Jump-Starting I-STEM for All Children

July 24, 2019 - San Francisco, CA

Technology and Engineering bring STEM To Life

Steven Barbato, Executive Director/CEO

International Technology and Engineering Educators Association

www.iteea.org

Empowering Educators to Effectively Implement Integrative STEM Education for ALL students!

ITEEA
Technology and Engineering bring STEM to Life!
International Technology and Engineering Educators Association
www.iteea.org

ENGINEERING byDesign™

Integrative STEM Education through the Content and Practices of Technology and Engineering Education

Students Who Study Technology and Engineering

"Bring STEM to Life!"

Video Link: https://www.youtube.com/watch?v=lwidCkCmWg4

What Integrative STEM looks like:
Jane Chen's incubator design

STEM^4: The power of collaboration for change

A joint document authored by Advance CTE,
Association of State Supervisors of Mathematics,
Council of State Science Supervisors, and
International Technology and Engineering Educators Association

ITEEA
Technology and Engineering bring STEM to Life!
International Technology and Engineering Educators Association
www.iteea.org

STEM Education Policy Collaborative

ADVANCE CTE

ASSOCIATION OF STATE SUPERVISORS OF MATHEMATICS
ASSM

CCSSO
Council of Chief State School Officers

Council of State Science Supervisors

ITEEA
Technology and Engineering bring STEM to Life!

NEXT GEN EDUCATION, LLC

Texas Instruments

www.iteea.org

ITEEA
Technology and Engineering bring STEM to Life!
International Technology and Engineering Educators Association
www.iteea.org

The Major Issues

»Lack of STEM preparedness

»Many STEM careers have not yet been envisioned

»Lack of Equity

Three Main Principles

Principle 1.

STEM education should advance the learning of each individual STEM discipline.

ITEEA
Technology and Engineering bring STEM to Life!
International Technology and Engineering Educators Association
www.iteea.org

Three Main Principles

Principle 2.

STEM education should provide logical and authentic connections between and across the individual STEM disciplines.

ITEEA
Technology and Engineering bring STEM to Life!
International Technology and Engineering Educators Association
www.iteea.org

Three Main Principles

Principle 3.

STEM education should serve as a bridge to STEM careers.

ITEEA
Technology and Engineering bring STEM to Life!
International Technology and Engineering Educators Association
www.iteea.org

Why does this matter?

- Student engagement
- Relevance
- Funding opportunities

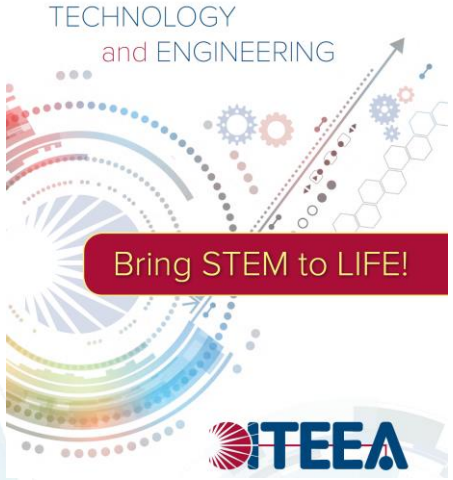
Recommended Actions

- Ensure high-quality STEM learning
- Increase access and equity for students
- Provide professional learning opportunities for teachers.

ITEEA
Technology and Engineering bring STEM to Life!
International Technology and Engineering Educators Association
www.iteea.org

WHO/WHAT IS ITEEA?

The professional organization for technology, innovation, design, and engineering educators.



Resource:

Who is ITEEA? Click Here!

https://www.iteea.org/File.aspx?id=90060&v=4416f187

ITEEA: Who We Are

Technological and Engineering Literacy for ALL students
- STEM Center for Teaching and Learning
- Standards-based EbD™ Curriculum for Grades PreK-12

Global professional development and membership services
- STEMinars
- STEM Journals for Prek_12
- IdeaGarden - ITEEA Headliner
- Leadership and Professional Growth
- Annual Conference

Awards and Credentials
- STEM School of Excellence, Program Excellence, Teacher Excellence, Emerging Leaders, + + +

