



Is there something cool about science, math, engineering, or technology that you want to share with your class and family? Write about it here.



My STEM Stories™

Introduction to Invention

Did you know that ideas are valuable?



**STEM
Inventor:**

Vocabulary

Term	Definition	Picture or Simplified Definition
Brainstorming	Brainstorming is collecting and sharing a lot of ideas to solve a problem.	
Creative Thinking	Creative thinking is using your knowledge and things you learn in school to come up with a new idea.	
Inventor	An inventor is a person who comes up with a new way to solve a problem.	
Intellectual Property	Intellectual property is a law that protects inventions.	
Entrepreneur	An entrepreneur is someone who turns ideas into a business and then gets to be their own boss!	

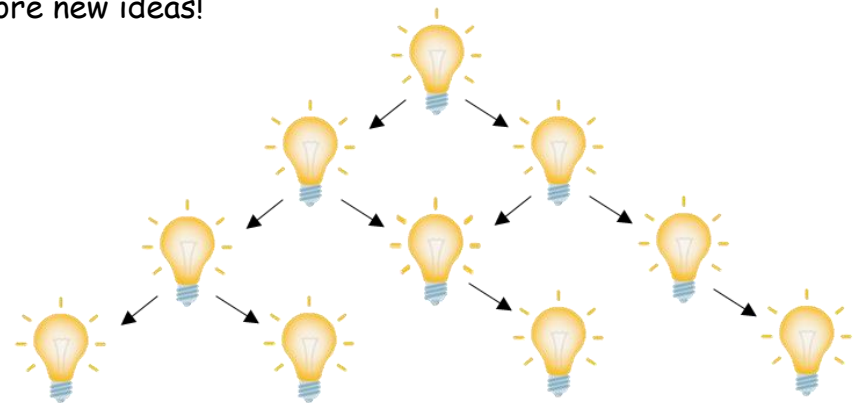
An example of the term in the inventor stories

Ideation and Innovation

We all come up with ideas. Sometimes they are about something we wish we had to play with (like a cool piece of playground equipment). Other times they are about something we wish we could change (like how we could make it easier to clean our room). But how do you know if your idea has value? Would you believe me if I told you that ALL ideas have value?

It's True!

Even if an individual idea may never become something you can hold in your hand, or turn into a product or service, it still has value. This is because all ideas are sure to do at least one thing—they lead to new ideas. And those ideas lead to even more new ideas!



Term	Definition
Brainstorming	Brainstorming is collecting and sharing a lot of ideas to solve a problem.
Creative Thinking	Creative thinking is using your knowledge and things you learn in school to come up with a new idea.
Inventor	An inventor is a person who comes up with a new way to solve a problem.
Intellectual Property	Intellectual property is a law that protects inventions.
Entrepreneur	An entrepreneur is someone who turns ideas into a business and then gets to be their own boss!

New ideas are what drive innovation and inventions like rain and sunlight help make new plants. Just like you need a lot of rain and sunlight for a single plant, a single invention is the result of many, many, many ideas.

Did you know that many famous (and many not so famous) inventors carry a small notebook with them? This is so they can write down their ideas as soon as they think of them. They know that every single idea they have has value. They know that all ideas deserve to be written down, so they aren't forgotten. They know that even if they can't use their idea right away, they might be able to use it in the future—either as it is, or as the spark for another idea.



Useful Phrases for Having Constructive Discussions

Asking Clarifying Questions

Can you be more specific?

Why do you think that is important?

What if the opposite were true?

Can you give me another example, so I can understand?

Adding to an Idea

I agree, and I have an addition: _____.

I would like to add to that idea.

Yes, that makes sense, and I would also like to add _____.

Respectfully Disagreeing with an Idea

Could you explain, because I have a different idea?

I respectfully disagree because _____.

I see your reasoning and disagree with some of the idea because _____.

TELL US ABOUT YOU AND YOUR INVENTION



As early as 500 BCE, people wanted to protect their ideas and inventions. They wanted to encourage new ideas but also wanted to stop others from imitating or copying their ideas.

Giving value to an idea is an important part of **intellectual property law**. Intellectual property laws are designed to protect ideas and innovations. However, they are complicated and continually being updated as new innovations are created that don't fit old patterns. Professionals who work in this field must have a good understanding of law, business, and technology.

