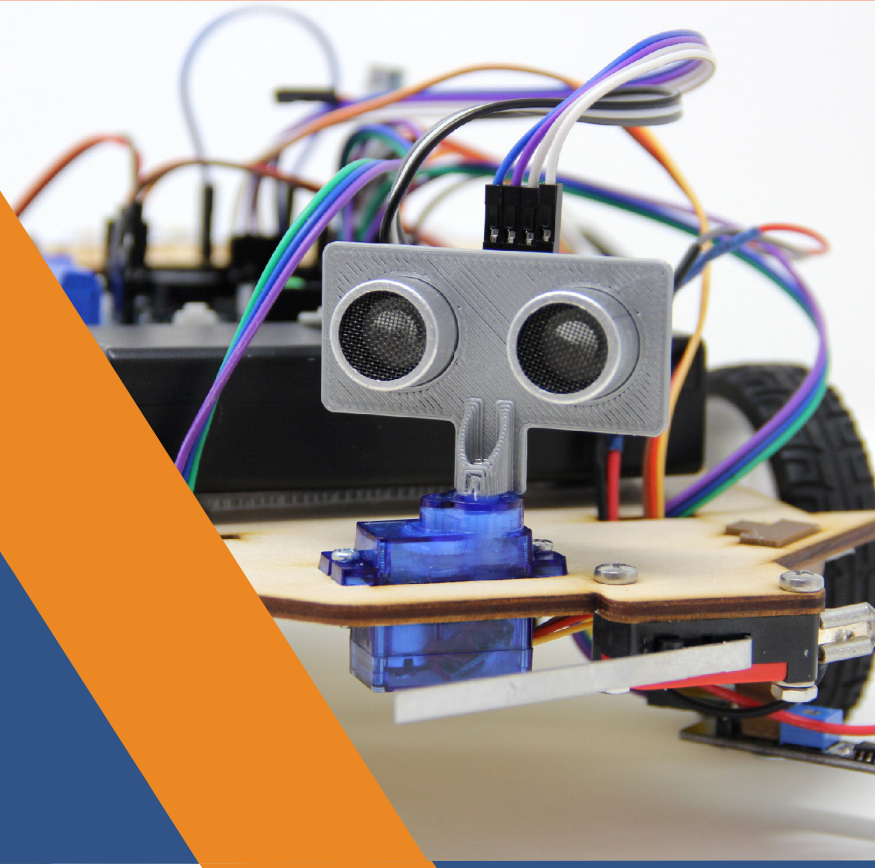
TinkRworks®
transforming learners to innovators



TinkRworks STEAM

SUPPLEMENTAL HANDS-ON STEAM CURRICULUM

888-998-4657 sales@TinkRworks.com www.TinkRworks.com

TinkRworks is a provider of exceptional STEAM[1]-powered hands-on projects designed to tranform learners to innovators by:

- Fostering a love of creating
- Enhancing problem-solving skills
- Reinforcing and expanding on concepts and ideas taught in school
- Providing delight & inspiring curiosity
- Encouraging self-expression

Components of TinkRworks STEAM Curriculum

Multidisciplinary projects

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- Individual student project kits
- Full innovation cycle exposure:
  - Art design
  - Assembly
  - Electronics integration
  - Coding
  - Testing

Standards-aligned curriculum

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- Supports CCSS, CSTA, NGSS & Other standards
- Curriculum maps with learning objectives, essential questions to answer, pacing guides & standards alignment.
- Detailed lesson plan, video modules, assessments, teacher led activities and student worksheets

Cloud-based learning platform

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- Chromebook, Mac, PC & Tablet compatible
- Embedded proprietary coding environment
- Links wirelessly to project kits
- Video modules for learning and reference

Professional development & support

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- End-to-end training on curriculum & project builds for both remote & in-person delivery
- Dedicated support team

