



As society's challenges grow ever more complex, so too does the need to work together to solve them. To help students become lifelong learners who excel in the types of "soft skills" needed for creative collaboration, increasingly, educators across the country have prioritized social-emotional learning (SEL) as a key aspect of their curricula.

SEL, as defined by the Collaborative for Academic, Social and Emotional Learning (CASEL), is "the process through which children and adults acquire and effectively apply the knowledge, attitudes, and skills necessary to understand and manage emotions, set and achieve positive goals, feel and show empathy for others, establish and maintain positive relationships, and make responsible decisions."¹

This idea of holistic education that prioritizes character development and the regulation of emotions has a long and storied history. In fact, the ancient Greek philosopher Plato argues in "The Republic" that a well-educated citizen must not at first specialize in particular subjects, but rather train themselves in how to be an ethical and moral person. "By maintaining a sound system of education and upbringing, you produce citizens of good character," he explained.²

While humanities like history and language arts likely come to mind as natural subjects in which to incorporate SEL, teaching STEM (science, technology, engineering and mathematics) using hands-on learning techniques can be equally effective. Invention education,³ a pedagogy that involves project-based inventing, prototyping and entrepreneurship, has the unique ability to cultivate SEL and authentically cater to the interests of students on an individual level.

Innovation Begins with Empathy

At the National Inventors Hall of Fame® (NIHF), we are privileged to honor and learn from some of our nation's most influential innovators. From 2004 Inductees Frederick Banting, Charles Best and James Collip, whose discovery of isolated, purified insulin continues to improve the lives of millions diagnosed with diabetes, to 2021 Inductees Lisa Lindahl, Hinda Miller and Polly Smith, who invented the sports bra so women could comfortably participate in athletic activities, inventors continue to demonstrate that the crucial first step in creating something impactful is often to think about how your invention can help another person.

The utility of empathy extends far beyond the scope of inventing. IDEO, one of the world's leading design companies, lists



Two Camp Invention® participants explore the power of empathy by using their SolarBot™ to learn about the lives of real insects.

empathy as a crucial component of its "human-centered design practice." By consistently focusing on the people who will be impacted by one of their design strategies, the company is able to scale their services, from product design to organizational strategy to global business challenges. "We've learned that tackling these issues as if they were design problems, even though they are outside the realm of design, leads to outcomes that are functional and emotionally meaningful for the people affected," IDEO said in a white paper. "Empathetic design has proven useful in addressing increasingly large systemic challenges such as education, healthcare, and organizational efficiency. This has inspired us to find ways to apply empathy in new contexts."⁴

In an academic setting, using empathy as a guiding principle to implement invention education is important not only because it will help students come up with more useful ideas, but also because, as research has shown, when we place ourselves in someone else's shoes, it strengthens our ability to contextualize information.⁵ Research published by MIT Press also shows how an empathetic mindset can increase our desire to help others, making it clear that empathy can act as a motivating force.⁶ In the context of a project-based learning technique like those used in invention education, teachers can encourage this mindset by introducing [brainstorming](#) activities that ask students to identify common problems that other people have, or improvements to things that already exist in the world.

1. The Collaborative for Academic, Social and Emotional Learning. *Overview of SEL*. <https://bit.ly/3nDewwt>
2. Edutopia. "Social and Emotional Learning: A Short History." *Edutopia*, George Lucas Educational Foundation, 7 Oct. 2011, www.edutopia.org/social-emotional-learning-history
3. The Lemelson Foundation. "Invention Education & STEM." *The Lemelson Foundation*, www.lemelson.org/our-work/education/

4. Battarbee, Katja, et al. "Empathy On The Edge - Scaling and Sustaining a Human-Centered Approach in the Evolving Practice of Design." *IDEO*, IDEO, new-ideo-com.s3.amazonaws.com/assets/files/pdfs/news/Empathy_on_the_Edge.pdf
5. Ibid.
6. "The Social Neuroscience of Empathy." Edited by Jean Decety and William Ickes, *Research Gate*, 2011, <https://bit.ly/3oASxHH>

The Need for Collaboration

One of the key advantages of a quality SEL education is its ability to teach students how to collaborate in ways that promote the quality of a project's outcome over the desires or ego of individual team members.

