National Inventors Hall of Fame®

THE IMPORTANCE OF EARLY EXPOSURE TO INNOVATION

As advances in technology continue to evolve the way industries do business, preparing children today for the jobs of tomorrow by teaching them STEM (science, technology, engineering and mathematics) skills is essential. One of the most effective ways to cultivate excitement in these subjects is to introduce students to inspiring innovators who bring the possibilities of a career in these fields to life.

THE IMPORTANCE OF AN INNOVATIVE MINDSET

Having an innovative mindset is crucial to succeeding in future career fields. Because these jobs often present problems that lack straightforward solutions, the earlier children can begin to develop this type of adaptive thinking, the more likely this skillset will follow them into adulthood.[1] Exposing young children to innovation is an effective way to encourage interest in STEM fields and develops the innovative thinking skills and curiosity required to excel in these careers.[2]

Unfortunately, not all demographics are exposed to innovation at equal rates. In fact, minority children experience this exposure far less than their non-minority peers. Because of this, minorities are significantly underrepresented in STEM fields despite expressing equal interest in STEM as children, even as our country continues to grow more diverse.[3] Partly to blame for this gap is a lack of exposure to innovation outside the classroom, as well as unengaging programming within classroom settings that fails to excite children to the relevance of STEM subjects.

INSPIRING INNOVATION ACROSS COMMUNITIES

Relatable role models are essential during a child's developmental learning state, as children who see themselves in others imitate traits with which they most identify.[4] For students interested in STEM, exposure to role models involved in these fields has the power to maintain their interest and increase the likelihood they will innovate in the future.

The effectiveness of role models has roots in what's called "observational learning," where children learn and copy behaviors and actions by watching and listening to other people. Common examples range from a child learning how to swing a bat after watching a baseball game, to the repetition of an inappropriate word first heard on the playground. According to early childhood educator Kylie Rymanowicz from Michigan State University, positive reinforcement is crucial in determining which behaviors will stick.

"People are more likely to imitate a behavior if they get some sort of positive reinforcement for it. For example, if a child overhears another child swearing, he might learn new words, but may not necessarily use them. If, however, the child gets some sort of reward for swearing, such as acceptance or encouragement from an adult, an observing child might be more likely to copy this behavior."[5]

A Camp Invention® participant shows off his prototype

1. Schiilar, P. (2001) Brain Research and Its Implications for Early Childhood Programs. Southern Early Childhood Associations. Retrieved from https://www.southernearlychildhood.org
2. Bell, A., Chetty, R., Jaravel, X., Petkova, N., & Reenan, J. (2017, December). Who Becomes an Inventor in America? The Importance of Exposure to Innovation [PDF].
3. Ibid.
4. Ibid.
5. Institute, T. C. (2016, March 04). How Thinking About Thinking Can Help Kids Build Resilience. Retrieved from https://www.canr.msu.edu/news/monkey_see_monkey_do_model_behavior_in_early_childhood
6. Steinberg, L. (2014, September 8). Lessons from the New Science of Adolescence. Retrieved from https://www.psychologytoday.com/us/blog/field-guide-families/201409/lessons-the-new-science-adolescence

A Camp Invention camper uses a magnifying glass to gain a new perspective

Instead of persuading children to distance themselves from negative influences, it is more effective to begin encouraging them to learn from role models who represent skills and traits that will positively impact them as they grow.

ENRICHING EDUCATION DRIVES INNOVATION

Young minds are malleable. Social scientists have discovered that children's brains are especially susceptible to experiences and that both positive and negative experiences can have a lasting impact on a young person as they mature.[6] In this metacognition stage, a child is much more likely to think deeply about their personal observations and growing curiosities about the world and themselves.[7]

To make the most of this important stage of development, educators can promote hands-on learning to grow a child's curiosity and help them develop into future innovators. This teaching method allows students to apply their natural wonder to the world around them in engaging ways.[8] This creative environment transcends the traditional classroom setting by stressing the importance of project-based learning to foster creative problem solving.

Because children are significantly influenced by their surroundings during their primary school years, it is vital to demonstrate the importance of invention and creativity by implementing activities that reflect these same values.[9]

OUT-OF-SCHOOL PROGRAMS CAN INTRODUCE INSPIRING ROLE MODELS

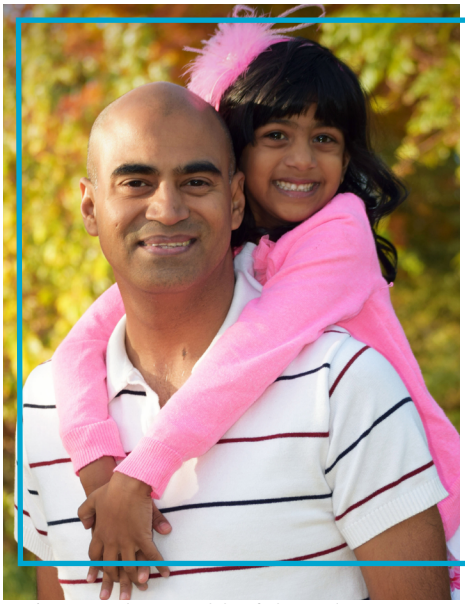
Introducing young minds to innovative, relatable role models and placing them in environments that allow the exploration of these inspirational figures is important; but often, due to lack of funding or an emphasis on standardized testing, these experiences are not given the attention they deserve. One way to address this problem is through the implementation of programming outside the confines of the normal school day. **A study commissioned by the Rand Corp. found that summer programming was especially beneficial for "low-income families who might not have access to educational resources throughout the summer months and for low-achieving students."[10]**

When infused with lessons in STEM, these types of outside programming opportunities can both inspire and encourage those potentially interested in a STEM career to follow through with their desire. A 2006 study published in Science magazine supports this strategy, and found that children interested in STEM at an eighth-grade level are significantly more likely to pursue a STEM-related career in college than those who simply perform well on math and science tests.[11] These two studies underscore the importance of exposure to innovation in early education, which sustains student engagement in STEM fields and makes related subjects more accessible for all students.

