



Around 2.6 million<sup>1</sup> years ago, in the savannahs of East Africa, our earliest ancestors began crafting the first stone tools. Using fissile rocks, including quartzites and volcanic rock, they struck these “cores” with a hammer stone, allowing them to harvest sharp stone pieces they would then use to craft choppers, scrapers and cutters.

Though rudimentary by today’s standards, these Oldowan tools<sup>2</sup>, named after the Olduvai Gorge in Tanzania where they were discovered, represent some of the oldest human inventions and demonstrate our inborn desire as a species to create solutions to real-world problems.

## The World Needs Big Ideas

From the early agrarian civilizations that cultivated large fields to support centralized populations to today’s modern societies that benefit from advancements in medicine, manufacturing and technology, our history is one defined by continuous improvement.

This constant innovation continues to improve the standard of living for people across the world, leading to global increases in life expectancy, literacy and access to electricity, as well as decreases in child and maternal mortality.<sup>3</sup>



*A group of educators share their creation during an invention education professional development opportunity from NIHF.*

While these improvements have undoubtedly benefited the lives of millions of people across the world, today we continue to face serious global challenges that we must not ignore, including climate change, loss of biodiversity, widespread infectious diseases and the rapid depletion of natural resources, to name a few.<sup>4</sup>

The world needs big ideas, and at the National Inventors Hall of Fame® (NIHF), we believe the best way to prepare today’s children for our increasingly complex future is to help them embrace their natural creativity through invention education.



*Two students work together to build a jetpack prototype at Camp Invention®.*

## What Is Invention Education?

Invention education is an approach that taps into a student’s inborn creativity by guiding them through the act of invention to develop a mindset that helps them navigate the complexities of their lives.

In stark contrast to passive learning strategies that task students with reaching predetermined answers, invention education is instead an open-ended approach to learning that challenges youth to solve real-world problems by developing unique ideas and making their thinking visible by creating invention prototypes.

Because all NIHF education programs are developed using lessons and insights from our [NIHF Inductees](#), our style of

1. Rotheimer, R. (2020, July 20). Oldowan tools. World History Encyclopedia. Retrieved May 22, 2022, from [https://www.worldhistory.org/Oldowan\\_Tools/](https://www.worldhistory.org/Oldowan_Tools/)  
2. Wayman, E. (2012, October 1). Becoming human: The origin of stone tools. Smithsonian Magazine. Retrieved May 22, 2022, from <https://www.smithsonianmag.com/science-nature/becoming-human-the-origin-of-stone-tools-55335180/>

3. Wolfson, E. (2019, December 23). 20 ways the world got better in 2019, in charts. Time. Retrieved May 22, 2022, from <https://time.com/5754155/global-advances-2019/>

4. Morris, C. (2022, February 7). World Economic Forum lists biggest global risks of 2022. Nasdaq. Retrieved May 22, 2022, from <https://www.nasdaq.com/articles/world-economic-forum-lists-biggest-global-risks-of-2022>

invention education benefits from and features the collective knowledge, wisdom and experience of some of the world’s most accomplished and impactful inventors. Our programs’ authentic hands-on activities give children the opportunity to develop the Innovation Mindset™ — a framework of essential skills and traits that emerged from taking a deep dive into interview transcripts and decades of other interactions and exchanges with Our Nation’s Greatest Innovators™.

Each word or term in a hexagon has a treasure trove of stories behind it. For example, the “Persistence” hexagon is brought to life through the stories of NIHF Inductees Marshall Jones (industrial lasers), whose motto is “Never Give Up,” and Radia Perlman (robust network routing and bridging), who speaks about being dismissed by skeptics along her invention journey. The “Entrepreneurship” hexagon is made tangible by NIHF Inductee Lonnie Johnson (Super Soaker®), who reinvested his earnings into energy invention and Eli Harari (floating gate EEPROM), who paved the way for today’s flash memory industry.



