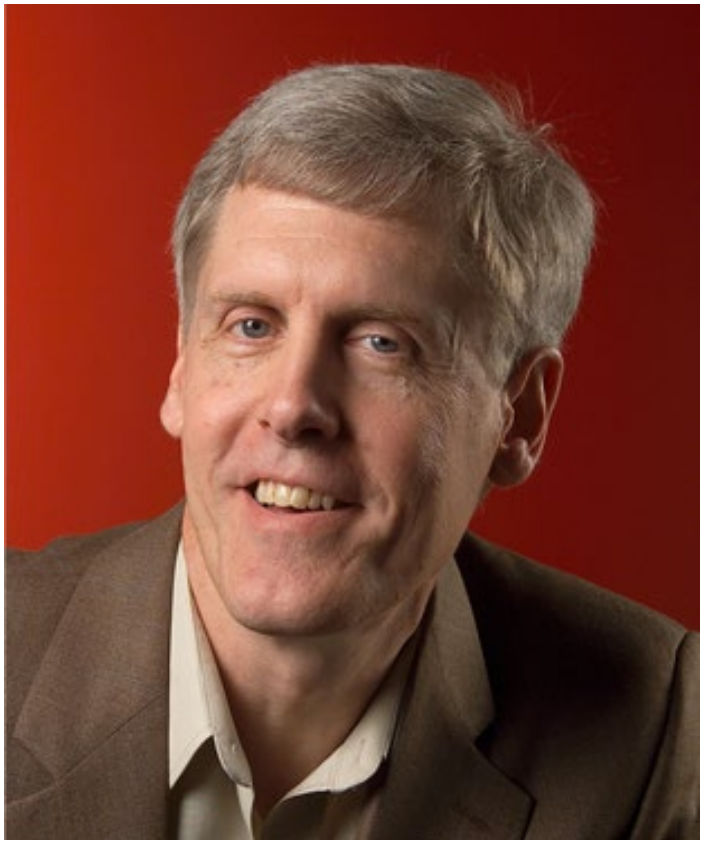
National Inventors Hall of Fame®

HELPING CHILDREN OVERCOME THE FEAR OF FAILURE

While we may not like to admit it, throughout our lives, we all fail countless times. From coming up short in a competitive sport to having a job application rejected, rarely do things always go according to plan.

However, these setbacks are valuable because they provide opportunities to learn and grow. For instance, we might learn to set a timer while dinner is cooking or become a stronger employment candidate and better prepare for interviews.



NIHF Inductee Steve Sasson, inventor of the digital camera

"You paint this picture of ultimate success, but inventors spend most of the time failing. We know way more about why things won't work than why they do. That's where we spend most of our time."

- Steve Sasson

In STEM (science, technology, engineering and mathematics) fields, which have historically produced some of the world's most important innovations, setbacks and failures are common occurrences. This is not unexpected, as individuals and teams working in these fields are compelled to find solutions that are unknown and challenge the status quo.

Coined by Duke University professor Sim Sitkin, these intelligent failures "occur when experimentation is necessary: when answers are not knowable in advance because this exact situation hasn't been encountered before and perhaps never will again."[1]

In the article, Edmondson explains that basic science researchers, for example, expect most of their experiments to fail (70% or higher in certain fields). They persist through these setbacks because they understand that failure is a necessary part of the work they do, and that each failure brings with it valuable information that could hold the key to unlocking potential breakthroughs.[2]

Reframing Failure

For educators seeking to prepare their students to use STEM-related skills in their future careers, helping them use setbacks as opportunities for learning can prove to be extremely beneficial.

In practice, this can be easier said than done, especially with the pressure many students feel to succeed. In an article published by the National Education Association, Mary Ellen Flannery paints a concerning picture of the mental distress many of today's students experience:

> "By high school and college, many students have run out of steam. Anxiety — the mental-health tsunami of their generation — has caught up with them. Today's teens and young adults are the most anxious ever, according to mental-health surveys."[3]

Flannery cites a Pew survey that found a staggering 70% of teens report that experiencing anxiety and depression is a "major problem" among their peers.[4] Additionally, a separate Pew study found that a majority of teenagers list "academic pressure" as their primary stressor.[5] This fear of not succeeding is self-defeating and can cause students to avoid trying new things.

