National Inventors Hall of Fame®

THE I CAN INVENT® MINDSET:

The National Inventors Hall of Fame's Approach to Invention Education

Think back to your most memorable learning experience. Odds are it does not involve a pop quiz or standardized test. Nor does it likely include even the most engaging lecture or seminar. Instead, your mind is probably drawn to an exciting project or an experiment that you developed for your school's science fair. Maybe you are thinking back to that frog you dissected to explore basic anatomy, or even a field trip to a museum where you had the chance to observe a work of art in person.

It is no surprise that the moments in our education we remember most fondly are ones that involve hands-on or in-person experiences. During experiential learning, the pedagogy rejects the idea that students should primarily rely on the memorization of facts disconnected from context. Instead, as psychologist David Kolb explains, this technique creates knowledge "through the transformation of experience." Therefore, "knowledge results from the combinations of grasping and transforming the experience."[1]

A camper tests an LED for one of their inventions.

As our world continues to grow ever more complex, so do the challenges that students will need to confront and overcome. Educators have increasingly stressed the importance of teaching 21st Century Skills, a collection of competencies needed to thrive in today's world, including abilities like problem solving, critical thinking and creativity.[2] While there is near universal agreement on the need to teach children traits that promote adaptability, there exist different opinions as to which skills are most essential.[3] It can be difficult and sometimes overwhelming for administrators and teachers to know exactly what competencies to promote throughout the year given their limited time and resources.

Invention Education as the Solution

In recent years, the emerging field of invention education has provided much-needed clarity by focusing on the importance of problem solving through the act of hands-on creation. According to the Lemelson Foundation, this type of learning refers to "deliberate efforts to teach people how to approach problem finding and problem solving in ways that reflect the processes and practices employed by accomplished inventors."[4]

Just as experiential learning allows students to contextualize the ideas and concepts they learn in the classroom, invention education applies a similar philosophy by adopting the same strategies that some of the most revolutionary innovators employ on a daily basis. This method both eliminates guesswork for educators and helps cultivate a mindset that embraces creativity and perseverance to overcome adversity.

The effectiveness of this approach has been independently verified by Opportunity Insights, a research institute based at Harvard University and led by world-renowned economist Raj Chetty.[5] As part of their groundbreaking study, "Who Becomes an Inventor? The Importance of Exposure to Innovation," the team found that when children are introduced to innovation at an early age, they are significantly more likely to be innovative into adulthood. The type of exposure to innovation is also important, especially if a young child can identify with an inventor to whom they are introduced. For example, "women are more likely to invent in a given technology class if they grew up in an area with many female inventors in that technology class."[6]

1. Kolb, D. A. (2015). Experiential learning: Experience as the source of learning and development. Upper Saddle River, NJ: Pearson Education.
2. Rich, E. (2020, July 28). How Do You Define 21st-Century Learning? Retrieved September 24, 2020, from https://www.edweek.org/tsb/articles/2010/10/12/01panel.h04.html
3. Hanover Research (2011). A Crosswalk of 21st Century Skills. Retrieved from https://www.montgomeryschoolsmd.org/uploadedFiles/about/strategicplan/21stCenturySkills.pdf
4. The Lemelson Foundation. (2019). Researching Invention Education - A White Paper. https://lemelson.mit.edu/sites/default/files/2020-04/ResearchingInventEdu-WhitePaper-2.21.2020.pdf
5. Opportunity Insights. Raj Chetty. Raj Chetty | Opportunity Insights. https://opportunityinsights.org/team/raj-chetty/
6. Bell, A., Chetty, R., Jaravel, X., Petkova, N., & Reenen, J. V. (2018). Who Becomes an Inventor in America? The Importance of Exposure to Innovation Executive Summary. Opportunity Insights. https://opportunityinsights.org/wp-content/uploads/2018/03/inventors_summary.pdf
7. Ibid.,

Unfortunately, the researchers' central findings also identified wide socioeconomic class, race and gender gaps when it comes to innovation. For instance, "white children are three times more likely to become inventors than Black children and only 18% of inventors are female." Additionally, children born into high-income families are a staggering "ten times more likely to become inventors than children from low-income families."[7]