The ability to work with others has never been more important due to the increasing complexity of the world around us. In an article published by the Kellogg School of Management at Northwestern University, Emily Stone, senior research editor of Kellogg Insight, explains that a growing reason why collaboration is essential has to do with “our individual knowledge base becoming more and more specialized.”⁷



A Camp Invention camper collaborates with fellow participants online.

Using the research of Benjamin Jones, a strategy professor at the Kellogg School, to explain this phenomenon, Stone explains that with complexity comes the need for people with specialized knowledge to come together and work toward common goals. Jones' paper uses the example of 1975 NIHF Inductees Orville and Wilbur Wright. In 1903, it took the efforts of two individuals to design and fly the first airplane. Fast forward to today, and it takes dozens of specialists to build a single functioning airplane engine. To get a plane safely off the ground, it takes the productive effort of many different teams, with each member possessing a specialized set of skills and working in collaboration.⁸

However, there can be such a thing as “too many cooks in the kitchen,” and having larger groups does not automatically lead to higher levels of innovation. In another paper authored by Jones and fellow Kellogg School professor Brian Uzzi, the researchers found that it isn't enough to have large teams whose members contribute novel or even conventional ideas. Instead, true innovative collaboration occurs when members of a team have both an understanding of the subject at hand and a willingness to pursue a novel direction.

7. Stone, Emily, and Benjamin Jones. “The Science Behind the Growing Importance of Collaboration.” *Kellogg Insight*, Kellogg School of Management at Northwestern University, [Insight.kellogg.northwestern.edu/article/the-science-behind-the-growing-importance-of-collaboration](https://insight.kellogg.northwestern.edu/article/the-science-behind-the-growing-importance-of-collaboration)

8. Ibid.

9. Love, Jessica, et al. “A Virtuous Mix Allows Innovation to Thrive.” *Kellogg Insight*, 2013, insight.kellogg.northwestern.edu/article/a_virtuous_mix_allows_innovation_to_thrive

10. Ibid.

11. Bell, Alex, et al. “Who Becomes an Inventor in America? The Importance of Exposure to Innovation.” The Equality of Opportunity Project, 2018, https://opportunityinsights.org/wp-content/uploads/2018/03/inventors_summary.pdf

“You want to be grounded in something that's well understood and yet be adding in the piece that's truly unusual,” Jones said in an article explaining his research. “And if you do those two things [and] stretch yourself in both directions, then you radically increase your probability of hitting a home run.”⁹

Uzzi adds that success in innovation often takes combining the expertise of disparate fields to produce impactful results. “Many of these novel combinations are really two conventional ideas in their own domains,” he explained. “You're taking established, well-accepted ideas, which is a wonderful foundation — you need that in science. But when you put them together: wow. That's suddenly something really different.”¹⁰

How to Implement SEL Using Invention Education

Whether educators are interested in using invention education to implement SEL in an in-person or distance learning setting, we recommend that teachers not shy away from assembling teams of students who might have very different academic interests, personalities or skill sets. Doing this will not only give children practice working with those who are different from them, but in keeping with the research above from Jones and Uzzi, this can also lead to surprisingly creative outcomes.

Additionally, we recommend that invention education strategies help introduce students to the lessons and stories of real, relatable innovators — both for the sake of authenticity, and because research has shown that the earlier children are exposed to inventors, the more likely they will become inventors when they grow up.¹¹

NIHF's [education team](#) embraces SEL and creates [education programs](#) that cultivate these essential skills. Through lessons and challenges inspired by our [NIHF Inductees](#), students who attend these programs confront real-world problems and are invited to discover empathetic solutions to improve the lives of others.

While learning various technical STEM competencies is important, children must also feel inspired. Guided by our NIHF Inductees, we seek to show participants how they too can make a difference by developing their own interests and helping make the world a better place.



A Camp Invention participant takes apart a wireless microphone to discover its inner workings.