Addressing the National Pipeline Challenges for Science, Technology, Engineering and Math (STEM) Professions...

...With Local Programs for Bay County Schools

Outline

- Why is STEM important & How are we doing?
- What are the “STEM Pipeline Challenges”
- What are we proposing to do about it?

Why is STEM Important & How are we doing?

- ***2005 – The Gathering Storm***,

  The National Academies of Science, Engineering, and Medicine, predicted ***"dire consequences"*** if the country could not compete in the global economy as the result of a ***poorly prepared STEM*** workforce." [1]

- ***2006 –*** International study (PISA) results indicated that the United States comparatively ranked the US as ***21st out of 30 countries***, on assessments of ***scientific competency and knowledge***. [2]

- ***2009*** – Presidential ***"Educate to Innovate Initiative"*** - to move U.S. students to the forefront of STEM career opportunities. Federal investments in STEM education were increased and the country began preparing to meet a goal of 100,000 better prepared STEM teachers by 2021. [3]

- ***2014 –*** The ***STEM Education Act*** is established, providing more advanced training opportunity programs for teachers. [3]

- ***2022 –*** International study (PISA) results ranked US ***18th out of 81 countries***,[4, 5]

  – Math Rank: **#34**
  – Science Rank: **#16**

  ➢ US behind **China, Japan and Europe** in Science & Math
  ➢ US also behind countries like **Vietnam & Latvia** in Math

In Short:

– US is falling behind key global competitors in STEM Education
– US not producing enough STEM professionals to meet US demand
– **US Shortfall >50,000 STEM pros/yr.** *(based on visa requests from US firms)*
– Long term trend does not bode well for US future (***national security, economy, & prosperity***)

References can be found in the Notes section of this slide

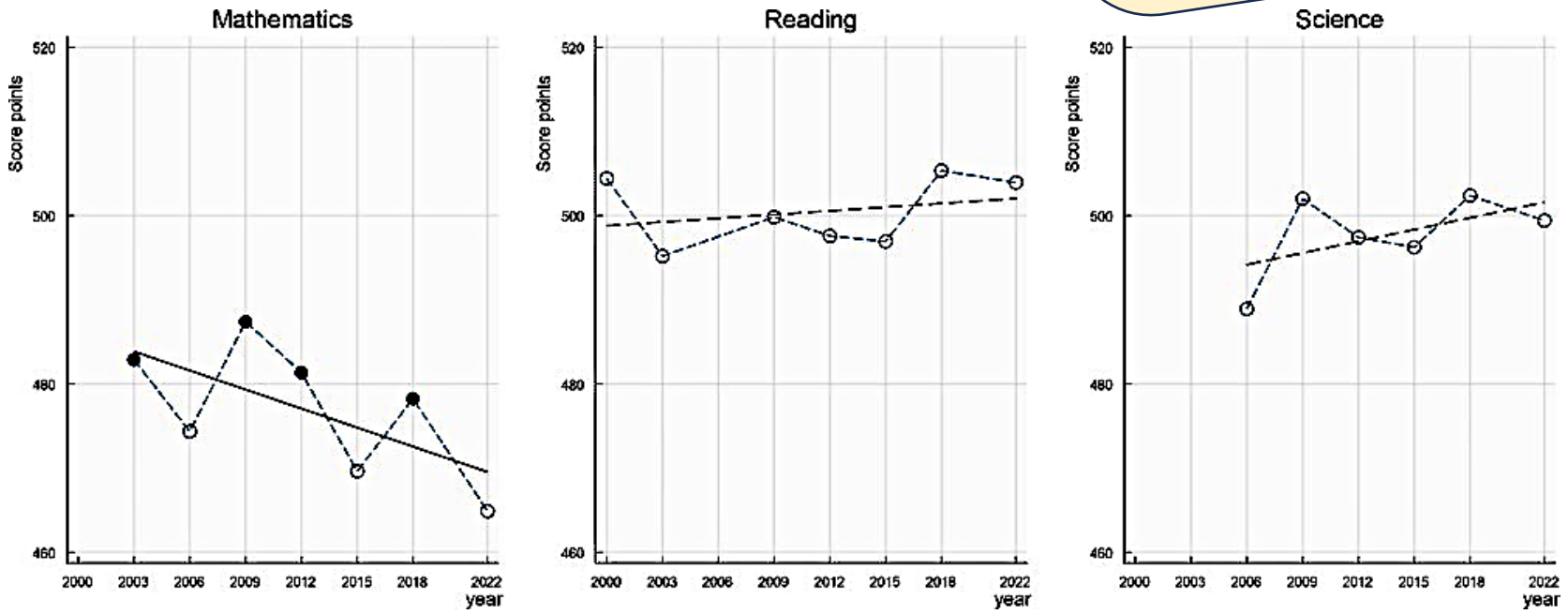
10 Year Trend - US STEM Test Scores

(PISA 2000-2023)

