm ideas in their journal. Share. (Possible responses include: can not buy them individually, lack of color variety, fragile.) Our focus is going to be on the fragility of eggs. My challenge to you is to invent something that will prevent an egg from breaking when dropped from an eight-foot ladder. This is step one, identification. It is recommended that a letter be sent home explaining both the egg drop and the individual invention project, so that parents can provide materials and offer support.

2. Because our problem is to prevent an egg from breaking, what type of background might we need to know? This is the foundation step. Discuss possible background such as packing materials and cartons. Students are not expected to research at this point. The goal is to raise awareness of what might be included during the foundation step.

3. The data step requires us to develop some questions about the invention. The purpose of questioning is to gather necessary information about the invention. If students are going to work in groups, have the groups meet and generate possible questions. Review with the students that the 5W questions are to be used. Because this egg problem is a contrived scenario, the list of questions may be short. Students should understand that when an inventor recognizes a problem or need, questions regarding an invention are more numerous. This is an example of how contrived scenarios do not exactly replicate the inventive process. The purpose of the egg task is to apply the steps of inventing in a nonthreatening and fun situation.

4. The next step, imagination, requires us to begin creating the invention. Your task is to think of possible ways to prevent the egg from breaking. Sketch your ideas. Label your sketches and list all materials and possible costs. Keep in mind that inventors revise their thinking as they work. Your first idea won’t be your last idea. Inventors should be open to considering many possibilities as well as questioning their thinking, so encourage groups of students to discuss ideas prior to making sketches. Students should use their Inventor’s Journal for invention sketches.

5. Once students have completed sketches of their inventions, bring the class together to share their ideas. Now that we have seen the ideas, what would inventors do next? The last step of inventing that we have studied is looking for limitations. As a group, discuss possible limitations on the sketches and ideas. Have students alter their sketches based on feedback that they receive.

6. Have students build their inventions. Test the inventions as a class. Review Shlesinger’s steps of inventing in the context of the egg drop. Reinforce to students that they are expected to do the identification, foundation, and data steps prior to imagining possible inventions. There should be evidence in their journals of all five steps for the next activity.
7. In preparation for the Invent Iowa program, students should develop an invention individually. Further information on Invent Iowa can be found in Appendix O. Present a summary of the Invent Iowa program to the class. In order to gain experience as inventors, I would like each of you to invent something by yourself. Keep in mind the various activities we have done throughout this study, especially the Inventor’s Journal and the steps of inventing. Perhaps some of you will want to use this invention for Invent Iowa. If your building has games from the K–2 portion of this curriculum or inventions of past students, show them as examples.

8. We will begin the inventing process in school, but the actual building of the invention will take place at home. I would like you to consider problems or needs that require solutions. As you know, inventors begin by identifying either a problem or need. Encourage students to brainstorm ideas in their Inventor’s Journal. This should be done independently and is not a group activity. Remember, you are listing as many problems and needs as you can! A good way to get students thinking about possible needs or problems is having them focus on school or home needs. Each student should generate 3–4 possible inventions in this step.

9. Next, have students focus on the foundation and data steps. Work on the foundation and data steps can be as structured as you feel necessary. Remind students that foundational research may range from library materials to personal interviews to Internet sources. Guiding questions, a created activity sheet, individual conferences, or a group discussion are as possible strategies to cover these early steps of inventing. If students have difficulty with developing questions about their invention for the data step, you may want to develop a possible list of questions as class. Questions that lead to the clarification of a student’s ideas are beneficial. Some examples of clarification questions are:

- Can you tell me how you arrived at that idea?
- What do you mean by...?
- Are you saying (repeat student statement)?
- Are there other possibilities here?
- What other ideas did you consider? Why did you reject the other ideas?
- Where will this idea lead?
- What other changes are possible?
- Can you explain how this will work?
- What might keep your idea from working well?
- What questions do you have about your idea?
- Has anything happened that might have taken your idea in a different direction?
10. Students are expected to maintain an authentic Inventor’s Journal that includes the components discussed in class as well as evidence of the five steps of inventing. Any ideas related to these steps generated in class should be in the Inventor’s Journal. Inventor’s Journals are required for Invent Iowa.

11. The imagination and limitations steps should be done at home. Set a date (approximately 3–4 weeks) when inventions and Inventor’s Journals are due. Send home a letter to parents (such as Appendix R—Information for Parents of Inventors) informing them of invention guidelines, expectations, and deadlines. Refer to Appendix P—Evaluation Rubric for guidance on evaluating student inventions.
Inventors Fair

Purpose

An Inventors Fair is an excellent culminating activity for the study of invention. Whether it is a local competition or strictly a celebration, the atmosphere should be one of enthusiasm and pride. The key is to plan early, include invited guests, and have fun. This unit gives some basic ideas and tips for planning an Inventors Fair.

“Anything one man can imagine, other men can make real.”

