

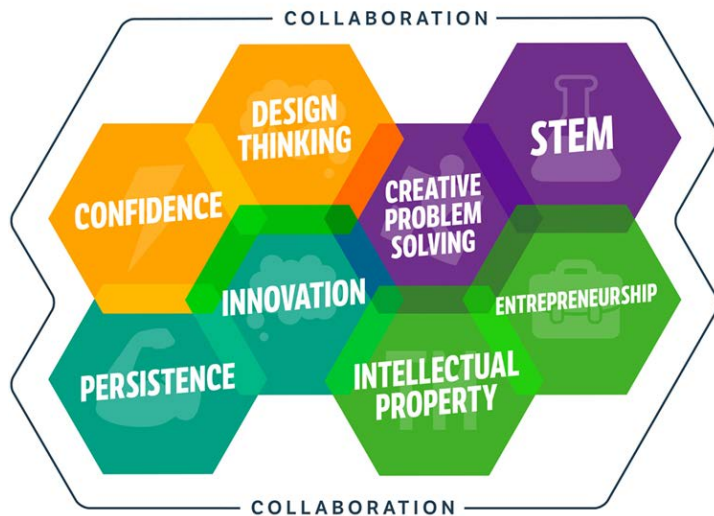


With a mission to promote innovation and entrepreneurship, for over 30 years the National Inventors Hall of Fame® has developed hands-on STEM programs that have inspired millions of students and educators in districts across the country.

Central to our programs' success and impact is the integration of the I Can Invent® Mindset – a comprehensive set of nine skills and attributes that empower students to transform imaginative concepts into practical solutions for real-world challenges.

Recognizing that many of today's students will pursue careers in fields that do not yet exist, we believe that one of the most effective ways to prepare them for the future is to teach them how to adapt and navigate problems that require nuance and creative problem solving.

Through the exploration of stories and insights from our Inductees, children gain invaluable lessons and see real-world examples of the I Can Invent Mindset in action. Instilling the components of this mindset ensures that students are not only prepared for the challenges of tomorrow but also are inspired to actively contribute to the evolving landscape of innovation and creativity.



Design Thinking Puts People First

As the world becomes increasingly complex, so do its challenges. However, while focusing on problems and ways to solve them, it can sometimes be easy to forget about how potential solutions will impact the people involved. In other words, if someone creates an effective solution to a problem, but it makes things more difficult for the end user, then the solution is flawed.

Design thinking directly addresses this concern by focusing on the solution rather than the problem. While this human-centered approach to design has been practiced for centuries, the concept was popularized in modern business circles in large part thanks to the work of Tim Brown, CEO and president of the design company IDEO. In an article published in the Harvard Business Review,¹ Brown defines design thinking as a discipline that matches people's needs with what is both technologically possible and financially viable:

"Put simply, [design thinking] is a discipline that uses the designer's sensibility and methods to match people's needs with what is technologically feasible and what a viable business strategy can convert into customer value and market opportunity. Like Edison's painstaking innovation process, it often entails a great deal of perspiration."²

Brown's invocation of National Inventors Hall of Fame Inductee Thomas Edison is fitting because ultimately, an invention is only as impactful as it is beneficial to others. By instilling the importance of empathetic problem solving from an early age, educators can help students learn how to develop ways to improve the lives of others.

Luis von Ahn's Inspiring Design Thinking

National Inventors Hall of Fame Inductee Luis von Ahn, co-creator of CAPTCHA (Completely Automated Public Turing test for telling Computers and Humans Apart), creator of reCAPTCHA and co-founder of language learning company Duolingo, believes in the power of human-centered solutions.



Born in Guatemala City, Guatemala, von Ahn has always had a natural curiosity for how things worked. His curiosity grew as he spent time during his childhood exploring the machines in a candy-making factory owned by his mother's family.

"I grew up in a country where inventors normally don't grow up," said von Ahn in an interview with the National Inventors Hall of Fame. "I think that has actually shaped a lot of things. A lot of the ways in which I think, and a lot of the projects that I decide to work on."

1. Han, E. (2022, January 18). What Is Design Thinking & Why Is It Important?: HBS Online. Business Insights Blog. <https://online.hbs.edu/blog/post/what-is-design-thinking>.