Have things improved much in the last 10 years, given all the USG funding? – ***No.***

- US math scores are **declining**
- Reading scores are relatively **flat** with no significant improvement
- Science scores show **very modest to negligible** improvement

Why?
Perhaps because all US education is LOCAL not Federal. Must Engage at Local level to affect change.



Note: The ***Programme for International Student Assessment (PISA)*** assesses the skills of 15-year-old students in reading, mathematics and science as core domains.

Our Systematic "Pipeline" Approach

- **Define the Pipeline:** Consider the entire journey to become a STEM professional – from first origins in K-5 grades through secondary education (6-12) and finally the college degree. This is the STEM pipeline through which all STEM professionals must travel, overcoming all the obstacles, barriers and misperceptions along the way.

- **Work the Challenges:** Each level presents its own challenges that can restrict the natural flow of STEM oriented students toward a STEM profession. In order to reduce the friction of the overall pipeline, we must understand the challenges in each level and develop initiatives to mitigate them as much as possible.

- **Focus on the Big Rocks with an understanding of Systemic issues:** We must understand these challenges enough to be able to focus on the areas where we can have the biggest impact (the Big Rocks) while also understanding the synergistic effects that one challenge can have on others. We must strive to identify the systemic issues underlying these challenges so that we can address the root of the problems in a manner that can effect a host of other related challenges.

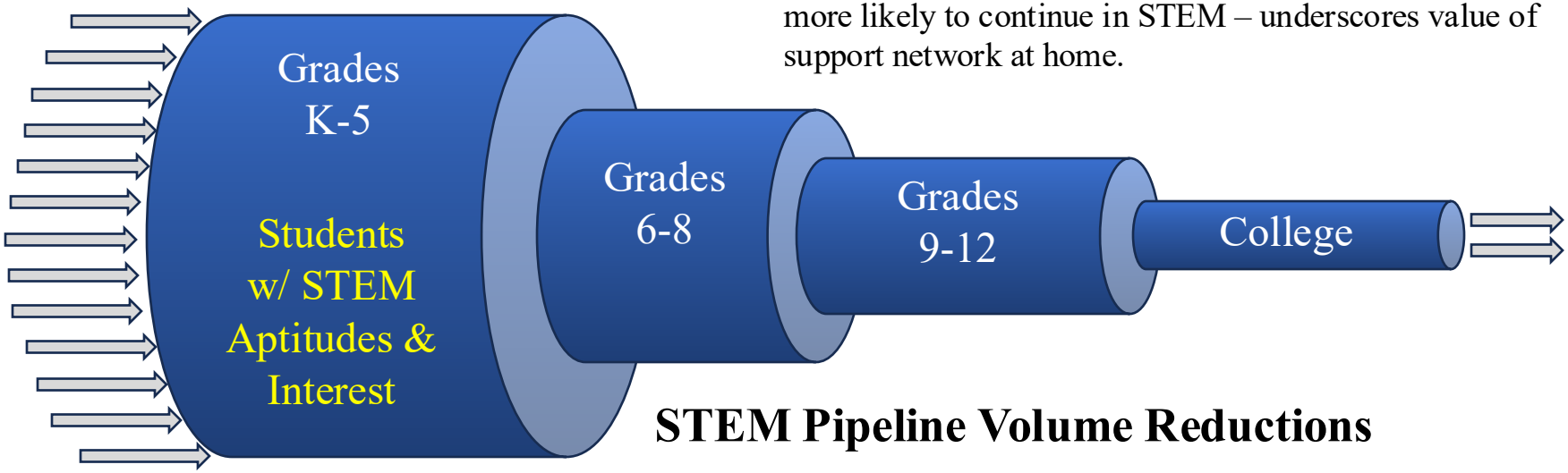
- **Develop & implement a long-range plan, that also has near-term impacts:** We should engage at all levels of the education ladder in a synergistic way such that our initiatives are mutually reinforcing, as much as possible. We should strive to start changing perceptions today, igniting passions today, and continue to serve as a persistent force across the academic ladder for decades to come.