"You can't hold an idea in your hand like you can money or jewelry, however, ideas still have a lot of value."

Explain why you think the previous statement is true or not true. Use examples from the introduction to support your answer.

When you are working on a new product or idea it is important to have a lot of different ideas and perspectives.

Do you agree or disagree with that statement and why?
Make sure you justify your answer.

LET'S MEET SOME INVENTORS

Andrea Sreshta and Anna Stork,
Co-Founders of LuminAID



The Challenge: Anna and Andrea were architecture students in New York City in 2010 when they heard about a massive earthquake in Haiti. They wondered what they could do to help the people affected and rescuers. In addition to the need for food, water, and shelter, they heard about increasingly dangerous night conditions caused by the lack of reliable sources of electricity. This inspired them to turn their attention to light.



Tony Hansberry II, from Jacksonville, Florida, was 14 when he developed the surgical procedure and device that is now known as the Hansberry Stich. This device significantly reduces the time and complications associated with specific surgeries. It caught the attention of doctors at the University of Florida who invited him to present and teach his technique at a medical education event. Tony is currently studying medicine at Morehouse School of Medicine.

Mythri Ambatipudi from San Jose, California, has been wowing the world with her inventions for almost a decade starting in 8th grade. From her Carbon dioxide Absorbing Retrofit System (CARS) that aims to capture carbon dioxide from automobile exhaust and her award-winning science fair project that proposed a method to combat the ZIKA virus, to her current college capstone project developing a machine learning algorithm to assist with combination antibiotic therapies, Mythri has yet to meet a challenge she can't tackle.

Sean Russel, grew up near the ocean in North Port, Florida. He was frustrated to see the impact recreational fishing waste—especially discarded fishing line and gear—had on the marine ecosystem. At 16 years old he founded Stow It-Don't Throw It, an organization that repurposes tennis ball containers into fishing line recycling bins that are redistributed to recreational fishers. Stow It-Don't Throw It now has partner organizations in over 10 states.

Nikita Rafikov of Evans, Georgia, has a bright future. At 11 years old, he figured out how to incorporate green florescent protein (GFP) into glass to create a window that also acts as a light. GFP is the protein found in some aquatic animals that is responsible for their bioluminescent characteristics. During the day, GFP absorbs energy from sunlight to provide light at night in homes without using electricity.

The Solution: The two students turned innovators and entrepreneurs designed an inflatable solar-powered lantern. In 2015, they pitched their product on *Shark Tank* and received offers from all five investors, which has helped them get their lantern to people in more than 100 countries.



Anna and Andrea's invention is inexpensive and packs flat to make shipping thousands of lights to areas affected by natural disasters or other emergencies easy. The light battery can be recharged using the small solar panel on the top of their lantern. There also is a built-in USB port to recharge your cellphone or mobile device. LuminAID's lantern replaces reliance on candles or kerosene lamps, which can cause fires and contribute to unhealthy indoor air quality—and can't charge their devices. LuminAID not only helps people who lose power or rely on unsafe sources to provide light, but also those who enjoy hiking and camping in the outdoors and remote areas.

JD Albert and Barrett Comiskey, Co-Founders of E Ink

JD Albert and Barrett Comiskey met when they were in college in Cambridge, Massachusetts. Even though they were studying different subjects—JD was studying mechanical engineering while Barrett was studying math—they both joined the MIT Media Lab. The MIT Media Lab is an organization that focuses on bringing together ideas and ways of doing things that people normally don't think go together. (Read more about the MIT Media Lab here: <https://www.media.mit.edu/about/mission-history/>.)

While they were at the Media Lab, JD and Barrett got the idea that they wanted to make electronic paper. Electronic paper is something that would feel like paper but would work like a tablet. They also wanted it to be thin, lightweight, and flexible so you could roll it or fold it as you would a newspaper.