Jonathan Swift

Materials

Appendix O—Invent Iowa Program Information

Timeline

1965 AD
The first 3D hologram is invented.
1. The purpose of this activity is to make invention a celebration. An Inventors Fair is an excellent opportunity for students to showcase their ingenuity. The structure of an Inventors Fair is up to you; it may even serve as a local convention (especially if several classes or grades within a building participate). Information for the Invent Iowa State Convention can be found in Appendix O, including evaluation criteria. It is suggested that at a minimum, inventors display either a model or prototype, use an Inventors Journal, and present their inventions to an audience. You may wish to invite younger grades and friends and relatives to the Inventors Fair. An Inventors Fair that is set in either a gym or multipurpose room allows invited guests to view the inventions easily. If you are interested in providing feedback to the inventors, friends and relatives could be used to evaluate the creations. Early preparation and organization are vital for a successful Inventor’s Fair. Be sure parents, students, other classrooms of students and teachers, and the local newspaper are informed well in advance. Remember that this activity is a celebration of invention.

NOTE: Please share the details regarding your Inventors Fair with the Invent Iowa Administrator at the Belin-Blank Center. We encourage your input, and are very interested in compiling your ideas and suggestions for other teachers. (800/336-6463 or http://www.education.uiowa.edu/belinblank).
Futuristic Inventing Application

Purpose
Invention is an on-going process, and successful inventors are truly visionary in their ability to think about the future. The purpose of this unit is to convey the importance of anticipating future needs. Students are asked to project well into the future and envision future needs that may one day require invention. Activities in this unit help students to predict how present-day items may be used in the future and to anticipate how future inventions might impact their life.

Materials
Activity Sheet 6—Inventor’s Journal • Community pile •

“The universe is full of magical things patiently waiting for our wits to grow sharper.”

Eden Phillpotts

Timeline
1980 AD
Rubik’s cube is invented by a Hungarian professor.
1. I would like for you to each write three predictions about yourself that you feel certain will come true. Write these in your Inventor’s Journal. Share. If going to college is one of your predictions, why is it useful to know this many years ahead of time? (Possible responses include: develop good study habits, save money, visit and collect information about schools, work on writing or other subjects, and get good grades.) If students can make accurate predictions on certain aspects of their lives, they will see that being prepared now can lead to success in the future. Good predictions require an ability to know what could possibly occur. Great inventors seem to have this sense of being able to “see” what could possibly occur. Discuss how this ability could make a great inventor (e.g., anticipation of needs gives an inventor a head start in the process of inventing). Once you can identify a need or problem of the future, you can begin developing an invention. Great inventors can turn what they see into a reality.

2. Let’s focus on computers. We can be fairly sure that computers will continue to be an important part of our lives in the future. For a while, computers were expected to take over the job of the classroom teacher. Some thought that one day someone would invent a “teaching computer.” So far, however, no teaching program has been invented that offers everything a real teacher can offer. The role of a human in the classroom seems to be very important. Instead of inventing a computer that replaces humans, inventing computers that help humans do their jobs better has been more common. For instance, a computer program that helps people keep track of important events and dates has proven to be very successful.

In your journals, I would like you to make two lists. On one list, I would like you to record things that you feel computers will control in the future. On the second list, I would like you to record things that you don’t feel computers will ever control. Inventors do this type of thinking to develop potential ideas for inventing. Be ready to support your ideas. Have students share their lists.

3. I would like you to draw a picture of a room in your house the way you think it will look 15 years from now. Label and provide descriptions of items in the room. Think about how life might be different 15 years from now before you begin to draw. Be sure to include new inventions in the picture. Have students share their drawings.

4. Students will now have an opportunity to build a futuristic invention. If your community pile is very sparse, you may want to send a note home requesting more materials. I would like you to build one of the inventions in your picture. Because this is just an opportunity to generate creative thoughts, we won’t progress through all of the steps of inventing. Begin by brainstorming and writing down some more ideas about your invention. Be sure you can answer what the invention does and how it looks. Once you have completed a sketch of your invention, you may begin building. Completed inventions should have names and a comprehensive description of what they do. The quality of the invention is enhanced through prior planning on the student’s part. You may want to evaluate sketches before building begins.
5. We have discussed the various categories into which inventions are grouped or classified. Who remembers some of those categories? For your last persuasive piece, I would like you to select the one category in which you think invention will make the most difference over the next 100 years. Be sure you support the category you choose in your paper.

*Note: There is a great deal that you could do that focuses on the future and inventing. A study of science fiction would fit in well at this point.*
Time Line

Name ____________________________________________
If I have to look at this berry stain one more day ...
Inventor: ____________________________________________

Where and when was he/she born? ____________________________________________

What are three interesting facts about this person when he/she was a child?
1. ____________________________________________
   ____________________________________________
   ____________________________________________

2. ____________________________________________
   ____________________________________________
   ____________________________________________

3. ____________________________________________
   ____________________________________________
   ____________________________________________

What was his/her most important invention? Why?
   ____________________________________________
   ____________________________________________
   ____________________________________________
   ____________________________________________
   ____________________________________________
   ____________________________________________
Draw a picture of his/her most important invention:

What are other inventions he/she invented?

_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________

If I met this person, I would like to ask him/her:

_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________
Directions: Interview six people to hear their opinions about inventions.