The Big Picture

The "Big Rocks"

Studies show:

- On average, Girls have a higher aptitude for STEM than Boys in K-5 this flips after 5th grade.
- Establishment of STEM classrooms has made a big difference in these Grades, for all students...but it doesn't carry through to higher grades as greater headwinds are encountered
- Varies a lot by school due to Equipment & STEM teacher training
- Most STEM inclined girls turn away from STEM in grades 6-8 – *(this is the biggest leak in the pipeline)*
- Why? – We know Societal norms, lack of role models, peer pressure, and limited exposure to active STEM professionals all contribute to loss of students in general and girls in particular.
- Reasonable to think that we lose a larger percentage of minorities at the same point, for the same reasons
- Students with parent(s) or close relatives in STEM fields more likely to continue in STEM – underscores value of support network at home.



STEM Pipeline Volume Reductions

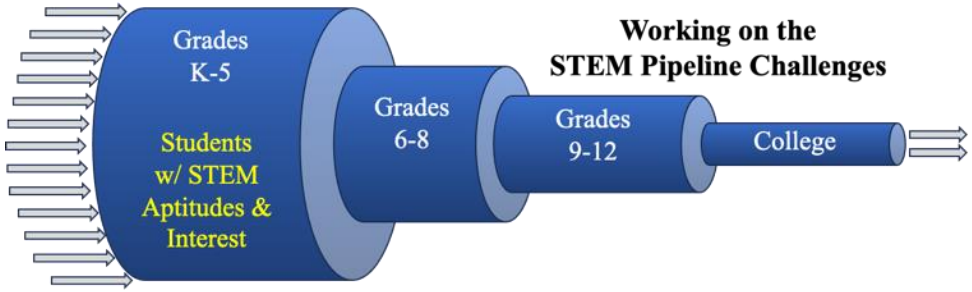
What are we doing about it?

- **Our Strategic Objectives:**
  - **Open Up the Pipeline:** Work across the academic ladder (K-12) to stimulate a passion in STEM early (K-5) and support that passion through high school and into college. Reduce barriers & change perceptions by increasing awareness and exposure to counter societal norms, lack of role models, etc.
  - **Long Term Objectives & Measures of Effectiveness:**
    (a) Increase the number of Bay Co high school grads pursuing college STEM degrees.
    (b) Increase the number of Bay Co high school grads that successfully achieve college degrees in STEM fields

- **A Multi-faceted Approach:**
  1. **Increase STEM Kits/Equip (K-12):** Purchase STEM equipment, tools and supplies for the Local Schools in classrooms at all levels, K-12.
  2. **Increase Hands-on Experiences:** Support *hands-on immersive experiences* in STEM after-school programs, local STEM summer camps, and scholarships to advanced STEM camps like Space Camp.
  3. **Increase STEM Awareness, Provide STEM Pro Mentoring & Coaching:** One-on-One mentoring for Invention Convention as well as in-class panels, STEAM night participation, College Coaches, etc.
  4. **Breakdown Barriers, Change Stereotypes, and Perceptions:** Demonstrate that anyone with passion for STEM and a baseline aptitude can achieve success in STEM careers. Recruit STEM pros from all backgrounds, races & genders and bring them into the classroom to serve as exemplars & role models.
  5. **Make College a more Accessible and Viable Option for all:** Strive to pull more lower income students into college STEM programs as 1st generation college students. This starts at the beginning of the STEM pipeline (K-5) by changing the "kitchen-table" conversations so that STEM field are considered viable options for their children. That perception must be reinforced across the academic ladder through a variety of activities, such that it woven into the fabric of everyone of our programs.

