



KEEPING STUDENTS ENGAGED IN OUT-OF-SCHOOL TIME:

How Invention Education Is Leading the Way

On July 14, 2022, in conjunction with five coordinating partners and more than 20 national organizations, the U.S. Department of Education launched the [Engage Every Student Initiative](#). This is a bold call to action for our nation's schools to use their ESSER funds on high-quality out-of-school time (OST) learning to address achievement and engagement gaps caused by the COVID-19 pandemic.

The government's recommendation for districts to use their precious resources on high-quality OST programming is grounded in years of independent research and describes activities and curricula that occur before or after the school day or outside the regular school year. Examples include "comprehensive afterschool or summer-learning and enrichment programs, vacation academies, work-based learning programs, youth development programs, and experiential or service-learning programs."¹

The Value of Effective OST Programs

In a report published by the RAND Corporation, a leading research organization that develops solutions to public policy challenges to help make communities safer, more secure, healthier and more prosperous,² researchers looked into the benefits of quality OST programs for students in kindergarten through age 7.



An educator engages students using a series of open-ended questions.



Open-ended exploration sparks a student's natural curiosity in OST invention education programming.

The researchers' key conclusions include:

- OST programs provide measurable benefits to youth and families on outcomes directly related to program content
- Academic OST programs can demonstrably improve academic outcomes
- Program quality and intentionality influence outcomes
- Youth need to attend regularly to measurably benefit from programming

According to the researchers, one of the key reasons why OST programs are so effective is that they can both specifically cater to the needs of individual students and meet the greater needs and goals of the school districts that support them.³ The RAND study also helpfully identifies three distinct categories of OST programs, followed by their common characteristics:

1. U.S. Department of Education. (n.d.). Engage every student initiative. Engage Every Student Initiative | U.S. Department of Education. Retrieved September 12, 2022, from <https://www.ed.gov/ost?src=rn>
2. Rand Corporation. About The Rand Corporation. RAND Corporation. Retrieved September 12, 2022, from <https://www.rand.org/about.html>
3. McCombs, J., Whitaker, A., & Yoo, P. (2017, October). The Value of Out-of-School Time Programs. RAND Corporation. Retrieved September 14, 2022, from <https://www.rand.org/pubs/perspectives/PE267.html>

4. Ibid.,

5. Dorn, E., Hancock, B., Sarakatsannis, J., & Viruleg, E. (2021, July 27). Covid-19 and education: The lingering effects of unfinished learning. McKinsey & Company. Retrieved September 12, 2022, from <https://www.mckinsey.com/industries/education/our-insights/covid-19-and-education-the-lingering-effects-of-unfinished-learning>

Table 1.

Key Dimensions Linking OST Program Content to Primary and Secondary Outcomes⁴

Program Focus	Typical Program Activities	Typical Frequency	Typical Staffing	Potential Primary Outcomes	Potential Secondary Outcomes
Specialty: Sports, arts, science and technology, youth development (e.g., soccer, drama, coding, Girl Scouts/ Boy Scouts)	Fundamental activities promoting skills of the specialty topic	Varies	<ul style="list-style-type: none"> Instructors with specific content expertise 	<ul style="list-style-type: none"> New experiences and opportunities Skill development (which may be targeted noncognitive skills for youth development programs) 	<ul style="list-style-type: none"> Noncognitive, developmental School behavior Academic achievement Attitudes
Multipurpose: 21 st CCLC, school-aged child care, Boys and Girls Clubs	<ul style="list-style-type: none"> Homework help Recreation activities (games, free play) Enrichment (arts, technology, sports) Snacks and/or meal 	<p>School Year: 5 days per week for 3 hours per day</p> <p>Summer: 5 days a week for up to 8 hours per day</p>	<ul style="list-style-type: none"> Youth workers May or may not include school teachers for homework help or academic enrichment 	<ul style="list-style-type: none"> Safety/supervision Family employment Homework completion New experiences and opportunities Health and wellness 	<ul style="list-style-type: none"> School behavior Noncognitive, developmental Academic achievement Attitudes
Academic: Summer learning programs, reading or math afterschool enrichment	<ul style="list-style-type: none"> Academic content (e.g., English-Language Arts, mathematics) Recreation activities Enrichment activities Snacks and meal 	<p>School Year: 3-5 days per week for 3 hours per day, typically 45-90 minutes of academic instruction</p> <p>Summer: 4-5 days per week for 4-6 weeks, either half-day or full-day, 60-120 minutes per subject</p>	<ul style="list-style-type: none"> Certified teachers provide academic instruction Youth workers provide recreational activities 	<ul style="list-style-type: none"> Academic achievement Safety/supervision Family employment New experiences and opportunities Health and wellness 	<ul style="list-style-type: none"> Noncognitive, developmental School behavior Attitudes