<table>
<thead>
<tr>
<th>Person Surveyed</th>
<th>The most important invention is...</th>
<th>An unnecessary invention is...</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
What:

Materials and tools:

Steps:

Problems:
Journal

Date _______ Time _____ Name __________________________ Witness ____________________

Entry:

_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________

Sketches:

Journal

Date _______ Time _____ Name __________________________ Witness ____________________

Entry:

_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________

Sketches:
Use the following questions to guide your research on an inventor. A good inventor keeps all ideas and responses in an inventor’s journal. Start recording your ideas and responses here.

1. What are some interesting facts about the “early years” of your inventor?

2. What are some events or people that may have influenced the inventiveness of this person?

3. What are some positive things that happened in this person’s life? What are some negative things?

4. Choose one of your inventor’s inventions to elaborate on. Include a picture on a separate piece of paper.

5. In your opinion, what is the greatest strength of this invention?

6. Based on your research, what advice do you think your inventor would give to beginning inventors?
Read each of the following statements. Circle the letter that comes closest to your opinion.

<table>
<thead>
<tr>
<th>False</th>
<th>Not Sure</th>
<th>True</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**When inventors were kids, they...**

1. acted similarly to other children their age. F  ?  T
2. read a lot of books. F  ?  T
3. were good at building things. F  ?  T
4. were serious and hard working people. F  ?  T
5. always completed one thing before starting another. F  ?  T
6. had a lot of odd ideas. F  ?  T
7. did not spend much time just having fun. F  ?  T
8. bothered adults by asking too many questions. F  ?  T
9. liked taking things apart. F  ?  T
10. wanted others to like what they did. F  ?  T
11. were very smart in school. F  ?  T
12. usually obeyed their parents. F  ?  T
13. had many different interests. F  ?  T
14. were relatively happy as children. F  ?  T
15. always carefully finished their school work. F  ?  T
16. behaved well in school. F  ?  T
17. often quit when something they were working on did not go well. F  ?  T
18. liked working alone on projects. F  ?  T
Invention Record

Inventor’s Name ___________________________ Grade __________

Name of Invention __________________________________________________________

1. What is the purpose of the invention?

2. What problem or need does it solve?

3. Tell how your invention is original or what improvement it makes on an existing product.

4. How does it work?

5. How is it made?

6. On the back of this page, draw a detailed picture of your invention.

Adult Witness _____________________________________________________ Date ________

Adult Witness _____________________________________________________ Date ________
Web of Invention Sub-Topics

Invention

- Important Inventors
- Long Ago
- Inventor’s Journal
- Steps to Reinvent
- Problems Today
### History Chart

<table>
<thead>
<tr>
<th></th>
<th>Soap</th>
<th>Metal Money</th>
<th>Fireworks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year Invented</strong></td>
<td>3000 BC</td>
<td>2600 BC</td>
<td>1000 BC</td>
</tr>
<tr>
<td><strong>Where Invented</strong></td>
<td>Phoericle (Costal area of Syria, Lebanon, and Israel)</td>
<td>Lydia (Part of country now known as Turkey)</td>
<td>China</td>
</tr>
<tr>
<td><strong>Fact</strong></td>
<td>Soap was prepared from goat fat and wood ash.</td>
<td>The first coins were bean shaped.</td>
<td>In many countries fireworks are used to celebrate festivals.</td>
</tr>
<tr>
<td><strong>Fact</strong></td>
<td>Soap was used in trading.</td>
<td>Coins were made from a mixture of gold and silver.</td>
<td>Italians were early leaders in staging firework displays.</td>
</tr>
<tr>
<td><strong>Fact</strong></td>
<td>The importance of soap was not recognized until 200 AD.</td>
<td>Each coin had a stamped design on it.</td>
<td>Bamboo was used to make early fireworks.</td>
</tr>
<tr>
<td><strong>Fact</strong></td>
<td>Soap was first used in medicine.</td>
<td>Historians believe that China and India invented coins independently.</td>
<td>Small lumps of charcoal were used to make sparks.</td>
</tr>
</tbody>
</table>

*Sources: Encyclopedia Britannica, The World Book Encyclopedia, and Encyclopedia Americana*
Air-conditioning
Airplane
Band-Aids®
Battery
Bicycle
Bifocal Glasses
Blood Bank
Bunsen Burner
Cardiac Pacemaker
Cash Register
Chemotherapy
Chocolate Chips
COBOL (computer language)
Color Photograph
Compound Microscope
Dishwasher
Disposable Diaper
Drinking Straw
Elevator
Golf Tee
Hair Relaxer
Horseshoe
Kevlar® (material in bullet-proof clothing)
Lasting Machine (automatic shoemaker)
Liquid Paper™ (white-out)
Mars Rover
Microphone
Motorcycle
Microwave Oven
Pasteurization
Peanut Products
Piano
Pocket Watch
Refrigerator
Rubber Band
SCUBA
Steam Engine Lubricator
Steel Plow
Submarine
Telephone
Toilet Paper
Traffic Signal
Typewriter
X-rays
Zipper

