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Dear Educator,

Welcome to the amazing world of inventing and creative thinking. You are about to embark on an exciting journey of inventive thinking and problem solving. This manual will provide you with a “road map” to guide you and your students on your journey. This manual is both a training aid and a reference guide. As a training aid it will assist in teaching how to stimulate and inspire kids to develop ideas through problem solving. When used as a reference guide, it becomes a handy source of invention-management options to refer to again and again.

This program will explore various ways to conceive of an idea and transform that idea into an invention. It will enable you to convey methods that will manage and organize the inventing process in a systematic and orderly manner.

We are grateful to the United States Patent and Trademark Office for allowing By Kids For Kids Co. to reprint and update this Inventive Thinking Curriculum Project.

Sincerely,



Norman Goldstein
Founder & CEO
By Kids For Kids Co.

This Toolkit is based on the inspirational efforts of a great number of individuals who contributed generously of their energy and talents to the continued development of Project XL educational outreach initiative at the U.S. Patent & Trademark Office.

We particularly wish to recognize the seminal work by:

Donald J. Quigg, Commissioner of Patents & Trademarks, 1985-1989;
Don Kelly
Marion Canédo
Ruth Nyblod
H. Anne Kelly

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Welcome Educators!

General tips to remember:

- Safety, safety, safety. If you are planning to use tools, make sure you instruct the students about your expectations. Immediately remove any student who does not follow the rules. Purchase or borrow safety goggles if you are using tools that might fling parts into the air. It is a good rule to require them to be worn whenever tools are used. Never use any power equipment without direct adult supervision.
- The most difficult challenge is to offer support and encouragement while critiquing or during a peer critique. This is a great time to discuss how to give feedback and how it feels to get and give advice.
- Listen more and talk less. Try to be conscious of facilitating student thinking and problem solving. The struggle is part of the process. An instant answer may not be the best answer. Usually the second or third is the best.
- The process is messy. Be prepared for the mess... and decide how to work with it. The "large box" technique may present space problems, but if the box fits under a student's chair, that may provide a viable option.
- An "inventor conference" with each student provides a good time to check on his or her progress.
- Whenever using a video or tape recorder or taking pictures of any participants, be sure to get their written permission.

Have fun! This should be a fun time for both students and teacher. For Teaching Tips, Additional Activities, and other Resources, visit By Kids For Kids online at www.bkfk.com/toolkit.

The *Inventive Thinking Toolkit* and complete teaching resources can be found on the *By Kids For Kids* web site: www.bkfk.com/toolkit.

Welcome to the next generation **Project XL Curriculum**, a key component in the *By Kids For Kids/Xerox Inventive Thinking Toolkit*. By Kids For Kids Co. is a revolutionary company that helps children understand the inventive process by studying the history of past inventions by children and learning how to create inventions. The Xerox Corporation has a long history of innovation in research and development, and is proud to be a sponsor of this joint project.

The *Inventive Thinking Toolkit*, found on www.bkfk.com, provides comprehensive resources related to inventing and inventors. The web site is designed for use by students, teachers, activity leaders, and parents, and offers a continually updated source of new articles to supplement the Project XL Curriculum.

The inspiration for By Kids For Kids Co. is the number of significant inventions children have created. The *Inventive Thinking Toolkit* is grounded in a constructivist approach that uses collaborative and problem-based learning to integrate and support cross-curriculum content. After using the *Inventive Thinking Toolkit*, your students will have the opportunity to submit their inventions online for patent.

The potential to secure a patent makes the *Inventive Thinking Toolkit* unlike any other educational offering.

RULES FOR AUTHENTIC JOURNAL KEEPING

(Use with your students!)

- Use the journal provided in the kit or online or get a bound notebook. Try not to use a spiral one whose pages tear out.
- Use ink and don't erase or white out anything. If something is wrong, just put a line through it.
- Make notes every day. Write down all the brilliant thoughts you have. . . one of your ideas may turn into an invention.
- Keep an eye out for problems. Watch when people struggle, and think about how something you could invent could help them!
- Record all your ideas for inventions.
- Make sketches and drawings so your idea can be seen.
- List all parts needed to make your invention. Make notes about where they come from and the cost of these materials.
- Explain how you make your model. You may only be able to draw a picture to explain your invention. Some models are difficult to build.
- Find an "inventor coach" if you can. This person will help you think about different ways to solve the problem. He or she may be able to help you build the invention.
- After you write in the book, sign and date your entry. Make sure you have someone witness your entry and sign next to your name.