1 STEAM = **S**cience, **T**echnology, **E**ngineering, **A**rts, **M**athematics

STEAM Product Portfolio

STEAM Projects	Beginner Programming Environment			Advanced Programming Environment					
	K	1st	2nd	3rd	4th	5th	6th	7th	8th
STEAM Academy	●								
Smart Lamp		T	●						
Pampered Plant		●	T	●	●	●			
Weather Station				T	●				
TinkRbot				●	T	●			
Planetary Pathways					●	T	●		
TinkRdrone								T	
SensorBot								T	
Morse Coding								T	

T **Target Grade Level –**
STEAM curriculum developed to support the specific grade level NGSS standards

● **Grade Band Support –**
STEAM curriculum developed to support delivery across multiple grade levels

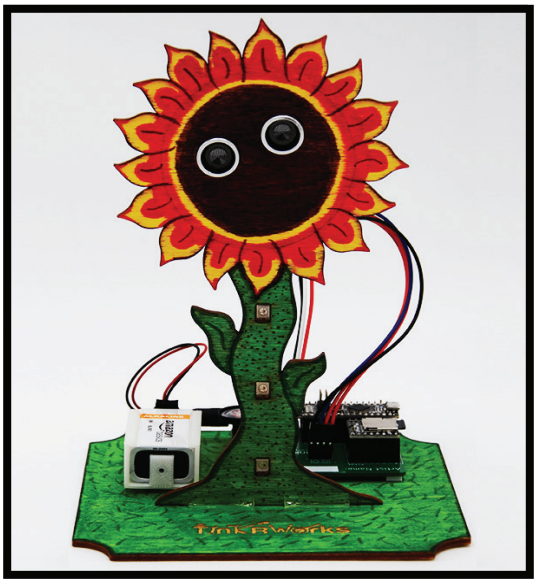
Note: Grade Band implementation cannot span both coding platforms.

KINDERGARTEN

STEAM Academy

Project Description -

Students will integrate art and technology in this unique project where artwork comes to life as people view it. They will start by using sandpaper, paint and other art supplies to customize a wooden template of either a rocket or a flower. Students will then incorporate technology into their artwork using programmable LEDs, a speaker, and an Arduino minicomputer which controls these elements. Students will learn about the primary colors of light and experiment with combining these to create any color they can envision. As a final step, the children will insert a proximity sensor that measures distances to objects and will code their artwork to come to life with sounds and lights of their choosing when someone approaches.



Students Take Home

Their very own interactive art project.

Key Concepts

Introduction to Arduino and circuitry; programming lights and sounds.

1ST GRADE

Smart Lamp

Project Description -

It's one thing to personalize a bedroom with posters and pictures, but it's another to do so with a smart lamp that not only lights up but also plays music that students compose. Students will create their lamp from acrylic panels, screws, and 3D-printed posts. They will then program a minicomputer to activate LEDs and music. They'll even customize it by creating their own designs on the panels. Students will use their hands and brains to make their very own unique bedside companion.

Students Take Home

Fully functional night light.

Key Concepts

Intro to design; programming lights, sounds, and sensors; social emotional learning (moods and feelings).

Next Generation Science Standards (NGSS) support for 1st grade learners:

Performance Expectations Arrangement(s):

1-PS4: Waves & Their Applications in Technologies for Information Transfer

Performance Expectations

1-PS4-1: Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.

1-PS4-2: Make observations to construct an evidence-based account that objects in darkness can be seen only when illuminated.

1-PS4-3: Plan and conduct investigations to determine the effect of placing objects made with different materials in the path of a beam of light.

1-PS4-4: Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.

2ND GRADE

Pampered Plant

Project Description -

Students combine electronics, sensors, and Arduino minicomputer to build and code a plant monitoring station. Students will program their station to indicate the "happiness level" of their plant by measuring the moisture level in the soil and displaying a happy or sad face on an LED grid. They will learn about plant science; how plants use energy from sunlight; how factors such as humidity, temperature, and the level of UV light affect plant growth. Students will experiment with sensors and learn to add them to monitor conditions.

Students Take Home

Their very own potted plant, complete with their plant monitoring system.