Willis Haviland Carrier
Orville and Wilbur Wright
Earle Dickson
Alessandro Volta
Kirkpatrick MacMillan
Benjamin Franklin
Charles Drew***
Robert Bunsen
Wilson Greatbatch
James Ritty
Gertrude Elion*
Ruth Wakefield*
Grace Hopper*
James C. Maxwell
Hans Janssen
Josephine Garis Cochran*
Marion O’Brien Donovan*
Marvin Stone
Eli Otis
G. F. Grant**
Madam C. J. Walker***
O. E. Brown**
Stephanie L. Kwolek*
Jan Matzinger**
Bette Nesmith Graham*
Donna Shirley*
David Hughes
Gottlieb Daimler
Dr. Percy LeBaron Spencer
Louis Pasteur
George Washington Carver**
Bartolomeo Cristofori
Christian Huygens
J. Standard***
Stephen Perry
Emile Gagnon and Jacques Cousteau
Elijah McCoy**
John Deere
Cornelius Drebble
Antonio Meucci
Joseph Coyett
Garret Augustus Morgan**
Christopher Latham Sholes
Wilhelm Roentgen
Whitcomb Judson, Gideon Sundback

Note: This list is a small sample of inventors and includes only one invention for each person. A (*) signifies a female inventor, and a (**) signifies a minority inventor. All others are white males.

Inventors are creative people who apply creative thinking to problem solving. It is believed that curiosity, openness to experience, access to a field and/or domain, perseverance, and divergent thinking enhance creativity. This appendix is intended to raise student awareness that they possess some of the skills that inventors use.

The creative process is complex and therefore difficult to describe in a sequential manner because steps and processes may overlap.

Mihalyi Csikszentmihalyi identifies five stages of the creative process:
- immersion
- incubation
- insight
- evaluation
- elaboration

E. Paul Torrance’s four creative thinking processes are:
- fluency (also referred to as “brainstorming” in this guide)
- flexibility
- originality
- elaboration
Problem Solving Defined
Problem solving is a series of steps to be followed to reach a solution to a need or a want.

Basic Problem Solving Steps:
1. **Identification**: Observe the facts. Answer these questions: What is known? Not known? Who needs/wants a solution? Who has the right to change it? Is there time to create a solution? Why is a solution sought? The answer to these questions are the facts to be considered when solving the problem.

2. **Foundation**: Generate 3–5 possible solutions for solving the whole problem or for each detail of the problem.

3. **Data**: Apply practical knowledge and skills to test solutions by keeping a journal, collecting data over a period of time, computing averages or charting information, and/or seeking other knowledge and skills appropriate to a problem/solution.

4. **Imagination**: Apply decision-making skills. Use the facts identified in step 1 and the information gained in step 3 to decide which solution will be implemented.

5. **Limitations**: Implement solutions. The factors identified in step 1 will assist an inventor as he/she puts the solution into practice. Implementation may require personal or group effort.

(Adapted from *How to Invent: A Text for Teachers and Students* by Edward Shlesinger, educator and inventor)

The steps above are listed sequentially, but they may be applied in any order to address the solution to a problem. Intuition and insight play important roles in each of these steps.

Purpose of Problem Solving
Problem solving is linked to leadership, creativity, survival skills, and improvements in the quality of life. Therefore, it is advisable that students learn a system for problem solving that can be adopted and adapted as needed.
Creative Thinking Process Tools:

- Fluency/brainstorming
- Flexibility
- Elaboration
- Originality

5W’s and 1H

- Who?
- What?
- Where?
- When?
- Why?
- How?
Fire Escape Invention

APPENDIX G

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Appendices 77
When someone has an idea that he/she feels may be worthy of a patent, he/she should investigate how to protect it. It is important to remember that applying for a patent is an expensive and time-consuming process. The U.S. Patent and Trademark Office (http://www.uspto.gov) publishes documents that provide information and guidance for inventors regarding the patent process. Titles include:

- The Story of the United States Patent Office
- Patents and Inventions: An Information Aid for Inventors
- Patent News (current laws of the Patent Office)
- The Official Gazette of the United States Patent and Trademark Office (weekly patent news)
- Index of Patents (annual index of the Gazette)
- Manual of Classification (list of invention classes and sub-classes)
- Guide for Draftsmen

These publications can be requested (for a fee) from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. The prices of publications change, so it is advised that you first write to request current cost. Many public libraries also carry these publications.


Patent, Trademark, and Copyright Defined

A patent is a grant issued by the U.S. Government giving inventors the right to exclude all others from making, using, or selling their inventions within the United States, its territories, and possessions. There are three kinds of patents:

- utility patents: granted for a term of 20 years to inventor or discoverer of any new and useful process, machine, manufacture, composition of matter, or any new and useful improvement thereof
- plant patents: granted for a term of 20 years on any distinct and new variety of asexually reproduced plant
- design patents: granted for a term of 14 years on any new, original, and ornamental design for an article of manufacture

A trademark (™) is a word, name, symbol, design, combination of word and design, or slogan used by a manufacturer or merchant to identify its goods or services. It distinguishes an item from those manufactured or sold by others. When it is used for services, a trademark can be called a service mark. Trademark rights come from using the mark, and marks are protected under common law from the time they are first used. While there is no requirement to do so, owners who have used marks and who have a bona fide intention to use them in federally regulated commerce may register them with the U.S. Patent and Trademark Office. This provides the owners with certain procedural and legal advantages. The use of a trademark with a mark indicates a claim of rights to it. An ® symbol is used when the mark is Federally registered. This type of registration may be renewed every ten years, as long as the registrant is still using the mark.