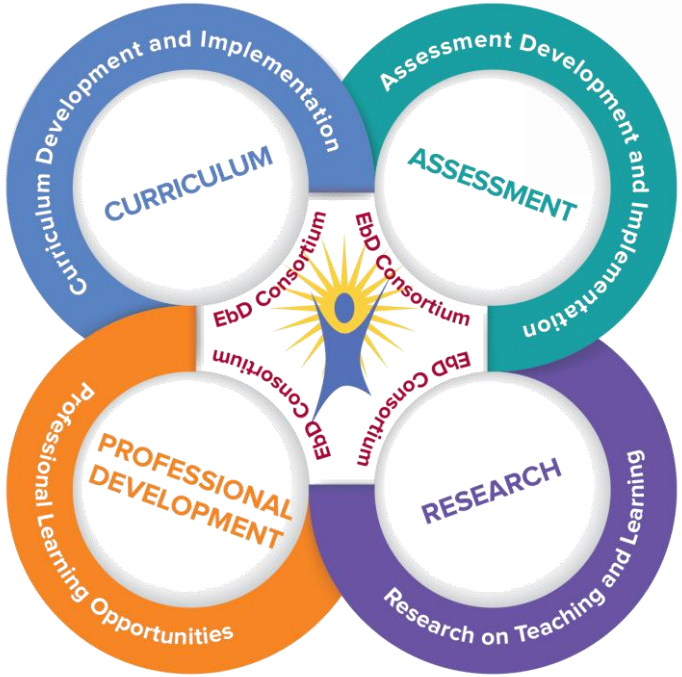
International ITEEA STEM Centers

Integrative STEM Education

"*the application of technological/engineering* ***design based*** *pedagogical approaches to* ***intentionally teach content and practices of science and mathematics education through the content and practices of technology/engineering education****. Integrative STEM Education is* ***equally applicable*** *at the natural* ***intersections*** *of learning within the continuum of* ***content areas, educational environments, and academic levels***"

(Wells & Ernst, 2012/2015)
(as adapted from Wells/Sanders VA Tech program documents 2006-10).

ITEEA's STEM Center for Teaching and Learning



ENGINEERING byDesign™

ITEEA
Technology and Engineering bring STEM to Life!
International Technology and Engineering Educators Association
www.iteea.org

CORE PROGRAM	K–2	EbD-TEEMS NXTGEN™	1-6 weeks
	3–6	EbD-TEEMS NXTGEN™ *(6th Grade Capstone)*, I^3	1-6 weeks
	6	*Exploring Technology*	18 weeks
	7	*Invention and Innovation*	18 weeks
	8	*Technological Systems*	18 weeks
	9	*Foundations of Technology*	36 weeks
	10–12	*Technology and Society*	36 weeks
	10–12	*Technological Design*	36 weeks
	11–12	*Advanced Design Applications* *	36 weeks
	11–12	*Advanced Technological Applications* *	36 weeks
	11–12	*Engineering Design (Capstone)*	36 weeks

HS Choices

6E Learning byDesign

ENGAGE

The purpose of the ENGAGE phase is to pique student interest and get them personally involved in the lesson, while pre-assessing prior understanding.

EXPLORE

The purpose of the EXPLORE phase is to provide students with the opportunity to construct their own understanding of the topic.

EXPLAIN

The purpose of the EXPLAIN phase is to provide students with an opportunity to explain and refine what they have learned so far and determine what it means.

eNGINEER Extend/Elaborate

The purpose of the eNGINEER phase is to provide students with an opportunity to develop greater depth of understanding about the problem topic by applying concepts, practices and attitudes.

ENRICH

The purpose of the ENRICH phase is to provide students with an opportunity to explore in more depth what they have learned and to transfer concepts to more complex problems.

EVALUATE

The purpose of the EVALUATION phase is for both students and teachers to determine how much learning and understanding has taken place.

Exploring and Colonizing Mars
The 6E Learning Cycle in Practice

Humans have always had an innate desire to explore past the boundaries of earth to the moon and beyond. What do humans need to know and be able to do in order to colonize Mars and live there for an extended period of time?

How to design a rover/robot to navigate and traverse the Mars surface to assist astronauts in the exploration and colonization of Mars?

Before we can solve a problem, we must understand it as thoroughly as possible. What exactly are we being asked to do? What resources are available? What are the specifications and constraints for solving the problem?
How will we know if we have succeeded?

Apply Engineering Design Process:
-Problem identification
-brainstorming
-specifications and constraints
-multiple iterations
-predictive analysis
-modeling
-testing and evaluation
-product refinement

How can the lessons we're learning here apply to other kinds of problems we might encounter in colonizing Mars? How else might the Mars Coleman assist with other problem scenarios? What about other environments, like deep sea research?

Self evaluation

Peer evaluation

Teacher evaluation

Identify STEM practices needed to solve this problem

What about other workforce knowledge and skills?