Key Concepts

Plant science; introduction to Arduino and circuitry; binary code and conditionals; integration of sensors and displays.

Next Generation Science Standards (NGSS) support for 2nd grade learners:

Performance Expectations Arrangement(s):

2-LS2: Ecosystems: Interactions, Energy, and Dynamics

2-LS4: Biological Evolution: Unity and Diversity

Performance Expectations

2-LS2-1: Plan and conduct an investigation to determine if plants need sunlight and water to grow.

2-LS2-2: Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.

2-LS4-1: Make observations of plants and animals to compare the diversity of life in different habitats.

3RD GRADE

Weather Station

Project Description -

Weather Station focuses on scientific concepts related to earth science. Students will build a weather-monitoring system using an Arduino minicomputer and a variety of sensors. Students will program the sensors using display it on an LED screen. They will learn about factors that affect weather, such as temperature and pressure. Students will learn about how weather data is analyzed and apply this to build weather forecasts.

Students Take Home

Their very own interactive weather station.

Key Concepts

Introduction to Arduino and circuitry; programming of sensors and LCD display; conditionals; weather factor and climate.

Next Generation Science Standards (NGSS) support for 3rd grade learners

Performance Expectations Arrangement(s):

3-ESS2: Earth's Systems

3-ESS3: Earth and Human Activity

Performance Expectations

3-ESS2-1: Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.

3-ESS2-2: Obtain and combine information to describe climates in different regions of the world.

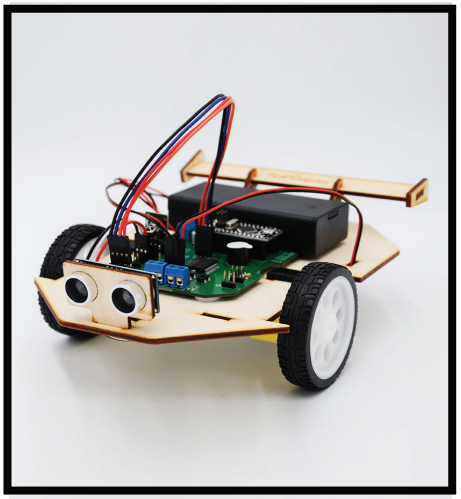
3-ESS3-1: Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.

4TH GRADE

TinkRbot

Project Description -

Students will create and customize their own robots, incorporating a variety of electronic components that enable movement and sensing. They will learn about motors, sensors, LEDs, and Arduino minicomputer. Students will experiment and integrate these components together to develop a fully-functional robot. They will then program it to move, explore, and interact with the environment, all the while linking their experiments back to concepts around energy, forces, and interactions. Students will also learn about the role of robotics in society today. They will develop skills by solving challenges centered around developing functionalities that include and combine motion, sound and light.



Students Take Home

Completed robots & remote control.

Key Concepts

Intro to robots and robot design; programming lights, sound, sensors, and motors; programming remote-control and subroutines; robotic coding challenges.

Next Generation Science Standards (NGSS) support for 4th grade learners:

Performance Expectations Arrangement(s):

4-PS3: Energy

Performance Expectations

4-PS3-1: Use evidence to construct an explanation relating the speed of an object to the energy of that object.

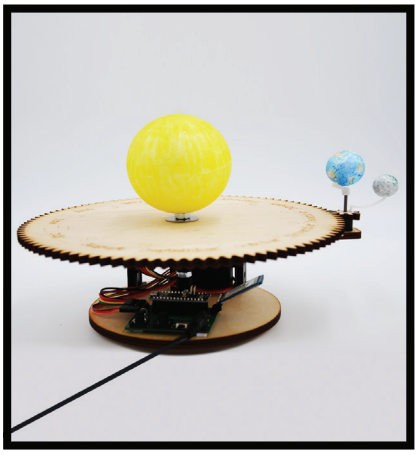
4-PS3-2: Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

4-PS3-3: Ask questions and predict outcomes about the changes in energy that occur when objects collide.