In a recently published white paper, the Lemelson Foundation highlights similar inequities when it comes to patenting and participating in STEM (science, technology, engineering and mathematics) disciplines.[8] The gaps are even more pronounced for "prolific patent holders and leading technology innovators," who are 90% male and close to 95% Asian or white, with much of the diversity that does exist being attributable to those who are born outside the country.[9]

While these statistics are discouraging, fortunately there are things we can do to address these glaring disparities. Opportunity Insights, for example, recommends that increasing exposure to innovation among underrepresented groups (women, minorities and children from low-income families) should be prioritized by policy makers. In fact, if these same groups went on to invent at the same rate as white men from high-income (top 20%) families, America's rate of innovation would quadruple.[10]

The Lemelson Foundation suggests that an effective way to tackle existing inequalities in STEM career fields and among the demographics of patent holders is to introduce invention education into the regular school day as part of a traditional K-12 curriculum. In this way, "schools have the potential to become places where invention can be taught to all and where young people can gain hands-on experiences with the processes, practices and potentials of inventing."[11]

The I Can Invent Mindset

Long before invention education gained the popularity and scholarship that it enjoys today, the National Inventors Hall of Fame® was developing education programs that embrace invention and innovation. For over 30 years, the belief that every child can invent has been a driving force in all we do.

In collaboration with our Inductees, individuals whose inventions continue to improve society, we have identified nine essential skills and traits that unlock creative potential. We call this the I Can Invent® Mindset.

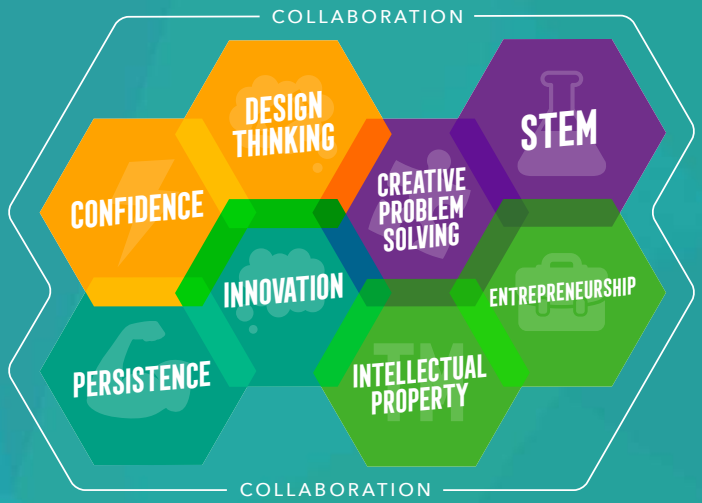
Design Thinking: Design thinking helps children identify and solve problems. By focusing on the people who will use the things they create, children can apply empathy to design solutions that meet their users' needs.

Confidence: Children build confidence as they turn their ideas into reality and begin to see themselves as capable creators. This will benefit them not only in the process of invention but in every area of life.

Creative Problem Solving: Through creative problem solving, children learn to use critical and creative thinking to develop innovative solutions, preparing them to take on both everyday problems and complex challenges.

STEM: By engaging in STEM, children will be better equipped to apply their ingenuity, pursue in-demand careers and make their mark on our rapidly evolving world.

Persistence: The persistence to recover from failure and overcome obstacles is essential for every aspect of life. Our programs foster perseverance through a "create, test and retest" approach to learning.



Innovation: The drive to innovate is what moves society forward. By engaging in hands-on challenges involving real-world issues, children are encouraged to dream up new inventions and improve upon existing ones.

Intellectual Property: As they discover the power and purpose of intellectual property (IP), children recognize the value of their own ideas. With an understanding of IP, children are prepared to protect their rights as creators.

Entrepreneurship: By exploring entrepreneurship and building basic business skills, children become curious, creative risk-takers and self-assured leaders who follow their dreams and can inspire others to do the same.

Collaboration: Acting as a unifying force, collaboration is essential to building on each of the other core aspects of this mindset and produces even more creative ideas and solutions.