It's clear that even from an early age[6], too many students are developing a relationship to learning and academics. Letter grades, a long imperfect[7] tradition of our national education system, in many cases cause students to value their grades over knowledge and mastery.

1. Edmondson, A. (2011, April). Strategies for Learning from Failure. Harvard Business Review. https://hbr.org/2011/04/strategies-for-learning-from-failure.
2. IBID.
3. Flannery, M. E. (2019, March 23). The Epidemic of Anxiety Among Today's Students. NEA. https://www.nea.org/advocating-for-change/new-from-nea/epidemic-anxiety-among-todays-students.
4. Horowitz, J. M., & Graf, N. (2019, February 20). Most U.S. Teens See Anxiety, Depression as Major Problems. Pew Research Center's Social & Demographic Trends Project. https://www.pewresearch.org/social-trends/2019/02/20/most-u-s-teens-see-anxiety-and-depression-as-a-major-problem-among-their-peers/.
5. IBID.

In a story published in The Atlantic, Jessica Lahey writes about her experience as a teacher, and how some of her students earned adequate grades but were not mastering the educational content.

"Conversely, some students actually learned very little but were good at 'playing school,'" Lahey said. "Despite dismal test scores, these students earned decent grades by turning in homework and doing extra credit. They would often go on to struggle in later courses, while their parents watched and worried."[8]

Arlyne Simon, biomedical engineer, author, inventor and entrepreneur

"No one goes through life without failures, without self-doubt. I certainly have had my fair share of failures and that dreadful imposter syndrome. But what I know for sure is that science education infuses us with resilience and design thinking skills that help us transcend life's failures. Experiments will fail, but you can start over at any time. You are not and never will be a failure."

- Arlyne Simon

In the classroom, the way in which teachers approach challenges and taking risks can play a significant role in how students manage their own perceived failures. In addition to providing a scaffolded approach to curriculum development that breaks lessons down into manageable chunks, educators can help their students begin to embrace and learn from their mistakes[9] by:

- **Adjusting the learning context**
  Providing children with a more comfortable learning context can have the added benefit of helping them feel more comfortable with making, and learning from, mistakes. For example, some students may find group work to be more emotionally challenging and may benefit from having additional options to work privately.
- **Encouraging persistence**
  Persistence can be learned. When teachers share some of their own vulnerability, emotions, problem-solving methods and commitment to continue, it can help students see that mistakes and challenges are a part of life.
- **Modeling self-compassion**
  It is important to normalize for students that learning is filled with ups and downs, and that it is OK to not know the answer to a challenge right away.
- **Building positive relationships with students**
  When students see that a teacher they connected with values academic tasks, they are more likely to try their best.
- **Focusing on resilience**
  Guiding students to build resilience also helps to raise their self-esteem, lower perfectionism and encourage them to think of past challenges in as opportunities.

While there is no such thing as a perfect pedagogy or educational policy, teachers and policymakers have a responsibility to help the students in their care develop a mindset that builds intrinsic motivation and instills the courage to create and explore.

Helping Children Build the Innovation Mindset

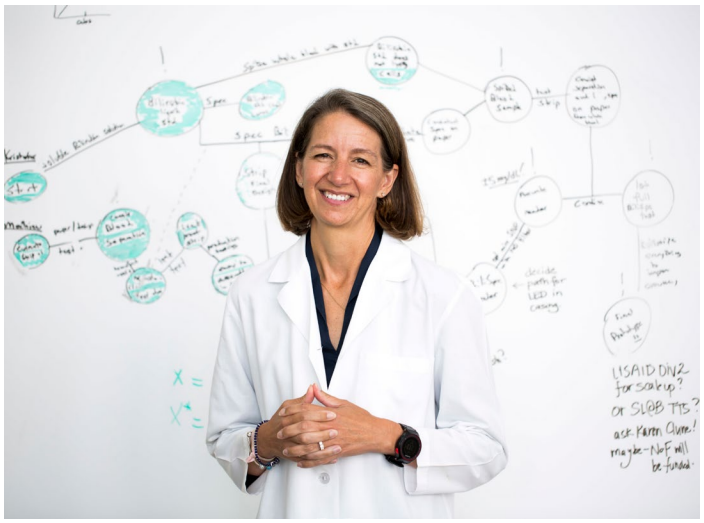
In collaboration with some of the world's most influential innovators, National Inventors Hall of Fame® (NIHF) Inductees, the NIHF education team has developed the Innovation Mindset — nine essential skills and traits that unlock creative potential.