A copyright (©) gives an author certain exclusive rights for a limited time: the right to reproduce the copyrighted work, to prepare derivative works, distribute copies, perform the work publicly, and display the work publicly. Copyright law protects maps, charts, books, musical works, dramatic works, photographs, paintings and other works of art, motion pictures, and sound recordings. Under current law, these works are protected for the life of the author plus 70 years.

Inventor Sketches

Inventor Sketches

Lydia O’Leary was born with a red-wine birthmark that covered half of her face. She spent much of her time hiding from her classmates. During recess she hid in the restroom. She hid when other children wanted her to answer questions about the birthmark. Her parents were concerned and took her to doctors, but none of them had a solution. If they had tried to remove her birthmark, her face would have been terribly scarred. She even tried getting a tattoo that matched the color of her skin, but it did not work.

Even though the birthmark was upsetting to Lydia, she set goals and tried to achieve them. She finished high school and graduated from college. She then started applying for jobs in New York City. However, her birthmark was unsettling to others. The job interviewers did not think she should work with the public. The only job she was able to get was as a painter of placards.

Stop reading aloud here, continue with the unit.

Share the rest of the story after the students have completed their creative problem solving plans.

Lydia did not plan to become an inventor. One day while she was painting placards, she made a mistake. To fix the error she painted over a dark color with several layers of lighter paint. Then she thought about it. Why not cover her birthmark the same way?

When she tried to cover it with makeup available in the stores, it did not cover her birthmark. She realized that the makeup she needed did not exist. So she went to the corner drugstore, bought some makeup products, and began experimenting with them. She also talked to a chemist. After she concocted a makeup, she put it on her face and it covered the birthmark! Wearing the makeup, Lydia applied for a job as a salesperson in a department store. She was hired in the hat department. After three weeks, she was the top salesperson.
Lydia’s life was changed. She told an interviewer for Reader’s Digest that when she communicated her excitement to her doctor, he encouraged her to share her makeup with others. She decided to produce it as a product that could be sold in stores. While most makeup foundation is less than 10% pigment, Lydia’s was 40%. That is what made the difference. It was specifically designed for people who wanted to cover unattractive marks. Lydia chose a name for it that described the effect: Covermark. “Covermark” is the original brand of corrective cosmetics from Lydia O’Leary designed to give the look of a perfect complexion.

When Lydia applied for a patent, she was turned down. The government did not grant patents for cosmetics. Cosmetics were thought of as applications that added to one’s beauty. That was the point of Covermark, according to the examiner. Lydia did not see it that way. Covermark did not just make her more beautiful, the product made it possible for her to function in society. She appealed the decision.

When Lydia presented her case to the eight judges in the Court of Appeals in Washington, D.C., she was again refused a patent. It was then that she realized that the judges did not understand. She asked to be excused. When she had returned, she had removed her makeup and revealed her face. The judges were shocked by the change in her appearance. They realized Covermark’s value: it could help others with birthmarks or scars. They granted her a patent. She is the only person who has ever been granted a patent for a cosmetic.

Lydia started a company to produce and market her product. Although she died in 1957, her company still exists today. Lydia never forgot the childhood embarrassment caused by her birthmark, and because of this, if children with birthmarks or scars contact Covermark, they will provide them with free makeup and instructional videos on how to apply it. Lydia O’Leary became an inventor because she needed a product that had not been made yet, and her invention continues to help people today.

The **Solution-Finding Grid** is based on the reading class problem on pages 38–39. Sample problem questions: How might the student find time to work on reading? In what ways might the student better understand the reading homework?

<table>
<thead>
<tr>
<th>Idea-finding possibilities</th>
<th>Cost</th>
<th>See results quickly</th>
<th>Parents will allow it</th>
<th>Resources are accessible</th>
<th>Relates directly to classroom material</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Get extra help from teachers</td>
<td>5</td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>24</td>
</tr>
<tr>
<td>Purchase a reading help program</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Redo class assignments at home</td>
<td>6</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>29</td>
</tr>
<tr>
<td>Get more books of interest to practice reading</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>Get a tutor</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>Make study guides</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>22</td>
</tr>
</tbody>
</table>

*Note: As you rate possibilities, it may be necessary to have a discussion to assign a number to those that seem very close. Be sure to assign each possible solution with a different rank. While two solutions might appear equally low on costs (e.g., redoing assignments at home and having a teacher provide extra help), you may need to help students take a close look and see where they can make a distinction. For example, getting extra help from a teacher versus redoing assignments at home might carry a subtle, but very real cost: teachers may ask for higher pay in response to longer work hours. Be sure it is clear to the students that just because one idea seems the best, it does not mean that it will solve the problem. Some problems require many attempts, as some solutions result in different problems later. In this grid example, the idea of redoing classroom assignments at home seems to be the best solution to try first, because it consistently ranks high according to several criteria (not just one or two).*
The Calvin Taylor model describes talent areas of productive thinking, communication, planning, decision making, and forecasting. This work is best known as talents unlimited, a program of the National Diffusion Network of the U.S. Department of Education. The Taylor model incorporates both the critical and creative elements of thinking. Every element of the Taylor model is used when a child invents. Rather than a taxonomy, this is a thinking-skills model that describes the essential elements of thinking, beginning with the academic talent and then incorporating the other talent areas, as described in more detail below.