2. Brown, T. (2008, June). Design Thinking. Harvard Business Review. <https://readings.design/PDF/Tim%20Brown,%20Design%20Thinking.pdf>

When he reached college age, von Ahn traveled to the United States to study at Duke University, where he graduated with a bachelor's degree in mathematics in 2000. He then became a graduate researcher at Carnegie Mellon University, earning master's and doctorate degrees in computer science in 2003 and 2005, respectively.

During his first year at Carnegie Mellon, von Ahn attended a talk by the chief scientist at Yahoo, who spoke about 10 problems the company currently did not know how to solve. One of these problems caught von Ahn's attention: identifying and stopping computer programs from stealing users' account information.

"It occurred to us, one way in which we could solve this is we could distinguish whether the thing that's getting the account is a human or computer," von Ahn said.

This became the initial inspiration for CAPTCHA, followed by reCAPTCHA's debut in 2007. Because both tests remain difficult for computer programs, or bots, to accurately complete, they represent reliable ways to prevent bots from causing harm online. For the end user, this has created a safer online experience and less spam.

By developing reCAPTCHA, a more advanced version of CAPTCHA that prompts users to decode a series of letters and numbers, von Ahn and his team were able to not only develop an effective way to prevent harmful spam but also aid in the digitization of books for archival purposes.

After selling reCAPTCHA to Google in 2009, von Ahn was inspired to create a way to provide equitable access to learning. In 2011, he co-founded Duolingo.

By making Duolingo's online learning platform free, adding gamification elements and creating an intuitive, user-centric experience, Duolingo's app has become the world's most popular language learning app, with over 75 million monthly active users.³

"Certainly, Duolingo is very influenced by where I'm from," von Ahn said. "The reason I am so interested in being able to give the education away for free is because I grew up in such a poor country, where I saw that people who don't have access to education barely learn how to read and write, and therefore never make a lot of money. Whereas people who have money can get themselves a really good education and therefore continue making a lot of money. So, [Duolingo] was very influenced by that."

Embracing Design Thinking

At the heart of design thinking is the idea that solutions to problems should prioritize the needs of people. This approach teaches students the importance of empathy and encourages them to consider the needs, options and circumstances others experience.

These are the kinds of ideas that can truly change the world

and ignite the enthusiasm of some of the most groundbreaking inventors. In von Ahn's personal journey, he reflects on how over time, he grew increasingly passionate about ideas that held the potential to positively impact a large number of people.

"Early on, what motivated me was surprising, non-obvious, clever ideas," von Ahn said. "These days, I'm a lot more motivated by large-scale impact. I think that is significantly more motivating."

STEM Fields Move Society Forward

Responsible for many of the innovations that have saved lives, shaped industries and collectively raised the standard of living for people around the world, STEM (science, technology, engineering and mathematics) fields continue to move society forward.

As the United States continues its transition from an industrial economy to a digital one, the need to train a diverse workforce that can meet increasing demands in these fields has taken on national importance.

In an article published by the Brookings Institution, Darrell M. West, senior fellow for the Center for Technology Innovation within Brookings' Governance Studies program, argues that in order for our country to keep pace with the rest of the world and satisfy demands in sectors ranging from domestic production and data analytics to supply chain management, collectively we must take bold steps to promote many exciting STEM career paths.⁴

A large part of this equation involves removing the barriers that have historically prevented more women and people of color from entering these fields. West agrees, and in his article shares a few examples of what this disparity currently looks like at the collegiate level.

"There are barriers facing women in STEM fields that discourage a big part of our potential talent pool from getting advanced degrees in those areas," West said. "Only 19.3% of engineering graduates right now are females, and only 17.9% of computer science graduates are women. And some of the same, if not more barriers, impact people of color."

Jacqueline Quinn's Commitment to Science

From a young age, National Inventors Hall of Fame Inductee Jacqueline Quinn had a deep love of science. This interest was in large part fostered by her parents — both of whom were science educators. In fact, some of Quinn's fondest childhood memories involve spending time in her father's laboratory.

"I don't know that I really had any options but to be pretty heavily involved in science just because it was so natural in my upbringing," Quinn said in an interview with the United States Patent and Trademark Office.