For Alaina Rutledge, vice president of education research and development at NIHF, and her team of education experts, keeping these attributes top of mind when creating new curricula is essential to our education programs’ impact, year after year.

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

Similar in purpose to 21<sup>st</sup> Century Skills, competencies that are helpful in preparing children for the challenges of their time, the Innovation Mindset represents a grouping of skills that unlock students’ potential and help them deal with challenges while navigating uncertainty and ambiguity. One of the secrets to its effectiveness: It creates an environment that promotes creativity.

## Can You Teach Creativity?

It’s a fair question, and one that continues to be asked and debated among educators and policymakers alike. One pivotal study concerning creativity was conducted in 1968 by George Land, who repurposed a creativity test used by NASA to select innovative engineers and scientists.

After administering the test to 1,600 5-year-olds, he gave the same test to the children at 10 and 15 years old. Finally, in 1985, Land tested 280,000 adults 25 and older using the same study.<sup>5</sup>

**Table 1. Test Results<sup>6</sup>**

Age Group Tested	Number Tested	Year of Testing	Percent Who Scored in the ‘Highly Creative’ Range
5 year olds	1,600 children	1968	98%
10 year olds	1,600 children	1973	30%
15 year olds	1,600 children	1978	12%
25+ year olds	280,000 adults	1985	2%

5. Vint, L. (2006). Creating a Culture of Creativity. International Design Conference - Design 2006 (pp. 1275–1284)

6. Ibid.,

“We were pretty shocked,” Land said in a TEDx Tucson talk he delivered in December 2011.<sup>7</sup>

He went on to explain that traditional education practices were causing children to use both convergent (judgment) and divergent (generating new ideas) thinking at the same time, causing the brain to work at a significantly reduced capacity.

“What happens to these children as we educate them, is we teach them to do both kinds of thinking at the same time. So when somebody asks you to come up with new ideas, [...] what we’ve mostly learned in school is to start looking at them immediately and trying to say... ‘we’ve done that, that’s crazy, it will cost too much,’” Land said. “When you actually look at what’s happening inside the brain, you find that neurons are fighting each other and actually diminishing the power of the brain because we’re constantly judging [and] criticizing.”<sup>8</sup>

Land’s findings suggest that our educational policies are teaching students, through no fault of their own, to be less creative over time. While there exist subjects and competencies that must require students to identify predetermined answers, especially when building foundational knowledge in a particular field, solving the challenges of tomorrow requires the ability to formulate new ideas.

Land’s study also tracks with our personal experiences concerning children and creativity, and when left to their own devices, are often endlessly imaginative and original. Often expressed through the act of play, when given the space and permission to express themselves, children will naturally do so.



*Two preschoolers proudly show the inventions they made during Invention Project®.*

In this way, perhaps instead of asking if creativity can be taught, instead we should be asking how we can remove the impediments that cause children to become less creative over time. NIHF’s approach to this strategy is to develop invention education programming that gives the space and permission for children to dream. Combined with age-appropriate educational standards and exposure to a diverse group of

Inductees, our programming has the power to both introduce children to a variety of STEM (science, technology, engineering and mathematics) career fields and help them construct their identities as confident creators.

Much like how an inventor’s work is never finished, invention education teaches children the importance of continuous improvement and how temporary setbacks are simply part of this process.

## Helping Today’s Students Become Tomorrow’s Innovators

With over 30 years of experience developing invention education solutions for school districts across the country, NIHF maintains that this approach to learning is one that prepares children for all the times in their lives when answers aren’t clear-cut or straight forward.

The earlier a child can start to build an Innovation Mindset, the greater chance they will have to cultivate and confidently apply its principles. It’s for this reason that we offer invention education programs for a wide range of ages, from preschool on.

To learn more about how NIHF can customize an in-school, afterschool or summer invention education solution to meet your district’s unique needs, we invite you to [visit our website](#).

7. TEDx Talks . (2011). TEDxTucson George Land The Failure of Success. Retrieved from <https://www.youtube.com/watch?v=ZfkMq-rYtnc>.

8. Ibid.,