4-PS3-4: Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

5TH GRADE

Planetary Pathways



Project Description -

Students create a rotating model of the Sun, Earth, and Moon as they bring to life their learnings about planetary orbits. The model they create, called an Orrery, teaches students about how the relationship between our planet and other celestial bodies affect life on Earth and how those relationships change through the year. Students will add and program electronics including a motor to drive the model and lights to illuminate the sun. They will learn how the movement of the Sun, Earth, and Moon affects what we see in the sky.

Students Take Home

Completed working Orrery model.

Key Concepts

Seasons and movement of the Earth and Sun; phases of the moon and how they relate to the Earth and Sun; integrating circuitry, programming lights and motors.

Next Generation Science Standards (NGSS) support for 5th grade learners:

Performance Expectations Arrangement(s):

5-ESS1: Earth's Place in the Universe

Performance Expectations

5-ESS1-1: Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from the Earth.

5-ESS1-2: Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.

6TH GRADE

TinkRdrone

Project Description -
Students design, build, and fly their own functioning quadcopter drones. They learn about the physics of flight and perform experiments to understand how flight is achieved. Students will customize drone frames and integrate electronics. They will learn and experiment with different components needed to get the drone airborne, including the flight-controller board, motors, gearing system, and propellers. Students will learn about flight dynamics such as yaw, roll, and pitch, by participating in drone games to develop their piloting skills.

Students Take Home

A custom drone, controller, battery, and battery charger.

Key Concepts

Newton's Third Law and fundamentals of force; introduction to physics of flight, drone design, motors, propellers, and manipulation of speed for flight control.

Next Generation Science Standards (NGSS) support for middle-school learners

Performance Expectations Arrangement(s):

MS-PS2: Motion and Stability: Forces and Interactions
MS-PS4: Waves and their Applications in Technologies for Information Transfer

Performance Expectations

MS-PS2-1: Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.

MS-PS2-2: Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

MS-PS2-4: Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.

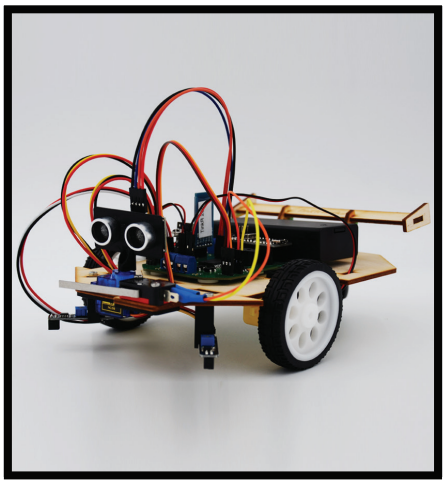
MS-PS2-5: Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.

MS-PS3-1: Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.

MS-PS3-2: Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.

7TH GRADE

SensorBot



Project Description -

Students learn about sensing robotics as they assemble and code robots capable of sensing and reacting to their surroundings. They will experiment with different sensors—touch, reflectance, ultrasonic, and infrared. After integrating sensors, students will develop coding skills by progamming the robot to solve challenges focused on object detection and avoidance, as well as line following. They will incorporate motions and light into the robot's reactions.

Students Take Home

Interactive, sensing robot, with remote control.

Key Concepts

Introduction to robots and robot design; introduction to foundational sensors (ultrasonic, reflectance, touch, infrared); integration of sensor data and motor programming to solve specific problems; intermediate algorithm development; robotics coding challenges.

Next Generation Science Standards (NGSS) support for middle-school learners:

Performance Expectations Arrangement(s):