First Steps

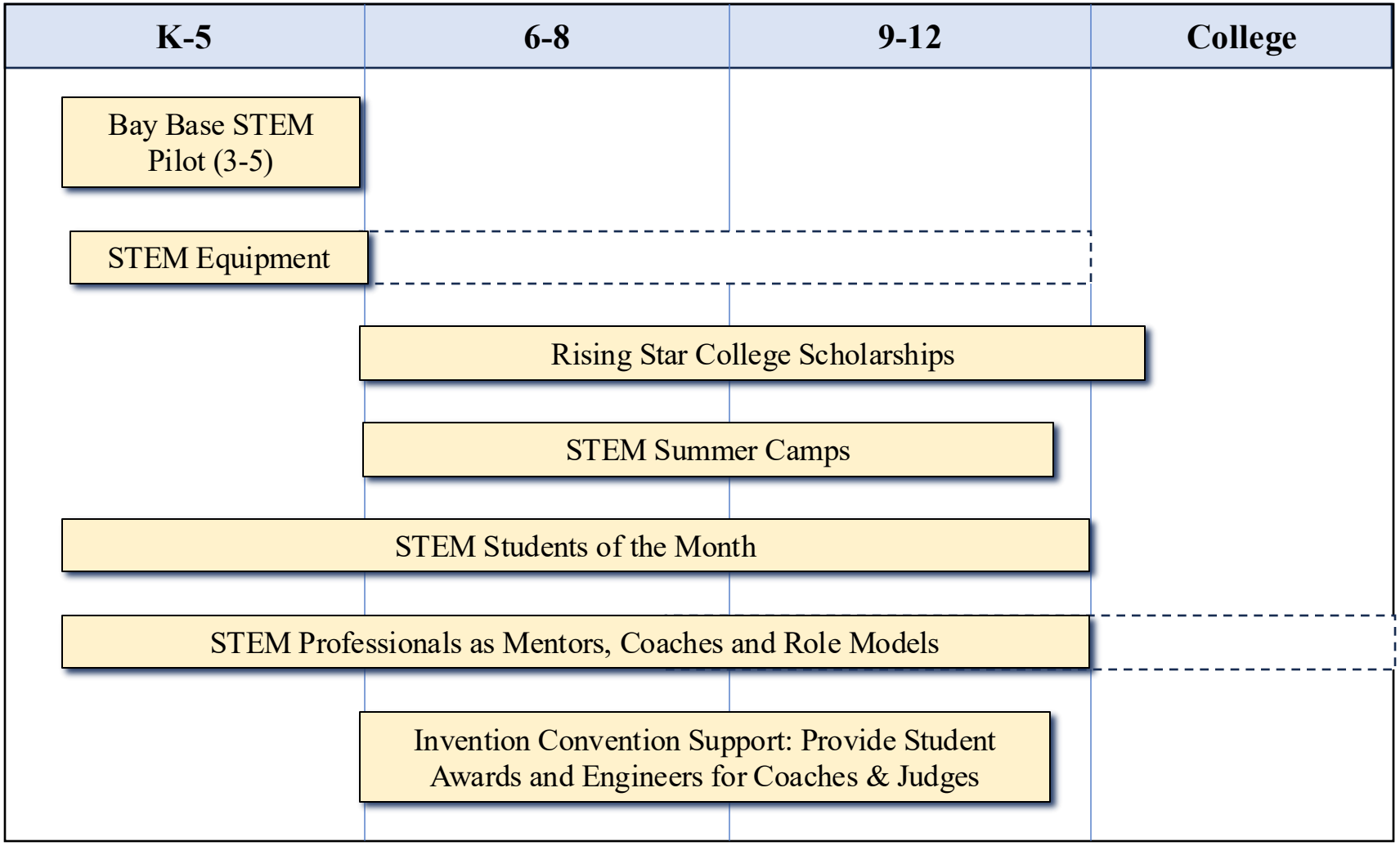
- **Initial Programs:**
  - Bay Base STEM Pilot
  - STEM Equipment for Schools
  - Rising Star Scholarships
  - STEM Student of the Month
  - STEM Pros as Mentors & Coaches



- **Proposed Initiatives:**
  - Future Expansion of Bay Base STEM to all students
  - Expand STEM Equipment Wishlist support for mainstream classrooms
  - Expand on Invention Convention & Entrepreneurial Fair (before, during & after)

Programs Across the Grades

Grades



Bay Base STEM Pilot

(On-Site School Portion)

- **Purpose:**
  1. To have an immediate and direct impact on the students involved &
  2. To serve as a test case that evaluates the value and impact of these STEM kits on local students in a manner that will enable potential transition to separate thrust areas:
     a) Future expansion to the full Bay Base program which includes approximately 1300 students ***($65,000)*** &
     b) Selective incorporation into mainstream STEM classrooms in cases where the teachers have not been trained in STEM education. ***($50/student)***

- **Provides:** STEM Kits for use in the Bay Base summer 2025 program for students in grades 3-5 at two school sites, for 50 students at each site. These kits will provide a hands-on, experience that inspire curiosity, encourage creativity, and build 21st-century STEM skills. Each school gets the following STEM kits during this pilot program:
  - **Lost Treasure** Modules of NIHF Invention Project series (50/school)
  - **Robotic Pet Vet** Modules of NIHF Invention Project series (50/school).
  - **NIHFTY Bot** Explores (50/school)
  - **GAMES** Kits of NIHF Camp Invention series (1/school)
  - **BASE CAMP** kits of NIHF Camp Invention series (1/school)

