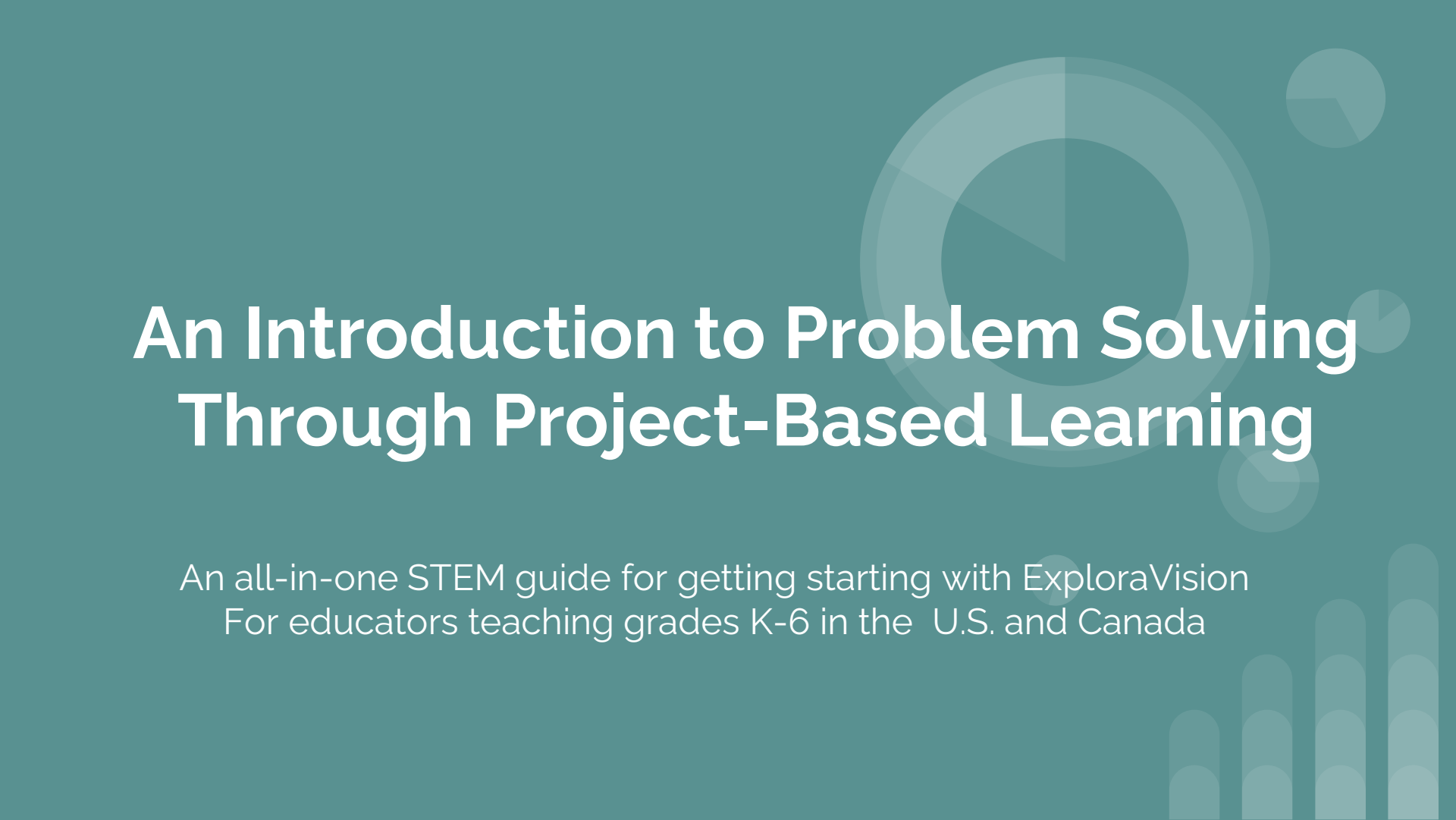




An Introduction to Problem Solving Through Project-Based Learning

An all-in-one STEM guide for getting starting with ExploraVision
For educators teaching grades K-6 in the U.S. and Canada



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What is ExploraVision?



Click the image to watch the “about ExploraVision” video

TOSHIBA



Through Toshiba's shared mission and partnership with NSTA, the Toshiba/NSTA ExploraVision competition has made a vital contribution to the educational community for over 30 years. It is a FREE virtual or in-person collaborative program and all students receive recognition for participating in the competition.

Why ExploraVision?



Why **Bill Nye the Science Guy** loves ExploraVision and his advice for students.