MS-PS2: Motion and Stability: Forces and Interactions

MS-PS3: Energy

Performance Expectations

MS-PS2-2: Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

MS-PS3-5: Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

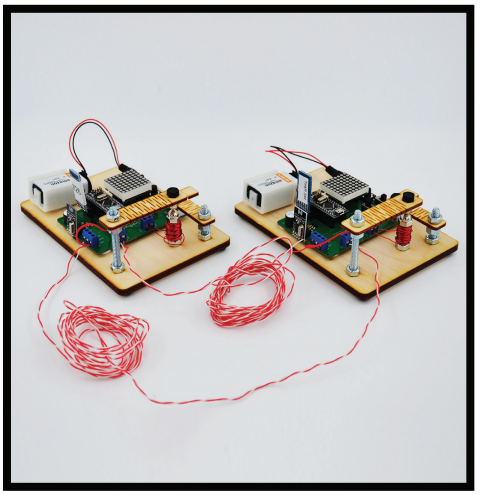
8TH GRADE

Morse Coding

Project Description -

Students will explore the history of human communications starting with cave paintings and learn how communications have evolved to modern-day wireless communications devices. In the process, they will create two devices that have allowed people to effectively communicate with one another: a traditional wired telegraph and a modern-day "wireless telegraph." Students will begin with the wired-telegraph project and will learn—and make—their own electromagnets which will serve as the central part of their design. They'll then create a key and a register and power up their system with a battery. Once done, they'll learn about Morse Code and use it to communicate information with other students within the classroom.

After completing their wired telegraphs, students will learn about wireless communications and create a device that acts as a wireless telegraph. Students will learn about radio waves and explore first-hand how they can be used to transmit and receive information. As they develop their devices, students will learn all about circuits and electronics, then use their devices to wirelessly communicate with each other.



Students Take Home

Completed wired-telegraphing system (complete with batteries) and wireless-communications device (complete with batteries).

Key Concepts

Electromagnetics, circuits and electronics; radio-wave properties; information technology (digital vs. analog signals & reliability); encryption and decryption.

Next Generation Science Standards (NGSS) support middle-school learners:

Performance Expectations Arrangement(s):

MS-PS2: Motion and Stability: Forces and Interactions

MS-PS4: Waves & their Applications in Technologies for Information Transfer

Performance Expectations

MS-PS2-3: Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.

MS-PS4-3: Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.

Standards-Aligned Curriculum

TinkRworks provides teachers with cross-curricular content that is aligned with CCSS, CSTA, and NGSS standards. Through the TinkRworks curriculum, the students will design and build their own project, gain coding experience, discover new vocabulary terms, and participate in critical-thinking opportunities.