3. Seeking Alpha. (2023, September 4). Duolingo: A Fast-Growing Language Learning Internet Company (NASDAQ:DUOL). Seeking Alpha. <https://seekingalpha.com/article/4632620-duolingo-a-fast-growing-language-learning-internet-company>

4. West, D. M., Nicol Turner Lee, S. B., Natalie Evans, J. J., & Regina Ta, D.M.W. (2023, August 1). Improving Workforce Development and STEM Education to Preserve America's Innovation Edge. Brookings. <https://www.brookings.edu/articles/improving-workforce-development-and-stem-education-to-preserve-americas-innovation-edge/>

This passion for science continued to grow, and while earning an undergraduate degree in civil engineering, Quinn also developed an interest in environmental engineering and exploring how the combination of technology, mathematics and science can help to preserve nature.

After completing her studies at the Georgia Institute of Technology and earning a bachelor of science degree in civil engineering, she began working at NASA on its space shuttle program. While there, she also earned master's and doctorate degrees in environmental engineering.

Through this experience, she learned about the harmful chlorinated solvent contaminates the agency used to degrease rocket engines, and how at the time, the most effective cleaning method available was to pump contaminated water out of the ground, treat it with iron and then pump the water back into the ground. At best, Quinn estimates that this method was only able to treat up to 100 pounds of contamination over a one-year span.

In response, together with a team of researchers from the University of Central Florida, Quinn developed an effective, environmentally safe cleanup technology called emulsified zero-valent iron, or EZVI.

“Our vision was to take the reactants and encapsulate them within an oil bubble,” Quinn said in an interview with Tech Briefs.⁵ “If you go by the old adage that ‘like likes like,’ what we’re trying to do is we’re trying to encapsulate the reactants in something that we know the contaminant is attracted to.”

When EZVI is introduced into polluted groundwater, the system functions akin to a sponge, drawing the contaminants into the emulsion where they undergo a breakdown process into benign by-products.

In an interview with the National Inventors Hall of Fame, Quinn explained that in addition to NASA’s renowned expertise in outer space exploration, EZVI serves as evidence of the organization’s commitment to developing groundbreaking technologies for Earth’s benefit.

“EZVI stands out as one of NASA’s most widely licensed technologies to date,” said Quinn. “While NASA is often associated with the realms of space and airspace, one of our most frequently licensed technologies operates quite literally beneath our feet.”

To date, the EZVI system has successfully purified groundwater reservoirs in proximity to government sites and facilities involved in the production of dyes, chemicals, aerosols and paint.

Helping Students Develop a Passion for STEM

Quinn was fortunate in that both of her parents worked as STEM educators and played a significant role in helping her cultivate a passion for science. For many others, especially those who come from disadvantaged backgrounds, finding a STEM role model can be challenging.

Because research shows that children who are exposed to innovation at an early age are more likely to innovate as they grow up⁶, it’s crucial that educators do their best to introduce students to relatable STEM role models.

Quinn herself believes in the importance of helping students cultivate an interest and passion in STEM from a young age.

“I think the earlier you can get your kids or students engaged in hands-on science activities, the more impact you’re going to have in influencing them to enter into a STEM curriculum or career,” Quinn said in an interview with the National Inventors Hall of Fame. “There’s a lot of research that suggests that if you don’t get a hold of the kids’ interest and engage them, even before the fourth grade, you really are not opening their eyes to the options that are out there that would influence their decisions to seek a career in a STEM-related field.”

Collaboration Produces Better Ideas

No matter what career path students ultimately take, they must be prepared to work collaboratively. Often, ideas and solutions are made better through collaboration because members of a team bring with them a unique set of backgrounds and experiences. Solutions resulting from the collective efforts of multiple people have the benefit of being vetted and fine-tuned through an array of perspectives.

This diversity of thought serves as an effective way to identify potential pitfalls, refine strategies and enhance the overall outcome. As team members contribute their distinct viewpoints, they act as a checks-and-balances system, scrutinizing proposed ideas from different angles and exposing blind spots.