They tried out a lot of different ideas. The first idea they tried was to make tiny balls the size of a piece of birdseed. These balls were white on one side and black on the other. Electricity

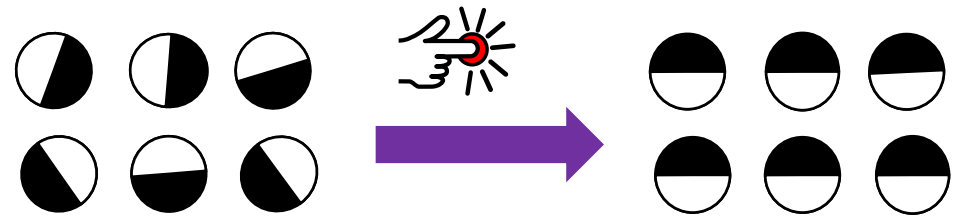
David Cohen, from Dallas, Texas, was 14 years old when he decided that robots were not only cool, they could hold the solution to a number of real-world problems he sees in his community. One of his first inventions was a robot earthworm designed to search for people trapped underground or under collapsed buildings. His favorite invention is a robot that kills mosquitoes before they can fly by drowning them using a pump-jet system.

Jai Kumar of South Riding, Virginia, likes to invent things that solve problems he sees every day. By age 12, he already had several inventions including a video game system for his local senior center and an automatic light dimming system for his school's cafeteria. Perhaps one of his broadest reaching inventions was his low-cost air filter prototype designed to be used in low-and middle-income countries. His air filter invention and prototype won him 3rd place at the 3M™ invention competition in 2015.

LET'S MEET SOME KID INVENTORS

16-year-old Kiara Nirghin of Johannesburg, South Africa, created a super absorbent polymer to help protect crops during severe drought. The polymer, made from orange peels and avocado skins, is capable of storing water reserves hundreds of times its own weight. This could allow farmers to store water from the rainy season to use during the dry season. The polymer also has the added benefit of sustainability as it uses recycled and biodegradable waste products.

At 15, Gitanjali Rao, from Lone Tree, Colorado, was named TIME magazine's Kid of the Year for her inventions. Her first invention, a device called Tethys, uses carbon nanotube sensors to detect lead in drinking water. Another is Epione, a tool that can measure changes in your blood related to drug addiction. These days she's working on her new app, Kindly, that spots and prevents cyberbullying messages.



could make them spin around so that the black side would show any writing on the paper. However, when they ran more experiments with them, they figured out that it was going to be very hard to produce these little balls on a large scale. They also discovered that someone else already thought of the idea and had a patent. A patent is like a note from the government saying that you are the only one who can use a specific idea for 20 years. So, it was back to the drawing board!

JD and Barrett were a little disappointed that they had to start over again, but that is how it goes sometimes. They went back to the library and back to the lab to research and test new ideas. In the end, they discovered that when they combined two ideas from different areas of science—medicine and electronics—they could create a new way to make electronic paper that no one had ever thought of before.

Their idea was to make very small rubber "bubbles," and inside they would put some liquid and very small pieces of special colored sand-like material. This sand-like material could move around inside the bubble, or "microcapsule," and allow you to write different things on the electronic paper.

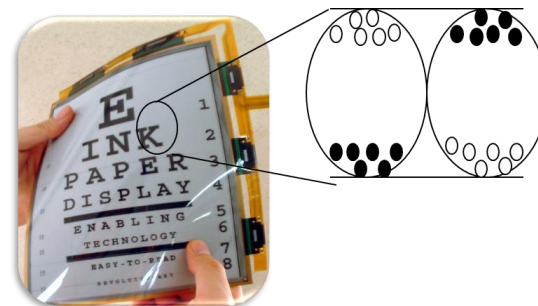
JD and Barrett tested their idea and shared it with people they knew. Eventually, they decided to start a company called E Ink and asked people from around the world to join their company and help them. They hired people from India, China, England, and Canada to help them improve their idea and to turn their idea into a product.



Barrett, Katharine, and Kim from the E Ink research team.

Everyone worked together sharing ideas, successes, and even failures. Sometimes, when they had to solve really hard problems and needed more ideas and different perspectives, they would form collaborations with other companies.

After years of hard work, JD, Barrett and the team at E Ink started selling their electronic paper! The first product didn't look exactly as they imagined it back in the Media Lab, but that was OK. They had invented something totally new even if there was still a lot of room for improvement.



After working on their inventions and company for almost 10 years, both JD and Barrett decided to try something new. Barrett went to business school and has since built a number of new companies. JD wanted to help other people with their ideas and splits his time between consulting as an engineer and teaching new inventors at the University of Pennsylvania.