8. The Lemelson Foundation. (2019). Researching Invention Education - A White Paper. https://lemelson.mit.edu/sites/default/files/2020-04/ResearchingInventEdu-WhitePaper-2.21.2020.pdf
9. Ibid.,
10. Bell, A., Chetty, R., Jaravel, X., Petkova, N., & Reenen, J. V. (2018). Who Becomes an Inventor in America? The Importance of Exposure to Innovation Executive Summary. Opportunity Insights. https://opportunityinsights.org/wp-content/uploads/2018/03/inventors_summary.pdf
11. The Lemelson Foundation. (2019). Researching Invention Education - A White Paper. https://lemelson.mit.edu/sites/default/files/2020-04/ResearchingInventEdu-WhitePaper-2.21.2020.pdf

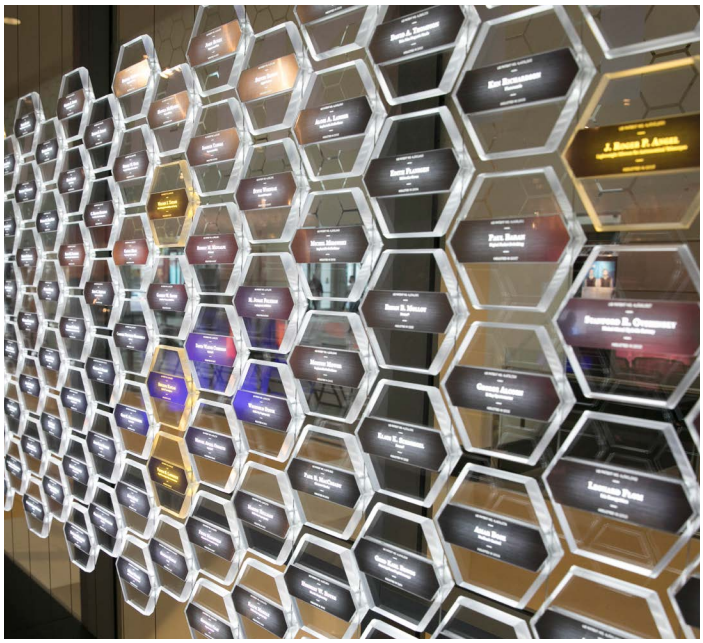
For Alaina Rutledge, vice president of education research and development at the National Inventors Hall of Fame, and her team of education experts, keeping these attributes top of mind when creating new curricula is essential to the impact our education programs continue to make year after year.

Below are some of Rutledge's thoughts on invention education, and how the design of the I Can Invent Mindset is a reminder that not only do great ideas build on one another, but that there is strength in collaboration.

The Strength of the I Can Invent Mindset

By Alaina Rutledge

Invention education provides a broad platform for students to develop skills necessary for college, career readiness and success. At the National Inventors Hall of Fame, we have spent many hours drilling into the essence of invention education and believe we represent the collective wisdom, experience and insights of some of our nation's greatest innovators. Through our relationships with hundreds of prolific innovators who have been Inducted into our Hall of Fame, we know that there are a thousand pathways that lead to and through invention. There is not one prescribed formula for inventing. There are, however, a set of common themes that we hear repeatedly about what it takes to successfully innovate.



The Gallery of Icons, an illuminated exhibit honoring each of our Inductees.

We've represented this in our I Can Invent Mindset. The honeycomb pattern of its design serves as a framework for more than just this graphic. It is also the design of our Gallery of Icons™, located at the National Inventors Hall of Fame Museum in Alexandria, Virginia.

We believe that invention education should foster a culture of acceptance accompanied by a well-established I Can Invent Mindset that provides a platform for participating in innovation equitably. This mindset helps students to not only build confidence in their own abilities but also realize that everyone has the potential to innovate.

A Mindset for Continuous Improvement

Never has the rate of change and disruption throughout the world been more apparent than it is right now. Given these circumstances, a common concern shared by parents and educators alike is how to best prepare students to overcome complex challenges that are difficult to predict and prepare for.

For more than 30 years, we have maintained that the best answer is to help children develop a mindset that embraces adaptation and the creative process. Therefore, the I Can Invent Mindset's most important takeaway is not a physical prototype or invention. Instead, what truly matters are the valuable experiences that can only be gained through the act of creating. Thanks to our enduring partnerships with our Inductees, we know the skills and attributes that make up the I Can Invent Mindset are effective and proven to help overcome obstacles of all kinds.

An inventor's work is never finished because they know that progress and improvement are always possible. We have been privileged to instill this spirit of optimism in millions of students across the country and believe that by using the I Can Invent Mindset, together we can invent a better future.

Camp Invention participants work together to design eco-friendly flowers.

Inductee Edmund O. Schweitzer III visits with participants at Camp Invention.