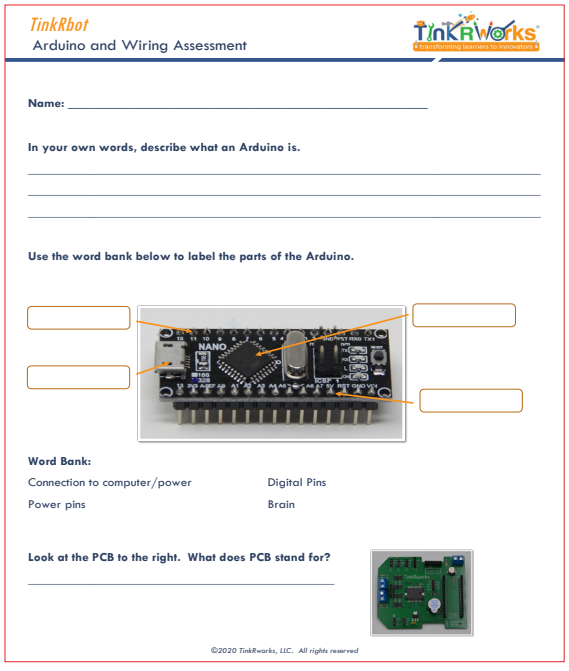
Scope and Sequence

Module	Content	In-Person Delivery	Remote Delivery
Introduction to Motors Standard Alignment CCSS.ELA-Literacy.L.4.4 CCSS.ELA-Literacy.SL.4.1 CCSS.ELA-Literacy.SL.4.1.C	• What is a motor? o How do motors work? o Where can motors be found? o How do DC motors work (video)? • Motor/generator activity • Types of generators that produce electricity	**Material Needed:** • "Introduction to Motors" PowerPoint • Motor and Generator Activity: o Robot chassis assembly o Kit: LED, 2 F-F jumper wires **Pacing :** 30-45 minutes **Delivery:** • Whole group instruction and discussion on: o What's a Motor? - Videos should be displayed to entire class o Motors and Generators • Motor and Generator Activity - Introduce the activity according to the slides, video should be displayed to the entire class. • Whole group instruction and discussion on the following section: o Generators (optional) - Use these slides if desired o Our Motor	**Material Needed:** • "Introduction to Motors" PowerPoint • Motor and Generator Activity: o Robot chassis assembly o Kit: LED ,2 F-F jumper wires **Pacing :** 15-30 minutes **Delivery:** • Whole group instruction and discussion on: o What's a Motor? - Videos are best displayed through meeting tool. o Motors and Generators • Motor and Generator Activity - Introduce the activity according to the slides, video may not be played through the meeting tool to the entire class or may be played by students indivisually • Whole group instruction and discussion on the following section: o Generators (optional) - Use these slides if desired o Our Motor **Sections** / **Video + Build Time** Motor and Generator Activity — 10-15 Mintues Full YouTube Playlist: TinkRbot

Snapshot of Standards-Based Assessment

TinkRworks curriculum includes informal and formal assessments. These assessments offer a combination of multiple choice, written response, and true/false questions that assess a student's level of understanding and progression.

TinkRworks also provides teachers and students with templates for digital portfolios. The digital portfolios are designed as a place for students to document their project journey and reflect upon their work. They are prompted to add in reflective responses, photos, and videos throughout their portfolio.



TinkRbot
Arduino and Wiring Assessment

Name: _____

In your own words, describe what an Arduino is.

_____

_____

_____

Use the word bank below to label the parts of the Arduino.

Word Bank:

Connection to computer/power — Digital Pins
Power pins — Brain

Look at the PCB to the right. What does PCB stand for?

_____

Cloud-Based Learning Platform

TinkRworks' proprietary, drag-and-drop programming environment helps students focus on developing algorithms to solve problems as they create code that is uploaded wirelessly to their project using a Bluetooth link. Each student's custom code for lights, speakers, motors, Arduino minicomputers, ultrasonic and infrared sensors brings their project to life in their own unique way. Additionally, instructional video modules chronicling the build process are provided for convenience and reference. Facilitators and students alike can interactively and dynamically utilize these modules to progress at their own pace.
No prior coding experience is required, both for facilitators and students.

Professional Development & Support

In-Person and Remote Training

TinkRworks' comprehensive professional development includes end-to-end training on curriculum and project build with lesson walk-through, concept exploration, as well as training on activities that reinforce concepts, troubleshooting strategies, and opportunities to discuss implementation questions. Certified facilitators have access to TinkRworks Support Team, email, or phone to ensure successful delivery of curriculum to their students.

In the Words of Educators & Administrators

Ryan Evans
SE Gross Middle School, District 95

Principal

TinkRworks selection:

S.E. Gross Middle School chose TinkRworks as their preferred vendor for STEAM design and curriculum due to their hands-on approach to student learning that is strongly linked to NGSS standards and offers students experiences like no other program out there. Their supportive staff provides robust training, amazing support and superior guidance through the entire process.

Impact:

S.E. Gross Middle School is working to prepare its students to be innovative and solution orientated problem solvers so that they are prepared for their lives and future careers. TinkRworks' STEAM programming stretches the limits of student thought by integrating many different modalities into their rich curriculum that is focused on problem solving and overcoming design challenges. Students at SEG who interact with this curriculum are better prepared for future success.

Ali Beirmeister
LaGrange Highlands School, District 106

Director of Teaching and Learning

TinkRworks selection:

There were two distinct factors that set TinkRworks apart from other STEAM organizations Highlands was considering: the hands-on approach of the STEAM projects and the level of customer support.

Impact:

Students demonstrated their drones in front of the board, who were instantly captured by the depth of their knowledge and ability to apply it to their STEAM project. The students' ability to talk about the design of their drones, as well as, the construction challenges they faced during the building process impressed the board most, as it went along with the theme of the school year, "safe to fail."

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