  (see appendix for details on these STEM kits)

- **Cost:** NIHF has provided an $8,000 grant which reduced our cost-share to **$5,000**

STEM Equipment - Example #1

Hutchison Beach Elementary School Wish List

This program will eventually grow to support all schools in Bay Co.
However, the first step will focus on the wish lists provided by Hutchison Beach & Patronis Elementary Schools:
(see links embedded with item name/description)

Hutchison Beach Elementary School STEM Wish Lists							
Focus Areas	**Grade Level**	**Notes**	**Item**	**Cost Per Item**	**Qty**	**Cost**	**Priority Level**
Life Science	K-5		☑ Aquaponics System	$3,599	1	$3,499	**1**
	K-5	Linked to Greenhouse	Greenhouse	$1,269	1	$1,991	**1**
	K-5		Shelf Bundle with Plant Hangers	$211	2	$422	**1**
	K-5		Roof Vent Opener	$84	2	$168	**1**
Engineering	K-5		☑ STEM Maker Supply Cart	$7,998	1	$7,998	**2**
	3-5		☑ Bristle Bots	$70	13	$910	**3**
Computer Science	K-5		☑ Ozobot Magnets	$30	6	$180	**3**
Robotics	K-5	Linked to Angelfish ROV	☑ Angelfish ROV Kit	$290	1	$290	**3**
			☑ Hydraulics Kit	$18	1	$18	**3**
	K-5		☑ Power Supply	$90	1	$90	**3**
	K-5		Testing Pool	$369	1	$369	**3**
			TOTAL			**$15,213**	

STEM Equipment

Patronis Elementary School Wish List

Patronis Elementary School STEM Wishlist							
Line Item ID#	Focus Area	Grade	Item	Cost Per Item	Quantity	Total Cost	Priority
1	Physical Science	K-5	Squishy Circuits (Class Pack)	$400	1	$400	1
2		K-5	Energy Sticks	$14	10	$140	1
3		K-5	Picasso Tiles Marble Run	$60	6	$360	1
4		K-5	Pitcher	$14	1	$14	3
5		3-5	Solar Bug Kit (Class Pack)	$105	5	$515	1
6		3-5	LED Lights for Circuits	$10	5	$50	1
7		3-5	Coin Cell Batteries (CR2032)	$6	12	$72	1
8		3-5	Copper Tape	$10	5	$50	1
9		K-5	meter stick	$9	10	$90	1
10		3-5	Electric Warming Tray	$60	1	$60	2
11		3-5	Electric Griddle	$45	1	$45	2
12		K-5	Clear Plastic Cups w/lids (2oz)	$4	4	$16	3
13		K-5	Clear Plastic Cups w/lids (4oz)	$18	2	$36	3
14		K-5	Clear Plastic Cups (8oz)	$7	5	$35	3
15		K-5	Rubber Bands -Mixed Sizes	$2	10	$20	3
16		K-5	Craft-Popsicle Sticks	$23	2	$46	3
17		K-5	Quiz Bowl Buzzers	$80	5	$400	1
18		K-5	Glow Sticks	$16	10	$160	1
19		K-2	Flashlights (8pk)	$18	10	$180	1
20		K-2	Batteries	$15	2	$30	2
21		K-2	Safety Goggles	$30	4	$120	1
22		K-5	Wooden Spoons	$10	2	$20	3
23	Life Science	K-5	Magnifying Glasses	$10	15	$150	1
24		K-2	Tweezers	$14	15	$210	1
25		K-5	Digital Microscopes	$99	6	$600	3
26		K-2	Anatomy Models Bundle	$115	5	$565	1
27		K-2	Skeleton Foam Floor Puzzle	$36	6	$216	1
28		K-2	3D Organ Apron	$22	5	$110	1
29		K-5	Owl Pellets	$65	12	$780	1
30		K-5	Owl Pellet Dissection Mat	$9	12	$108	1
31		3-5	Preserved Squid (in a pail)	$6	100	$600	1
32		K-5	Salt Water Aquarium	$569	1	$569	2
33		K-5	Sterilizer for Aquarium	$48	1	$48	2
34		K-5	Chicken coop heater	$73	1	$73	1
35		K-5	Fresh Flakes Poultry Bedding	$15	2	$30	1
36		K-5	Baby Chicken Food	$15	2	$30	1
37		K-5	Chicken Brooder	$280	1	$280	1
38		K-5	Outdoor Chicken Coop	$125	1	$125	1
39		K-5	Marine Salt (Aquarium)	$25	1	$25	2