Click the image to watch why Bill Nye support ExploraVision

Why ExploraVision?



How much **fun** the ExploraVision **past winner** had with working on ExploraVision, what he has learned from the program, and his **advice** for students.

Click the image to watch how ExploraVision made a difference

How can you engage young kids?



How did a **K-3 mentor** engage younger kids in ExploraVision? Learn from her about how to encourage young minds and to on course.

Click the image to watch how to implement ExploraVision to K-3 kids

How can you incorporate in your classroom?



Click the image to watch how to implement ExploraVision in your classroom

How do you engage younger students in ExploraVision? Learn from Ms. Jennifer O Sullivan, a 4-6 teacher, who uses the program and her advise.

How can you incorporate in your classroom?



How do you engage younger students in ExploraVision? Learn from Ms. Maureen Foelkl, a 4-6 teacher, who uses the program and her advise,



Introducing Toshiba/NSTA ExploraVision

- ExploraVision is a STEM competition for K-12 students in the US and Canada
- It challenges students to **think creatively** yet **collaboratively** about current scientific research and technology and its limitations
- Teams of 2-4 research an existing technology and **envision what that technology might look like 10 and more years in the future**
- Teams then identify what scientific “breakthroughs” are required for their idea to become a reality and **describe the consequences** that technology may have on society
- Teams then **describe the idea with a visual in online form**
- Then 4-12 grade finalists **develop a prototype, build a website with a short video, or live online presentation to judges** of their invention
- K-3 finalists **create virtual poster** and **live online presentation to judges**
- ExploraVision is more than a science fair or a competition—it lets you **dream big** and **solve a problem you care about** using science!



Brainstorming: Solve Problems by Asking Questions

- How can we safely and easily bring light to people who need it?
- How can we keep our clothing dry and stain-free?
- How can we keep our soldiers safe from bullets?
- How can we allow people to connect and find information easily?



Brainstorming: Inventors Who Solved Problems

Early 1900's: Ichisuke Fujioka developed an economical, durable, mass-market light bulb.



Ichisuke Fujioka, a co-founder of Toshiba



Matsuda Lamp

1956: Patsy Sherman invented Scotchgard, a water and stain repellent.



Patsy Sherman, Chemist & Inventor, 3M



Scotchgard

1965: Stephanie Kwolek invented Kevlar, a strong, synthetic fiber used in body armor.



Stephanie Kwolek, Chemist, DuPont



Kevlar

2007: Steve Jobs developed Apple's first widely-adopted smartphone.



Steve Jobs, former CEO, Apple



iPhone Gen. 1

Brainstorming: Generating ExploraVision Ideas

- Need help brainstorming?
Encourage students to solve global challenges in the 17 areas addressed by the UN SDGs.
- Past ExploraVision winners developed solutions to reduce food waste, eradicate disease, improve energy efficiency and more.



[Learn more about UN SDGs](#)



Brainstorming: Generating ExploraVision Ideas

Step One: Thought Starters

Does your family or community face any environmental or health issues?

Do any current technological devices or scientific solutions address these issues?

Are there any current events or problems that make you worried for your future?

(Examples: pollution, climate change, disease, natural disasters)

What technology do people currently use and how could it be improved?

Think about which of these areas you are interested in learning more.





Brainstorming: Generating ExploraVision Ideas

Step Two: Generating Investigative Questions About Problem Area

1. What questions do you have about the problem area?



2. Refine your questions:

How can we...?

Is there an alternative to...?

How much does...?

Could we create...?

What if...?

Is it possible...?



3. Rank your questions in order of interest:

1.

2.

3.

Brainstorming: Generating ExploraVision Ideas

Step Three: Categorizing Your Questions into Subject Areas

Do your investigative questions fall into any of these categories?

- Climate change
- Sustainable energy
- Food shortage/population growth
- Space
- Healthcare/Pandemic
- Mental health & social sciences
- Robotics
- Artificial Intelligence
- Infrastructure/civil engineering (building bridges, etc.)



Can you expand or modify your questions based on these areas of concern?

Research: Understanding Your Topic

- How is your area of concern impacting local or global communities?
- What improvements could be made in this area?
- What inventions already exist in this area?
- What recent improvements have there been in this area?
- What key problems are there in this area?
- What's the history and future of the area?
- Check [past winning coaches' suggestions](#) on picking up your topic.
- Check last year's [students' motivations](#) for a project.