- **Productive Thinking** promotes creative thinking in the Taylor model. It suggests thinking of many ideas, varied ideas, unusual ideas, and adding to those ideas.

- **Communication** has six elements which include:
  - give many, varied, single words to describe something
  - give many, varied, single words to describe feelings
  - think of many, varied things that are like another thing in a special way
  - let others know that you understand how they feel
  - make a network of ideas using many, varied complete thoughts
  - tell your feelings and needs without using words.

- **Planning** requires that students learn to tell:
  - what they are going to plan
  - the materials that they will need
  - the steps that they will need to accomplish the task
  - the problems that might occur.

- **Decision Making** teaches the student to:
  - think of the many, varied things that could be done
  - think more carefully about each alternative
  - choose one alternative that they think is best
  - give many, varied reasons for the choice.

- **Forecasting** is the last of the five talents and requires students to make many, varied predictions about a situation, examining cause-and-effect relationships.

The telephone was first patented in 1876 by Alexander Graham Bell, but he was not its original inventor. The telephone was invented by Italian-American Antonio Meucci more than 20 years earlier. Meucci’s story reminds us how important it is to get a patent for an invention.

Meucci immigrated to America from his home in Florence, Italy, in 1845. He settled in the New York City area and spent much of his time inventing. He created 30 working telephone models between 1850 and 1862. Meucci wanted to patent his invention, which he called the “teletrofono,” but he did not have the $250 it cost to apply for one. He tried to raise money for the patent by arranging a demonstration at the Western Union Telegraph Company. Meucci did not succeed in raising enough money, and he left his telephone models at Western Union for storage.

In 1876, Meucci heard that a man named Bell had received a patent for the telephone. Bell, who worked at Western Union, had stolen Meucci’s ideas and claimed them as his own!

Meucci spent many years fighting Bell in court over the rights to the telephone patent. Before the case was settled, Meucci died without profiting from or receiving proper credit for his invention. In 1893, Bell’s patent expired, and the case of the true inventor was left unresolved.

Finally, in 2002, the United States Congress passed a resolution recognizing Antonio Meucci as the true inventor of the telephone.

Invent Iowa is a comprehensive, statewide program developed to assist Iowa's educators in promoting the invention process as part of their regular K–12 curriculum. Since 1987, Iowa students have had the opportunity to express their inventiveness and solve problems in an educational way. Local schools and AEAs provide opportunities to showcase student inventions at local and state Invention Conventions. The culminating invention experience for Iowa students in grades 3 through 12 is the Invent Iowa State Invention Convention. Students must receive an official invitation to attend the state convention. This invitation is issued by an authorized Invent Iowa Area Education Agency coordinator. All inventions at a convention must be a completely new product or significant new application of an existing product. The invention must also be original student work.

At the convention, students are expected to give a brief presentation to the evaluators, identifying the problem the invention addresses, the process of developing the invention, and how the invention works to solve the problem. Students should also be prepared to answer questions concerning the invention, including critical thinking, research, and problem-solving activities. Inventions are evaluated based on the model or prototype, the display, the student presentation, the Inventor's Journal, and the discussion of the invention and the invention process.

The Belin-Blank Center Website (http://www.education.uiowa.edu/belinblank) is an excellent resource for more details regarding Invent Iowa, including:
- How to make an invention display board
- What makes a good invention
- The inventor's journal
- A guide for convention evaluators
- A sample Invent Iowa evaluation form
- Invention feedback ideas
- Rules for the convention.

We believe Invent Iowa makes a significant contribution to the education of Iowa students. The invention process teaches many important skills: critical thinking, problem-solving, mechanical ability, and communication.

If you would like to serve as an evaluator for the convention, or have questions about the program, please call the Belin-Blank Center at 800/336-6463.
Invent Iowa has developed an Evaluation Rubric to provide convention evaluators, teachers, and students with a coherent and uniform way to evaluate a student invention. The Evaluation Rubric provides uniformity throughout the Invent Iowa program in defining product and presentation excellence.

During product development, the inventive student has the opportunity to measure the characteristics of his/her invention in terms of the Invent Iowa Evaluation Rubric. After project completion, the Invent Iowa Evaluation Rubric provides guidelines for evaluators examining inventions at local, regional, and state-level invention conventions.

The United States Patent and Trademark Office (USPTO) has determined that in order to receive a patent, an invention must be “new, useful, and nonobvious.” Invent Iowa has used this information to form three categories of invention assessment (novelty, usefulness, and appeal). Each category has two questions, forming the six criteria for invention. For example, the criterion of “novelty” is measured with the questions “Does the invention involve a new idea?” and “Is the invention a fresh or unexpected idea?”