Patronis Elementary School STEM Wishlist							
Line Item ID#	Focus Area	Grade	Item	Cost Per Item	Quantity	Total Cost	Priority
40	Earth/Space Science	3-5	Pocket Lab-Weather Sensor	$126	6	$756	1
41		K-5	Rock Kit	$21	5	$105	1
42		K-2	Clay Soil	$16	2	$32	1
43		K-5	Magnetic Solar System	$24	6	$144	2
44		3-5	Modeling Erosion & Deposition	$225	1	$225	1
45		3-5	Glass Plates	$16	2	$32	3
46		3-5	Flourescent Minerals	$50	2	$100	1
47	Coding/Robotics	K-3	Indi Class Pack/Code Mats/Literacy Cards	$3,360	1	$3,360	1
48		3-5	Bolt Power Pack + Coding Mat	$3,178	1	$3,178	1
49		K-5	Coding and Robotics Cart	$5,000	1	$5,000	2
50		K-5	Portable Robotics Table with Wood Frame	$250	3	$750	1
51		K-5	Tech Hub Storage & Charging	$2,037	1	$2,037	1
52	Engineering	K-5	Straw Builders	$25	5	$125	3
53		K-5	Magna Tiles	$119	5	$595	2
54		3-5	Engineering Notebooks (50 pk)	$80	8	$640	1
55		K-5	Glue Sticks (480 pk)	$115.37	1	$115.37	2
56		K-5	Ada Twist Scientist (book)	$11.00	5	$55.00	2
57		K-5	Iggy Peck Architect (book)	$12.00	5	$60.00	2
58		K-5	Leo the Little Engineer (book)	$12.00	5	$60.00	2
59		K-5	Keva Planks-Class Set	$1,319.99	1	$1,319.99	2
60	Professional Learning	K-5	NSTA (March 2026) (national conference)	$2,500	3	7,500	2
61		K-5	ITSE (June 2025) (national conference)	$2,500	3	$7,500	3
62	Math and Sequential Thinking	3-5	Think Fun-Laser Maze	$35	6	$210	2
63		3-5	Battleship Board Game	$17	6	$102	2
64		3-5	Math Dice	$10	10	$100	1
65		3-5	Think Fun-Gravity Maze	$21	6	$126	2
66		3-5	Mathterpieces (book)	$12	6	$72	1
67		3-5	The Grapes of Math (book)	$6	6	$36	1
68		K-5	Number Line Dry Erase Boards (10 pk)	$15	6	$90	2
69		3-5	Fraction War Card Game	$10	6	$60	1
70		3-5	Yummy Magnetic Fractions	$20	6	$120	1
71		3-5	Magnetic Fraction Tiles	$19	5	$95	1
72		3-5	Geometric Solids	$19	6	$114	2
73		3-5	Rush Hour	$14	6	$84	2

Grand Total	**$42,276**
High Priority	**$17,480**
Med Priority	**$16,352**
Low Priority	**$8,444**

Rising Star Scholarships

- **Purpose:** Select 5th grade students who show aptitude for STEM and establish a $500 college scholarship for use Gulf Coast State College (GCSC) which will be waiting for them when they graduate high school.

- **Precept:** The underlying objective of these advanced scholarships is to promote and sustain interest in STEM as these students as they climb the academic ladder from elementary school through high school. The GCSC Foundation has done this sort of thing in the past and it has proven to be an incredibly powerful way of encouraging students to pursue college education as they mature and move upward in the academic grades. It also gives the student a 6-year goal to strive for and a destination to reach after high school. Our long-term goal is to provide one for each elementary school in the Bay District (20 schools = $500x20 = $10,000) each year. However, for this year we will start with just a few

- **Provides:**
  - *Initial Goal:* Provide 1-3 scholarships, competitively across Bay District
  - *Steady State Goal:* Provide 1 for each elementary school in the Bay District (20 schools)

- **Cost:**
  - *Initial Goal:* 3 Rising Star Scholarships = $1500/yr
  - *Steady State Goal:* 20 Rising Star Scholarships = $10,000/yr

Summer STEM Camp Scholarships

- **Purpose:** Provide scholarships to summer STEM camps for students showing aptitude and interest in STEM fields. These summer camps are held on the GCSC main campus and each camp is led by a master-class STEM teacher.