Inventive thinking has been identified as an essential twenty-first-century skill by the U.S. Patent and Trademark Office (PTO) and the North Central Regional Educational Laboratory (NCREL), among other organizations. Recent developments in technology and innovation have brought renewed interest to invention. The world has dramatically changed during the twenty years since the XL Curriculum was first developed. Since 1985, cell phones, e-mail, and the Internet provide dynamic access to unlimited communication and information. Recent trends in education such as the federal *No Child Left Behind Act* emphasize the need for accountability relative to student achievement in core content areas. The goals of the *BKFK* program complement and strengthen classroom instruction consistent with the directives of standards-based assessment.

When a student is asked to "invent" a solution to a problem, the student must draw upon previous knowledge, skills, and experience. The student also identifies areas where new learnings must be acquired in order to understand or address the problem. This information must then be applied, analyzed, synthesized, and evaluated.

Through critical and creative thinking and problem solving, ideas become reality as children create inventive solutions, illustrate their ideas, and make models of their inventions. The *By Kids For Kids/Xerox Inventive Thinking Toolkit* provides children with opportunities to develop and practice higher-order thinking skills.

America has a rich history of inventors and the economic benefit they provide through products such as the light bulb and the automobile. Now, economists also look to invention and new applications of technology to bring prosperity in our digital age.

While inventive thinking is valuable across the curriculum, it is critical to the STEM (Science, Technology, Engineering, and Math) disciplines. The teaching of inventive thinking is experiencing new attention and renewed interest. The process of inventing involves a complex set of skills and application of prior knowledge. By identifying a problem and finding a solution through inventing a unique product or adaptation of an existing product, students integrate a number of important skills in real-world project-based activity.

A critical issue facing the country is the achievement gap between urban minority students and those in better-resourced (often suburban) schools. Math and science scores have been especially troubling in underserved areas. Educators struggle to find ways to motivate students to take the more challenging coursework needed to create a pipeline of skilled minority and women professionals.

The jobs of the future will require creativity, innovative thinking, and the ability to design solutions. This curriculum, valuable in the 1980s, is now critical.

Project XL—PTO's nationwide educational outreach program founded in 1985—proves that there is an inventor in everyone. Due to the interdisciplinary nature of inventing, this updated version of the Project XL Curriculum is aligned with standards across the curriculum. Additional theories and insights from recent research appear in this version as well. Many new activities are provided to assist with sparking creative juices and guiding the process of inventing. Use this curriculum with this accompanying teacher's guide book, the student journals, and the enclosed DVD.

Answer Key for Scavenger Hunt (Student Journal, page 3)

Who was the first woman to receive a patent? Mary Dixon Kies, from Killingly CT, for a process of weaving straw with silk or thread. **What image is most reproduced in the world?** Mickey Mouse—7,500 items have his likeness on them. **What did Luis Alvarez invent?** In 1949, Luis Alvarez invented a radio distance and direction indicator, important radar systems that were used during World War II to locate and land aircraft (patent #2,480,208). In addition, he collaborated on an invention that changed nuclear theories: a hydrogen bubble chamber used to detect subatomic particles. Alvarez, a famous Hispanic inventor, was born in San Francisco and was awarded the Nobel Prize in Physics in 1968. In 1978 he was inducted into the National Inventors' Hall of Fame. **Who invented Google?** Larry Paige and Sergey Brin invented Google in 1998 when they were only in their late twenties. Their mission was to make all the information in the world accessible and useful. They started it in their dorm room at Stanford University. Now Google is recognized as the world's largest search engine. **What did Lonnie G. Johnson invent?** Johnson, a famous African American, invented the Supersoaker, a water gun with pressurized water delivery that flies a great distance with great accuracy. Since 1990, over 40 million of these toys have been sold. **Who invented the Personal Computer (PC)?** In 1976, Steve Jobs and Steve Wozniak produced a homemade microprocessor computer board in Steve Jobs' parents' garage and called it Apple I.