For each of the six invention criteria, the Evaluation Rubric provides four possible levels of mastery. The inventor will be assessed on his/her level of mastery of each criterion. The inventor’s diagram, model or prototype, Inventor’s Journal, and oral presentation (called the criteria for entry) will also be assessed based on the levels of mastery. Each level is assigned a point value used to determine a numerical score for the invention. The levels and point values are:

- **Beginner** (one who is just starting to learn); 2 points
- **Amateur** (one who engages in inventing as a leisure activity, without the skills of a professional); 3 points
- **Skillful** (person with greater proficiency developed through training or experience); 4 points
- **Expert** (one having or demonstrating great skill, dexterity, or knowledge as the result of experience or training); 5 points

Point values are subtotalled along the right side of the form, giving total scores within each criterion for invention and entry. Point values can also be subtotalled along the bottom of the form, giving total scores within each level of mastery. The subtotal from the criteria for invention and from the criteria for entry are added together. Invent Iowa inventors can earn a total score between 20 (for a beginner) and 50 (for an expert).
# Evaluation Rubric

## Criteria for Invention

<table>
<thead>
<tr>
<th>Appeal</th>
<th>Usefulness</th>
<th>Novelty</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Invention</strong></td>
<td><strong>Usefulness</strong></td>
<td><strong>Novelty</strong></td>
</tr>
<tr>
<td><strong>Subheadings</strong></td>
<td><strong>Rules</strong></td>
<td><strong>Points</strong></td>
</tr>
<tr>
<td><strong>Invention</strong></td>
<td><strong>Usefulness</strong></td>
<td><strong>Novelty</strong></td>
</tr>
<tr>
<td><strong>Subheadings</strong></td>
<td><strong>Rules</strong></td>
<td><strong>Points</strong></td>
</tr>
<tr>
<td><strong>Invention</strong></td>
<td><strong>Usefulness</strong></td>
<td><strong>Novelty</strong></td>
</tr>
<tr>
<td><strong>Subheadings</strong></td>
<td><strong>Rules</strong></td>
<td><strong>Points</strong></td>
</tr>
<tr>
<td><strong>Invention</strong></td>
<td><strong>Usefulness</strong></td>
<td><strong>Novelty</strong></td>
</tr>
<tr>
<td><strong>Subheadings</strong></td>
<td><strong>Rules</strong></td>
<td><strong>Points</strong></td>
</tr>
<tr>
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<td><strong>Usefulness</strong></td>
<td><strong>Novelty</strong></td>
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<tr>
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<td><strong>Novelty</strong></td>
</tr>
<tr>
<td><strong>Subheadings</strong></td>
<td><strong>Rules</strong></td>
<td><strong>Points</strong></td>
</tr>
<tr>
<td><strong>Invention</strong></td>
<td><strong>Usefulness</strong></td>
<td><strong>Novelty</strong></td>
</tr>
<tr>
<td><strong>Subheadings</strong></td>
<td><strong>Rules</strong></td>
<td><strong>Points</strong></td>
</tr>
</tbody>
</table>

### Levels of Mastery

- **Beginner**
- **Amateur**
- **Skilled**
- **Expert**

### Points Distribution

- **Appeal**
- **Usefulness**
- **Novelty**

---

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## Criteria for Entry

<table>
<thead>
<tr>
<th>Entry Point</th>
<th>Subtasks</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>J</td>
<td>Is the Inventor's Log thorough and complete?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>L</td>
<td>Is the Inventor's Log a precise and comprehensive representation of the invention?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

- A highly developed and comprehensive working replica of the invention.
- A description of the invention.
- A description of the highlights of the invention.
- A brief statement of the invention idea and solution.
- A partial description of the invention.
- A sketch or drawing of the invention.

### Levels of Mastery

**Amateur**

**Beginning**

**Skilled**

**Expert**

**Inventor**

**Presentation Points**

<table>
<thead>
<tr>
<th>Points</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
</table>

- Elaborate and attractive diagram with all parts clearly labeled and explained.
- An attractive diagram with all parts labeled.
- A simple drawing of the invention.
- A well-developed and comprehensive working replica of the invention.

---

**Note:**

- A clear idea of the invention is presented professionally.
- Communication a high level of knowledge and understanding of the process leading to the invention.
- The invention idea is well described.
- A working replica of the invention is created.
- A sketch or drawing of the invention is presented.
## Evaluation Rubric

<table>
<thead>
<tr>
<th>TOTAL SCORE</th>
<th>Entry Subtotals from page 2</th>
<th>Invention Subtotals from Page 1</th>
<th>Subtotals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Points</td>
<td>Evidence of Expertise</td>
<td>Evidence of Skillfulness</td>
<td>Evidence of Amateur Status</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Evidence of Beginner Status</td>
</tr>
</tbody>
</table>

Comments:
Teaching Materials

- The Association for Women in Science
  (print calendar)
  Detroit Area Chapter
  PO Box 7210725
  Berkley, MI 48072

- The Big Book of Cool Inventions:
  Tons of Inventions, Experiments,
  and Mind Bending Games
  Margaret Kenda and William Kenda
  McGraw-Hill—2000
  ISBN 0071352082

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  Projects in Design Technology
  Barbara Eichelberger & Connie Larson
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  ISBN 0866516271

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  Harriet Hodgson
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  HarperCollins Publisher—1997
  ISBN 0060928204

- Entrepreneurs
  Volume 3 of Readers Theater
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  ISBN 1878707469

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  BT Bound—2001
  ISBN 078572222x
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  Alford E. Brown & Harry A. Jeffcott, Jr.
  Dover Publications—1970
  ISBN 0486225968