- **Provides:**
  - Initial Goal: **11** STEM Camp scholarships = 9 students of the month & 3 ICEF participants.
  - Steady State Goal: **37** STEM Camp scholarships = 9 students of the month, 6 ICEF participants, and one for each middle & high school (22)

- **Cost:**
  - Initial Goal: 11 STEM Camp scholarships = **$1100/yr**
  - Steady State Goal: 37 STEM Camp scholarships = **$3700/yr**

STEM Student of the Month

Started in April, will continue into foreseeable future

Special Achievement Awards (ICEF)

We gave out awards w/ coins to 10 students at ICEF

Core Values for all Awards & Scholarships

Core Values and Key Characteristics for Merit-based Selection (at all grades)

- **Passion**
  - Curiosity for STEM topics or the natural world in general
  - Enthusiasm for research and innovation
- **Diligence**
  - Exhibits self-discipline, persistence, patience, focus and determination
- **Aptitude for STEM**
  - Rational and objective thinking
  - Structured/logical thinking
- **Collaboration/cooperation**
  - Works well with mentors and team members
  - Contributes to a body of work, collaboratively with a team
  - Communicates ideas clearly
  - Strong work ethic

These values and characteristics will be considered for all grade levels and will be commensurate with age-appropriate development.

Partners & Collaborators

- **Bay District Schools**
  - Jill Hansen* – Dir, Science Curricula, Bay District Schools
  - Cyndee Walker – Bay Base Program Coordinator
  - Erin Brack* – West Bay Elementary STEM
  - Olivia Breeze – Hutchison Beach Elementary STEM
  - Julie DeFelice* – Walsingham Elementary STEM
- **Gulf Coast State College**
  - Katie McCurdy* – Exec. Dir, Community Engagement
  - Dunkin McClane – Asst. Dir, GCSC Foundation
- **US Navy**
  - Damion Dunlap* – STEM lead at NSWC, Panama City Division

**Denotes Senior Advisory Board members to the STEM Origins Foundation.*

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Appendix A:
Bay Base STEM Kits

Invention Project®

FOR FLEXIBLE, YEAR-ROUND LEARNING

FOR GRADES PREK-8

A NATIONAL INVENTORS HALL OF FAME® EDUCATION PROGRAM

TRANSFORM YOUR CLASSROOMS

Invention education leverages children's natural inclination to create and guides them through the act of invention to build the mindset and skills they need to navigate life. Invention Project® is the key to bringing this transformative approach to learning into the classroom.

This flexible, innovative program adapts to fit your district's needs and your students' learning styles with equitable, developmentally appropriate instruction that aligns with national and state standards and seamlessly integrates life skills.

> "There is no shortage of creativity among young people, especially if we let them **follow their instinctive curiosity.**"
>
> **GERTRUDE ELION**, NATIONAL INVENTORS HALL OF FAME INDUCTEE

AUTHENTIC LEARNING

- Engaging, hands-on activities promote teamwork and collaboration
- Experiences that build competency in decision-making and self-management
- Opportunities to practice empathy and relationship skills

STRESS-FREE IMPLEMENTATION

- Step-by-step curriculum guide and online resources reduce prep time
- Individually packaged materials allow for hassle-free implementation
- Dedicated National Inventors Hall of Fame® support

FLEXIBLE & IMMERSIVE CURRICULUM

- 32 unique modules with six hours per module
- Instructor-led and asynchronous learning opportunities for in-school, afterschool and summer implementation
- Includes pre- and post-tests to track student progress

Learn more about Invention Project **here.**

I CAN INVENT MINDSET

Like all National Inventors Hall of Fame® education programs, Invention Project is designed to lead students to build the I Can Invent® Mindset — a growth mindset encompassing essential skills and traits demonstrated by innovators including our Inductees. This mindset is instilled through hands-on exploration and strengthened through application.

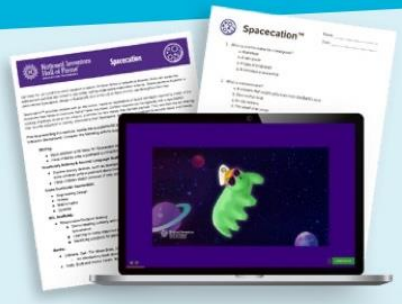
Invention Project equips educators to foster each aspect of the I Can Invent Mindset, enabling students to unlock their full potential, discover the power of their own creativity and confidently overcome challenges in any area of life.