While educational programs can encourage inventive interests within the confines of a classroom, minority children still face outside obstacles that frequently discourage them from pursuing innovation in their secondary education. To address this discrepancy, elementary and middle schools must collaborate to create out-of-school STEM programs for all students. By introducing these young learners to environments where they can experience how innovation impacts their personal world, they are able to see firsthand how relevant STEM is to their daily lives. The skills they learn within these programs, paired with the inspiration they receive from innovative role models, can have life-changing consequences.

A Camp Invention camper measures building materials for his invention

7. The Child Mind Institute, (2016, March 04). How Thinking About Thinking Can Help Kids Build Resilience. Retrieved from https://childmind.org/article/how-metacognition-can-help-kids/
8. Struyven, Katrien, Filip Dochy, and Steven Janssens, (2008, February 1). The Effects of Hands-On Experience On Students Preferences for Assessment Methods. Journal of Teacher Education 59 69-88. DOI: 10.1177/0022487107311335
9. Salyers, F., & McKee, C. (2018, September 23). The Young Adolescent Learner. Retrieved from https://www.learner.org/workshops/middlewriting/images/pdf/W1ReadAdLearn.pdf
10. Mccombs, Jennifer Sloan, Catherine H. Augustine, Heather L. Schwartz, Susan J. Bodily, Brian Mcinnis, Dahlia S. Lichter, and Amanda Brown Cross. "Making Summer Count: How Summer Programs Can Boost Children's Learning." The Rand Corp., 2011. DOI: 10.1037/e525802012-001 Learning."



Nikaya spends time with her father and STEM role model Anurag

2018 MIGHTY MINDS WINNER INSPIRED BY FATHER TO INVENT

While sitting in her elementary school classroom, 8-year-old Nikaya Baranwal decided that she wanted to create her very own invention: a chain reaction obstacle course. To accomplish this, Nikaya turned to her father Anurag Kumar, a mechanical engineer and primary source of inspiration, for help.

Her desire to create just like her father is consistent with the Opportunity Insights research, which states that early exposure to innovation substantially increases the likelihood that children will become innovators in adulthood. The same study also found that a parent's area of research influences a child's decision to follow the same career path.[12]

From an early age, Nikaya demonstrated a natural interest in STEM subjects. However, her parents were careful not to push her in any one direction.

"I very rarely give Nikaya direction," her mother Smriti Kansal said. "I encourage her to explore her own ideas instead of telling her how to do things."

As advocates of personalized learning, an educational approach that encourages self-discovery, both Kumar and Kansal viewed their daughter's desire to build and design an obstacle course as a perfect opportunity for her to learn by doing.

After showing her how the different pieces and parts of the obstacle course interact with each other, Kumar let his daughter take the lead. For the next three days, the two worked as a team. Eventually, the obstacle course grew so large that it took up the entire living room.

https://www.youtube.com/watch?v=BnEGEH0AmXw

"Nikaya continued having new ideas, and the obstacle course continued getting bigger," Kumar said. "This is a lot like how science and invention work. You invent one thing and then the next thing gets added to that to make it better."

Kumar made it a priority to spend time working with Nikaya on the project each day. He believes one of the most important ways to cultivate a child's interest is to spend time with them to make the activity more fun and engaging.

"What I have seen is when parents take the initiative on their own and engage with kids, that's the best thing they can do," Kumar said. "Just telling them to study isn't enough. Though the intention is there, it's not enough. Personal engagement and participation with your kids is the best motivation."

Kumar's dedication to working hands-on with Nikaya inspired her to see the obstacle course through to completion and submit a winning application video of her invention to the 2018 Mighty Minds contest. Nikaya's first-place submission won her and her family an all-expenses-paid trip to attend the 46th National Inventors Hall of Fame® Induction Ceremony in Washington, D.C. While there, she met and interviewed 2018 Inductee Sumita Mitra, inventor of the first dental filling material to include nanoparticles.

Nikaya plans to continue inventing and has dreams of becoming a mechanical engineer just like her father.

Though engaging a child in hands-on play and discovery is time-consuming, Kumar believes this is the best way to both encourage and deepen a young person's interest in STEM fields.

"If we work with kids on one small experiment at a time, it might just be a game or playtime at first, but it builds up and will give them an interest in STEM programs later in life," Kumar said.

Nikaya and her family pose at the 46th National Inventors Hall of Fame Induction Ceremony

11. Tai, R. H., Liu, C. Q., Maltese, A. V., & Fan, X. (May, 2006). Planning early for careers in science. Science, Vol 312, 26
12. Bell, A., Chetty, R., Jaravel, X., Petkova, N., & Reenan, J. (2017, December). Who Becomes an Inventor in America? The Importance of Exposure to Innovation [PDF].