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  Delacorte Press—1996
  ISBN 0385321627

• The Best of Rube Goldberg
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  Robert C. Hayden
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  Alfred A. Knopf—1991
  ISBN 0679807829

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  ISBN 1562948946

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  Steve Parker
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  ISBN 1856975746

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• Inventions (Book and CD-Rom)
  Chris Oxlade
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**Websites**

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• Fostering Academic Creativity in Gifted Students:
  http://www.kidssource.com/kidsource/content/academic_creativity.html

• IBM’s Patent Source:
  http://www.ibm.com/ibm/licensing/

• Invent Now:
  http://www.invent.org/index.asp

• The Inventive Thinking Curriculum Project:
  http://www.uspto.gov/web/offices/ac/ahrpa/opa/projxl/invthink/invthink.htm

• InventNet: Inventor’s Network:
  http://www.inventnet.com

• Kids Inventor Resources:
  http://www.inventored.org/k-12/

• The Lemelson-MIT Awards Program:
  http://web.mit.edu/invent/

• Lesson Plans for Teaching Invention:
  http://inventors.about.com/msub11lp.htm?once=true&

• 100 Years of Innovation:
  http://www.businessweek.com/innovation/home/index.html

• The Patent Café:
  http://www.patentcafe.com

• US Patent and Trademark Office:
  http://www.uspto.gov/

• US PTO Kids Pages:
  http://www.uspto.gov/go/kids/
Information for Parents of Inventors

From: ____________________________________
Date: ____________________________________

Your child is interested in making an invention and attending the _________________________ Invention Convention on ________________ in ________________________________.

This is an optional activity. For your child to attend the Invention Convention he/she must complete the necessary requirements according to the guidelines below. All work must be done at home.

1. Each invention must be a completely new product or a new application of an existing product that solves a real (new) problem.

2. The invention must be the original work of the student. Although young inventors may receive adult assistance with power tools in constructing the model or display, all creative design and problem solving activities associated with the invention must reflect the original work of the student.

3. Displays to be presented at the convention should include:
   • Student’s name and title of the invention
   • A statement of the problem identified, the purpose of the invention in solving the problem, a description of how the invention works, and an explanation of how the invention would improve life now or in the future.
   • A working model or a diagram of the invention that provides evidence that it will work. Photographs may be used if the invention is too large for the display area.
   • A display that explains and promotes the invention. Lettering should be neat and all words should be spelled correctly.
   • A written log or journal that documents the inventor’s thought processes and chronological development of the invention. Each entry should include the inventor’s name, date, what was done, parent initials, and signature of the inventor.
   • Documentation that a similar invention does not exits. Students should check catalogs, call stores, and check http://www.uspto.gov (click on Patents and then click on Search Patents).

4. Inventions must be safe. No invention resembling a firearm in appearance or action will be accepted.

5. Electrical power but no running water or other power source will be available for students.

6. The invention must be self contained and displays must fit within a 36” by 36” table space.

More information is available at http://www.education.uiowa.edu/belinblank
Brainstorm—n.-a bright idea; v.-to generate many ideas about a topic in hopes that one or more are bright or useful ideas

Community Pile—a collection of items assembled by the class that are used to assist the inventive process

Contrived Scenario—a written description of a scene with people and/or circumstances that suggest or need a response

Copyright—sole right to print, copy, perform, film, or transfer to different formats a literary, artistic, or musical creation

Data—facts or information

5W's and 1H—six words that assist in thinking and inventing, each beginning with w/h: who, what, when, where, why, how

Invention—a new product or process

Inventive Process—steps taken by inventors to invent a product or process

Inventor—one who makes a new object or process or uses an object in a new way

Inventors Fair—a gathering of inventors who share their inventions with others

Inventor's Journal—a written record of an inventor’s work, containing writing, sketches, and notarized (authorized) signatures that verify existence

Inventor's Toolbox—a collection of symbols that represent steps in the process of invention

Patent—a document granting the inventor sole right to make, use, or sell an invention

Problem Solving—a systematic procedure to take care of a need or want

Research—a process of locating existing information or collecting new information

Trademark—a registered word or symbol that identifies a company or product

Visionary Skills—the ability to imagine what is needed in the future or what the implication of an invention may be
The Connie Belin National Center for Gifted Education was established by the Iowa State Board of Regents in June 1988. The Center was named for Connie Belin in recognition of her leadership in education. The Center was renamed The Connie Belin & Jacqueline N. Blank International Center for Gifted Education and Talent Development in February 1995 by the Iowa State Board of Regents. The new name recognizes the extensive support of Myron and Jacqueline N. Blank of Des Moines, Iowa. The new name also reflects the Center’s increasing focus on international policy issues as well as its diversification into various areas of exceptional talent.

Dr. Nicholas Colangelo, Director, Myron and Jacqueline N. Blank Professor of Gifted Education
Dr. Susan Assouline, Associate Director
Dr. Clar Baldus, Administrator, Rural Schools Program, Inventiveness Programs, State Coordinator for Invent Iowa
Ms. Catherine Blando, Administrator, Curriculum Development
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Mr. Edward McElvain, Administrator, Web Services
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