Past ExploraVision Winners, Grades K-3

A novel way to treat diabetic foot ulcer



"My family suffers from diabetes, so I start reading about it. Then I found that every 30 seconds a leg is amputated and 85% of these amputations is due to diabetic foot ulcers.. -- Surabi Janakiraman

The Diabetic-Balance, "DiaBal" shoe helps detect and prevent diabetic foot ulcers by using different sensors for pain, blood flow/pressure/sugar and temperature. Sensors detect loss of balance and use motors and conveyor belts to spread the feet, stabilize and prevent falling.

Protection against armed violence



"We wanted to solve the problem of youth deaths from gun violence, because firearms are the number one cause of death for children in the US. – the MasterPack team

A lightweight bulletproof backpack, MASTERPACK, is made from graphene material which will include an expandable graphene shield, GPS locator, radio wave communication, and will be powered by radio frequency energy harvesting. It will also include a net launcher that can trap and hopefully stop or trip a shooter. It's a backpack with zippers, storage compartments for your lunch and schoolwork and in cool colors and designs that kids will want to wear.

Past ExploraVision Winners, Grades K-3

A team of unmanned drones to extinguish wildfire safely



"Wildfires in the US are a big problem, destroying a lot of land, which is a habitat for plants and animals. If trees keep being destroyed there will be less clear air for humans and other animals to breathe."

Project FOREST is a team of unmanned drones that can sense elements of wildfire like smoke and heat. They will respond by going to the location and dropping fire extinguishing balls on the wildfire. It'd allow for fewer people and water to be needed. Also, the drones could reach areas that may be difficult to access for people and vehicles.

Help Kids Enjoy Swimming and prevent them from Drowning



"My friend nearly drowned when we were playing at a pool. There must be a way to not let this happen." -- winner, [Isaac Mesfin](#) (click & watch how they come up with the idea)

To stop any additional deaths from occurring, a team of third graders from Saint Joseph School in Seattle, Washington, created iSuit. This adaption of the traditional swimsuit will use artificial intelligence to release oxygen to inflate the suit and use radio waves to send a message if conditions of distress are transmitted.

Past ExploraVision Winners, Grades 4-6

Technologies to remove microplastics contain in soil



"Our team is mad with plastics. People could become sick from digesting too much plastic!."

Plastic is a problem because it is infesting our soil and showing up in our food. [Fungi Plastivore Purifier \(FPP\)](#) uses a compression system that inserts capsulated Pestalotiopsis microspora spores into the soil where plastics were located using advanced LIDAR technology. Pestalotiopsis microspora devours and breaks down polyurethane, turning it into organic matter. FPP will clean and purify our soil, leading to healthier food and water conditions while preventing serious illnesses.

Help reduce the frustrated hospital wait time with technology



What one of the team members, Zach says about why they invented the ER Assistant." – his [video](#)

The [ER Assistant](#), is an ER reception with all the necessary tools and AI equipped to admit hospital patience and to diagnosed efficiently and effectively.

Past ExploraVision Winners, Grades 4-6

An effective roofing alternative



"We wanted to tackle a climate change and wanted to do naturally." – Algateile team, [Aditya Thakar](#) (click & watch how they came up with the idea)

Algateiles consist of a polycarbonate sheet that algae grow under and a sheet of steel that algae grow on. Algateiles offer an effective roofing alternative that counters anthropogenic carbon dioxide in the atmosphere. The Algateile system supports the algae's basic needs: fresh water, sunlight, and CO₂ to photosynthesize. Algateile will absorb thirty-two pounds of CO₂ per year.

A New Way to Combat noise pollution



"Exposure to continual noise causes stress, poor concentration, hearing loss, and heart conditions. Recent research states that noise effects children's learning."

RMF (Relinquit Mutatio Figura) seeks to help societies across the globe combat noise pollution. Their project, "RMF: Leaves Changing Shapes" uses liquid-elastomers (LCE's) and 4-D printing, creating a leaf shape-shifting system to absorb sound waves. RMF also returns natural environmental sounds into communities, ultimately absolving health risks associated with noise pollution.

Engineering Process for Problem Solving

The engineering process is often used by professional engineers to solve problems and it can be used to structure your team's ExploraVision efforts:

1. Identify and define the problem
2. Gather information and perform research
3. Brainstorm and develop possible solutions
4. Design your solution
5. Build a prototype
6. Test it
7. (Rebuild it, if needed)
8. Evaluate your solution



Components Required to Complete a Project

- Abstract
- Description
 - Present Technology
 - History
 - Future Technology
 - Breakthroughs
 - Design Process
 - Consequences
- Bibliography
- Sample Web Pages
- Note: please visit [here](#) for the K-3 and 4-6 entry template

Project Formats

Grades – K-3

Storyboard

Grades 4-6

Presentation

(Slides/Google

Slides or Standard

ExploraVision

Project Format)





Key Components: Breakthroughs, Design Process, and Consequences

Breakthroughs: Research and describe the breakthroughs necessary to make your future technology a reality. Describe why this technology doesn't exist today. Choose one of your required breakthroughs and describe an investigation that would need to be carried out to test your project. If possible, include the kind of data or measurements that would be collected in this investigation.