In part thanks to the wide range of OST program options, and their ability to cater to the unique needs of school districts, the U.S. Department of Education's belief in their effectiveness and integration in the Engage Every Student Initiative is well reasoned. The negative academic and social-emotional effects of the COVID-19 pandemic have been reported to disproportionately impact students who belong to demographic groups in need of greater access and opportunities⁵, and using funding resources for OST programs that provide multiple benefits to families and students represents a smart investment. According to the authors of the RAND study, "OST programs for low-income students are worthy of public investment and should be funded at levels that support high-quality programming."⁶

The Power of Open-Ended Exploration

One of the many advantages of OST programs is that they can provide students with the time and space to explore and embrace their natural curiosity.

[John Falk](#), founder of the Institute for Learning Innovation and Emeritus Sea Grant Professor of Free-Choice Learning at Oregon State University, is a nationally recognized leader in the field of OST learning. His expertise led him to partner with the National Inventors Hall of Fame® to study the effectiveness of incorporating [authentic invention education](#)⁷ pedagogy in an OST program.

Studying the beneficial effects of just one week of Camp Invention®, the National Inventors Hall of Fame's flagship K-6 summer enrichment program, Falk found:

- Statistically significant improvements in creativity, STEM interest and the ability to use and apply problem-solving techniques
- Even larger statistically significant improvements in the above areas for students who attended Camp Invention multiple times over a four-year span
- Sustained long-term increases in creativity, STEM interest and problem-solving abilities ranging from one to four years after attending the program

6. McCombs, J., Whitaker, A., & Yoo, P. (2017, November). The value of out-of-school time programs. Wallace Foundation. Retrieved September 12, 2022, from <https://www.wallacefoundation.org/knowledge-center/pages/the-value-of-out-of-school-time-programs.aspx>

7. The National Inventors Hall of Fame. (n.d.). How NIHf embraces authentic invention education. National Inventors Hall of Fame®. Retrieved September 12, 2022, from <https://www.invent.org/blog/trends-stem/21st-century-skills-students>

8. Summit Education Initiative. Equity and achievement for all students. Summit Education Initiative. (n.d.). Retrieved September 12, 2022, from <https://seisummit.org/>

9. The National Inventors Hall of Fame. (n.d.). Proven benefits of Camp Invention. Retrieved September 12, 2022, from https://www.invent.org/sites/default/files/2022-03/2021_SEI-Evaluation.pdf

10. Componential Theory. Componential Theory - an overview | ScienceDirect Topics. (n.d.). Retrieved September 13, 2022, from <https://www.sciencedirect.com/topics/psychology/componential-theory>

Additional research conducted by the Summit Education Initiative⁹ found that National Inventors Hall of Fame education programs improved children's social-emotional learning outcomes, sense of belonging, college-going identity, future sense of self and motivation for academic success in school.⁹

Key to the effectiveness of invention education in OST programming is its ability to combine engaging, hands-on learning with exploration that inspires students' innate curiosity.

Often, this type of creative learning environment is made possible thanks to the consistent use of open-ended questions, giving children permission to expand their thinking. It's within these safe creative spaces where magic happens. Instead of worrying about their ideas having to conform to a predetermined or "correct" answer, participants are free to create their own solutions to real-world problems and develop a natural interest and passion for what they're learning.