Learn more about Invention Project here.

WHAT'S INCLUDED

EDUCATOR RESOURCES

- Step-by-step curriculum aligned to national and state standards
- Pre- and post-test to track student progress
- Curriculum supports such as videos and presentations



STUDENT RESOURCES

- Step-by-step activity guides
- Individually packaged materials
- Supplemental online resources

FIRST-CLASS CUSTOMER SERVICE

- Available 24/7 for questions that come up
- Offers a complete and customized training program to prepare for classroom implementation
- Supports submitting paperwork for grants and other state/national funding
- Will work with each district to build the right set of modules and program for them

Learn more about Invention Project here.

KEY SKILLS AND CONCEPTS

- Animal Science
- Biology
- Engineering
- Measurement and Data

ROBOTIC PET VET™ MODULE OVERVIEW

By developing their knowledge and skills in biology, physiology and circuitry to take apart and diagnose their robotic dogs, students are able to enhance their problem-solving skills. After helping their pets recover, children celebrate the homecoming of their customized robotic pet as they demonstrate design engineering concepts by constructing an interactive dog park attraction.

CURRICULUM HIGHLIGHTS

THIS MODULE EMPHASIZES THESE ASPECTS OF THE I CAN INVENT MINDSET:

STEM

Exploring the inner workings of a robotic dog and discovering basic engineering principles.

CREATIVE PROBLEM SOLVING

Following step-by-step instructions to investigate dog anatomy to perform surgery.

CONFIDENCE

Realizing they are capable problem solvers as they fix a robotic dog.

Learn more about Invention Project here.

KEY SKILLS AND CONCEPTS

- Responsible Decision-Making
- Design Thinking
- Engineering Design
- Speaking and Listening
- Art
- Forces and Interactions

NIHFTY BOT EXPLORES™ MODULE OVERVIEW

Using their very own NIHFty Bot™ plushie, students apply STEM and creative problem-solving skills to design solutions and engineer new innovations to bring NIHFty's world to life. Combine the NIHFty Bot Explores materials with classroom materials, recycleables and creativity supplies to enhance students' designs as they create gadgets, devices, accessories and adventure items for NIHFty Bot. NIHFty Bot Explores provides six hours of hands-on content for your students.

CURRICULUM HIGHLIGHTS

NIHFTY BOT EXPLORES EMPHASIZES THESE ASPECTS OF THE I CAN INVENT MINDSET:

STEM

Exploring STEM concepts, like physics and engineering design, through hands-on activities.

CREATIVE PROBLEM SOLVING

Applying creative problem solving to create, test and recreate solutions to invention challenges.

PERSISTENCE

Building persistence to overcome fun challenges, from chain reactions to deep-sea gear.

Learn more about Invention Project here.

KEY SKILLS AND CONCEPTS

- Gross Motor Skills
- Fine Motor Skills
- Teamwork
- Creative Thinking

GAMES OVERVIEW

Games supplement our modules by giving children the opportunity to engage in more teamwork, out-of-the-box thinking and physical fun through energetic and enriching activities.

CURRICULUM HIGHLIGHTS

GAMES EMPHASIZE THESE I CAN INVENT HABITS:

CONFIDENCE

Gaining confidence and building agility through both collaboration and competition.

CREATIVE PROBLEM SOLVING

Applying creative problem solving to devise strategies in games using unusual objects and new rules.

PERSISTENCE

Building persistence to overcome fun challenges, from balloon tosses to relay races.

Learn more about Invention Project here.

KEY SKILLS AND CONCEPTS

- Gross Motor Skills
- Fine Motor Skills
- Teamwork
- Creative Thinking

BASE CAMP OVERVIEW

Base Camp fosters teamwork and nurtures creative thinking by exploring challenges that encourage children to think critically. The energetic and enriching activities set the tone for continuous learning, creating a dynamic environment.

CURRICULUM HIGHLIGHTS

BASE CAMP EMPHASIZES THESE I CAN INVENT HABITS:

STEM

Exploring STEM concepts, like physics and engineering design, through hands-on activities.

CREATIVE PROBLEM SOLVING

Applying creative problem solving to devise strategies in games using unusual objects and new rules.

PERSISTENCE

Building persistence to overcome fun challenges, from tower builds to invention trivia.

Learn more about Invention Project here.