Design Process: Describe three different features your team considered for the design of your technology. These features should be directly related to your current project, not one submitted in previous years. Describe why your team rejected each feature in favor of the ones in the submitted technology. Explain why the features in your submitted project are better than the ones you rejected.

Consequences: Recognizing that all technologies have consequences, describe the potential positive and negative impact of this new technology on society.



Summary and Sources: Abstract and Bibliography

Abstract:

- An abstract should help the reader understand your project quickly and encourage them to read on
- In no more than 150 words, summarize your proposed future technology and other relevant information

Bibliography:

- Include all research sources in the bibliography. Please cite in MLA or APA
- Sources must be clearly labeled and include title, author, publisher, and copyright date (depending on citation format)

Communication: Website & Video

- Each team will learn how to best communicate the value of their project. Teams can either hand-draw or build actual websites that succinctly explain their project in 5 pages or fewer.
- Images, text and diagrams need to include descriptions of future ideas/technologies
- When possible, use data to backup your project's claims
- If your team wishes to create a video, consider using the website as a “storyboard” to layout the important themes



Not able to build a website? Consider these: Word (horizontal letter), PowerPoint or hand-drawn



Judge Expectations

- Each judge awards points for ideas that **haven't been invented, overall creativity, scientific accuracy, strong communication, and feasibility of the project's vision**
- Judges award higher scores to entries that are different from those that have previously won
- **Judging is divided into two phases:** regional and national judging. All eligible projects will be evaluated in the regional judging phase
- 24 regional winning teams will move on to national judging, where **8 teams become finalists**

Who are our judges?

ExploraVision judges are career scientists, innovators, engineers and industry professionals who recognize the value of STEM education. Past judges worked for NASA, UPenn and other forward-thinking organizations.

Due to their deep expertise, judges can assess the feasibility of submitted projects.

Resources

- [ExploraVision website](#) (more details on the entire program)
- Tap into [Skype a Scientist](#), which connects established scientists and K-12 students via video chat for 30-60 minute, Q&A sessions
- Ask for **mentorship from parents or other adults** in the community who work in field(s) related to the project
- Collaborate with **school librarians** for research and **language arts teachers** for communicating the big idea
- Useful websites for students: [NASA Climate Change](#), [Kids National Geographic](#), [Robotics for Kids](#), [Referral MD](#), [What's an Engineer?](#), [EIA for Kids](#), [DOE Sustainable Energy](#), [USPTO for Kids](#)
- Useful websites for teachers: [Robotics](#), [Science Friday](#), [NASA](#), [ASCE](#), [NGSS](#)





Resources

- NSTA's Science Competition Director on ExploraVision:
- [What is ExploraVision](#)
- [How to Kick Off ExploraVision](#)
- [How to choose an ExploraVision topic](#)
- [How to Form ExploraVision Teams](#)
- [How to Keep Your Team Motivated](#)
- [How to Prepare for ExploraVision Project and Get Started](#)
- ExploraVision [FAQ](#) video



Resources

- Past ExploraVision teachers have used this program as a tool to motivate students and bring schools together. Here are a few ideas to inspire you:
- Teachers at a magnet school in Nashville organized a **school-wide Shark Tank-style program** where teams presented their projects before a panel of four, including a non-science teacher, a parent, a community representative, and an expert in STEM
- A teacher in Atlanta hosted an **award ceremony** for upper grades with district leadership
- In Ottawa, a teacher celebrated the end of the year-long program with **cupcakes**





Resources & Collaboration Tools

Getting your students organized and ready for this **FREE** K-12 STEM competition can be done **easily** and **virtually** through the use of online tools such below.



Are you overwhelmed in this school year? Have questions or want to know tips on how to introduce to your classroom and how to get started virtual teams?
Email to: **exploravision@nsta.org**



Social Media

Search #ExploraVision on Twitter, Facebook and Instagram to get how other educators are using ExploraVision and keep motivating students

You will see cool photos from the ExploraVision winners as well as teachers chronicling their teams projects over the school year.

Follow Toshiba on social media for program updates and inspiration!

Join our Community!