For novel ideas, the input of a team can be especially important. While inventing the world’s first sports bra, the Jogbra[®], co-inventors Lisa Lindahl, Hinda Miller and Polly Smith each played a unique role in solving a problem, meeting a need and helping to revolutionize women’s sportswear.

Lisa Lindahl, Hinda Miller and Polly Smith’s Revolutionary Teamwork



As an avid runner, Lindahl estimates that during the late 1970s she would run about 30 miles a week. At the time, however, there did not exist a garment that provided her — or any woman — adequate chest support for comfortably running or engaging in other athletic activities.

5. SAE Media Group. (2011, March 1). Dr. Jacqueline Quinn, Environmental Engineer, NASA’s Surface Systems Office, Kennedy Space Center, Florida. Tech Briefs. <https://www.techbriefs.com/component/content/article/9460-dr-jacqueline-quinn-environmental-engineer-nasas-surface-systems-office-kennedy-space-center-florida-24976343>

6. Bell, A., Chetty, R., Jaravel, X., Petkova, N., & Reenen, J. V. (n.d.). Race and Economic Opportunity in the United States. Opportunity Insights. http://www.equality-of-opportunity.org/assets/documents/race_summary.pdf

Unlocking Creative Potential With the I Can Invent Mindset

While there is no standard way to ensure successful innovation, our National Inventors Hall of Fame Inductees often highlight shared skills and traits that have benefited their own professional lives. These essential qualities form the I Can Invent Mindset.

In our ongoing collaboration with Inductees, we seamlessly integrate this powerful, proven mindset into each of our National Inventors Hall of Fame education programs. As we cultivate a pathway for all students to unlock their innovative potential, educators can trust that the I Can Invent Mindset is not only effective in fostering innovation but also universally applicable. This mindset proves valuable not just in fueling creativity but also in navigating and overcoming obstacles and challenges across all facets of life.

While she tried wearing regular bras, a size smaller for compression, over time the straps would stretch out and loosen, causing great discomfort.⁷ She then realized the need for a bra that could be worn specifically during athletic activities — one with stable straps, no seams or clasps that could chafe, breathable fabric and the right amount of compression to prevent excessive movement.

She brought the idea to her childhood friend Smith, who at the time was working as a costume designer for the Champlain Shakespeare Festival in Burlington, Vermont.

“Lisa had the idea; she knew I had the sewing skills, so she came to me,” recalled Smith in an interview with the National Inventors Hall of Fame. “We went out and bought two jockstraps and made sort of a rough prototype.”

Miller, who was working with Smith at the Shakespeare festival, soon joined the team to develop an athletic bra, and the trio ended up making history.

“We didn’t know we were going to start a business; we didn’t know we were going to design a product,” Miller said in an interview with the National Inventors Hall of Fame. “We knew that this product was needed, and we said it was right that every woman, no matter their size, shape or age, had the right to the benefits of fitness and exercise.”

Lindahl and Miller would go on to commercialize their invention as the Jogbra, and they co-founded Jogbra Inc., later renamed JBI, in 1977. In doing so, they launched a billion-dollar industry and gave millions of women and girls around the world the ability to participate in sports, fitness and athletic activities.

“I don’t believe the Jogbra would have happened without all three of us,” Smith said. “Lisa was the idea, I was the fabrication and Hinda was the driving force behind making it happen.”

Teaching the Importance of Collaboration

Problems in STEM fields are often complex, and effective solutions require diverse skills and perspectives. By fostering a collaborative mindset, educators can guide children to appreciate the value of teamwork, communication and the exchange of ideas. These skills are not only essential for conducting effective research but also for addressing the most difficult, real-world scientific and technological challenges.

Additionally, by encouraging collaboration through STEM curricula, educators can prepare students for the interdisciplinary approach they’ll be expected to engage in when they enter the workforce. Just as the Jogbra was conceived, invented and promoted by a team of individuals with different skills and expertise, the problems of tomorrow require the efforts and input of those with innovative mindsets and diverse backgrounds and experiences.

7. Murashima, C. (2023, July 22). As the Women’s World Cup Gets Underway, a Look at the History of the Sports Bra. NPR. <https://www.npr.org/2023/07/20/1188869644/as-the-womens-world-cup-gets-underway-a-look-at-the-history-of-the-sports-bra>