By incorporating the different aspects of the Innovation Mindset in their creative process, students begin to understand that setbacks are a completely natural part of creating something new. Children who participate in NIHF programming develop the

6. Glass, K. (2021, April 23). Kids need less academic pressure and more support after a year of isolation and learning losses. The Washington Post. https://www.washingtonpost.com/lifestyle/2021/04/23/learning-losses-academic-pressure-mental-health/.
7. Lahey, J. (2018, June 19). Letter Grades Deserve an 'F'. The Atlantic. https://www.theatlantic.com/education/archive/2014/03/letter-grades-deserve-an-f/284372/.
8. IBID.
9. Eva, A. (2017, Nov. 28). Why We Should Embrace Mistakes in School. https://greatergood.berkeley.edu/article/item/why_we_should_embrace_mistakes_in_school.

persistence to transform their ideas into working prototypes in a space that encourages them to embrace the challenges they encounter along the way.

The curriculum for each in-school, afterschool and summer program from NIHF is developed with direct involvement from NIHF Inductees, and lessons from world-changing innovators are infused in the hands-on activities included in these programs. This means children benefit from valuable opportunities to practice aspects of the Innovation Mindset with the understanding that successful inventors approach problem solving and setbacks with this same mindset.



NIHF Inductee Rebecca Richards-Kortum, inventor of medical devices for low-resource settings

"I think whenever you are doing science or you're trying to invent a new technology, failure is an inevitable part of the process, and you fail way more often than you succeed. And I think learning how to learn from failure — how to persist and not lose your belief in the problem that you're trying to solve and your ability and the ability of your team to solve that problem — it's really critical. So, I think it never feels good to fail, but it's such an important teacher. If you're not failing, you're not trying. And if you're not learning from failure, you're never going to get to success."

- Rebecca Richards-Kortum

According to Jayme Cellitioci, creativity and innovation strategist at NIHF, the Innovation Mindset represents the DNA of all NIHF education programs and enables her team to provide the most authentic invention education experiences possible.

"I have observed students' sense of awe, inspiration and excitement as they interact with NIHF Inductees visiting their Camp Invention® site," Cellitioci said. "While some of the conversations between the Inductees and children center around the STEM side of invention, the most powerful exchanges often come from their conversations around what it takes to be an inventor. These children hear about persistence, collaboration and other key tenets of invention from our Nation's Greatest Innovators™. These Innovation Mindset insights are delivered into every NIHF education program through videos, tips on posters, guidance for Instructors and the overall pedagogy."

In this way, each NIHF program creates safe, inspiring spaces where students are encouraged to try new things and explore to their heart's content. By engaging in creative, hands-on activities that exercise different parts of the Innovation Mindset, children not only build confidence in their own abilities but also realize that everyone has the potential to innovate and create something new.

An inventor's work is never finished because they understand there is always the potential for progress and improvement. As research from Opportunity Insights has found that exposure to innovation at an early age dramatically increases the likelihood that children will innovate into adulthood[10] , it is clearly essential to provide students across the country with access to quality invention education. By solving real-world problems through hands-on activities, children can begin to transform their understanding of failure from a discouraging setback into simply a necessary step toward something greater.

10. Bell, A., Chetty, R., Jaravel, X., Petkova, N., & Reenen, J. V. (n.d.). Who Becomes an Inventor in America? The Importance of Exposure to Innovation . Opportunity Insights . https://opportunityinsights.org/wp-content/uploads/2018/03/inventors_summary.pdf.