When it comes to creativity, the power of language should never be underestimated. While the phrase, "How might we ...?" feels like a modern-day question starter, its roots date back to at least the 1960s when creativity scholar Sidney J. Parnes was articulating the tenets of creative behavior.



Open-ended questions that maximize starters such as this are invitations. They are invitations for novelty and usefulness.

What amazed me as I began digging deeper into the intellectual property side of invention education is that these two words, "novelty" and "usefulness," are found in both the most widely accepted definitions of creativity¹⁰ and the [requirements for a utility patent](#).¹¹ Open-ended questions are woven into National Inventors Hall of Fame programs to help children experience that, when it comes to generating new and useful ideas, there is no one right answer. Instead, there is an invitation for them to imagine the possibilities and the "What ifs...?" that are necessary to make the leap from what is to what might be.

— **Jayme Cellitioci**,
senior director of education at
the National Inventors Hall of Fame



Two educators collaborate at a National Inventors Hall of Fame Professional Development Workshop.

Learn More About Implementing Invention Education

At the core of effective invention education is student engagement. Often, one of the best ways to cultivate this within an OST learning environment is by asking questions that spark curiosity.

While so much is available to students online, using the internet as the sole source for exploring ideas and creating dialogue has pitfalls and limitations. In his book "The End of Absence: What We've Lost in A World of Constant Connection," author Michael Harris argues that while ease of access to a nearly unfathomable amount of information has its benefits, it does not represent a substitute for our natural disposition to explore the world around us.

"The Googleization of knowledge—that ultimate searchability—creates a great bounty of potential avenues for research," Harris says. "It cannot, however, become a substitute for the strange vagaries of human intuition and creative leaps. We need to insist on a certain randomness, and a large degree of pure, haphazard discovery, in the tools we use to explore our world."¹²

In "What the Internet Is Doing to Our Brains," author Nicholas Carr is even more direct in his criticisms of the internet's ubiquity in our everyday lives. In an interview with National Public Radio, he argues that the internet is a medium based on interruption, hindering our ability to concentrate.

11. The United States Patent and Trademark Office. (2017). 2107 Guidelines for Examination of Applications for Compliance with the Utility Requirement. United States Patent and Trademark Office. Retrieved September 13, 2022, from <https://www.uspto.gov/web/offices/pac/mpep/s2107.html>

12. Harris, M. (2015). The End of Absence: Reclaiming what we've lost in a world of constant connection. Current.

“Neuroscientists and psychologists have discovered that, even as adults, our brains are very plastic,” Carr explained. “They’re very malleable, they adapt at the cellular level to whatever we happen to be doing. And so the more time we spend surfing, and skimming, and scanning...the more adept we become at that mode of thinking.”¹³

Of course, the internet is not inherently bad, and in the context of research, it represents a powerful tool that has democratized access to information. The most effective kind of exploration does not shy away from using technology. However, using the internet exclusively as a tool for discovery is not ideal, and we believe it is essential for students to practice the type of learning and open exploration that flourishes within the context of invention education.

To further this approach, and to help schools across the country provide engaging invention education to their students in any learning environment, the National Inventors Hall of Fame has developed a range of educational programming designed to ignite children’s natural curiosity.

[Visit our website](#) to learn more about why thousands of school districts continue to choose the National Inventors Hall of Fame as an educational partner.



An educator encourages a student engaging in hands-on invention education.

A few highlights from the Hall of Fame’s ESSER-qualified programming include:

- Hands-on STEM activities that help students make real-world connections to what they’re learning
- Modules designed to be flexibly implemented in an in-school, afterschool or summer learning environment
- Actionable strategies students can use to develop an I Can Invent® Mindset, which unlocks creative potential
- Lessons that help educators close COVID-19-related academic and engagement gaps
- Creative invention education strategies teachers can use in their classrooms

13. Carr, N. (2010, June 2). ‘The shallows’: This is your brain online. NPR. Retrieved September 15, 2022, from <https://www.npr.org/2010/06/02/127370598/the-shallows-this-is-your-brain-online>