Integrative STEM Content and Infrastructure for delivery:

- Engineering byDesign™ and EbD-BUZZ (LMS)
  6E Learning byDesign™
- EbD™ Pre-Service Teacher Education Initiative
- Professional Development Programming

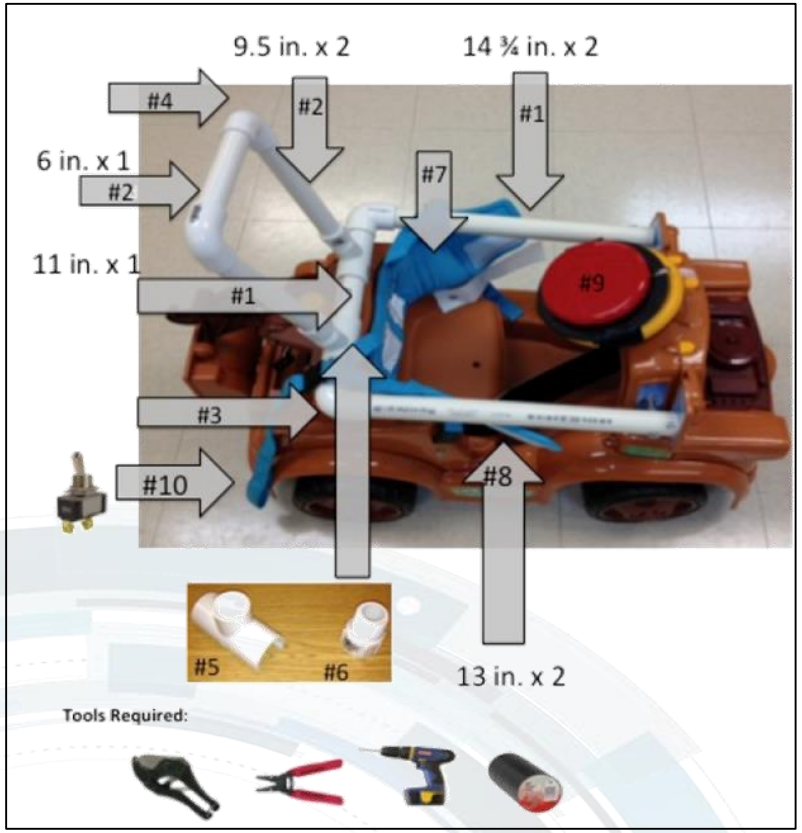
Professional Development:

- Professional Learning Communities
- STEMinar Series
- National Teacher Effectiveness Coaches
- Authorized Teacher Effectiveness Coaches

  (State/District train-the-trainer model)
- Higher Ed STEM Endorsement Course Sequence
- Just-in-time Micro-badging

*Safety series 2019-2020 *http://iteea.org/microbadge.aspx*

What Integrative STEM looks like:



ITEEA Dream Ride . . . Go Baby Go Style

What Integrative STEM looks like:

ITEEA Dream Ride . . . Go Baby Go Style

Seated Mode

Standing Mode

Powered Walker Mode

Use STEM Skills to Change Lives

Inspire Student Innovation

Scan me

Impactful Design-Thinking Project

Ready-Made Lesson Plans + Slides

Let's REACH Together!

iteea

RE@CH challenge

An Innovative Assistive Technology Challenge for Middle School, High School, and College STEM Students

Teachers receive excellent classroom teaching tools:

ITEEA Technology and Engineering bring STEM to Life!
ucators Association

Submission Guidelines

Students will learn the details of the REACH Challenge, including a sample submission. This section provides teams with tips on finding a User-Expert, product discounts, templates, and tips on technical writing, photography and videography.

DOWNLOAD

Assistive Technology

Students will explore the world of adaptive and assistive technology, as well as why these technologies are critically important for those with ability challenges. The exploration will include case studies, resources, and an inspiring lesson on the power of inclusiveness.

DOWNLOAD

User-Centered Design

Students will create a piece of adaptive technology as they develop a high-level of understanding of User-Centered Design, where the engineer includes its end user throughout the design process, which is filled with iteration. This section includes a fun lesson on the importance of failure.

DOWNLOAD

Emapthy + Safety

Students will learn how empathy and safety methods are applied to each step in the User-Centered Design process. This section includes an activity on listening, and how to conduct a good user interview to obtain qualitative and quantitative data.

DOWNLOAD

Engineering Prototypes

Students will build a working prototype of their idea, applying what they've learned about User-Centered Design. Tips, tricks and resources for prototyping will be taught through hands-on activities as well as explorations and slides on common mechanisms and control systems.

DOWNLOAD

Intellectual Property

Students will take on the role of an entrepreneur as they learn how to present their innovation to the world. This section includes information about open source options and the patent process, as well as tips on protecting intellectual property.

DOWNLOAD

Scan me

Teachers and students will use their STEM skills to REACH a member of their community who has a challenge to overcome, and design a viable adaptive or assistive technological solution.

Projects can be submitted to ITEEA for an opportunity to earn awards and funding for their STEM program!

Prototyping Tips + Tricks

© 2019 Iterate Innovations LLC

What is a Prototype?

A prototype is a working product that helps engineers obtain Proof-of-Concept (PoC)—evidence that their idea can actually work—and test the product with a User-Expert to gain feedback and determine the need for any iterations.

Essentially, prototypes are the engineering bridge that takes an idea and turns it into a reality!

Engineering a Prototype

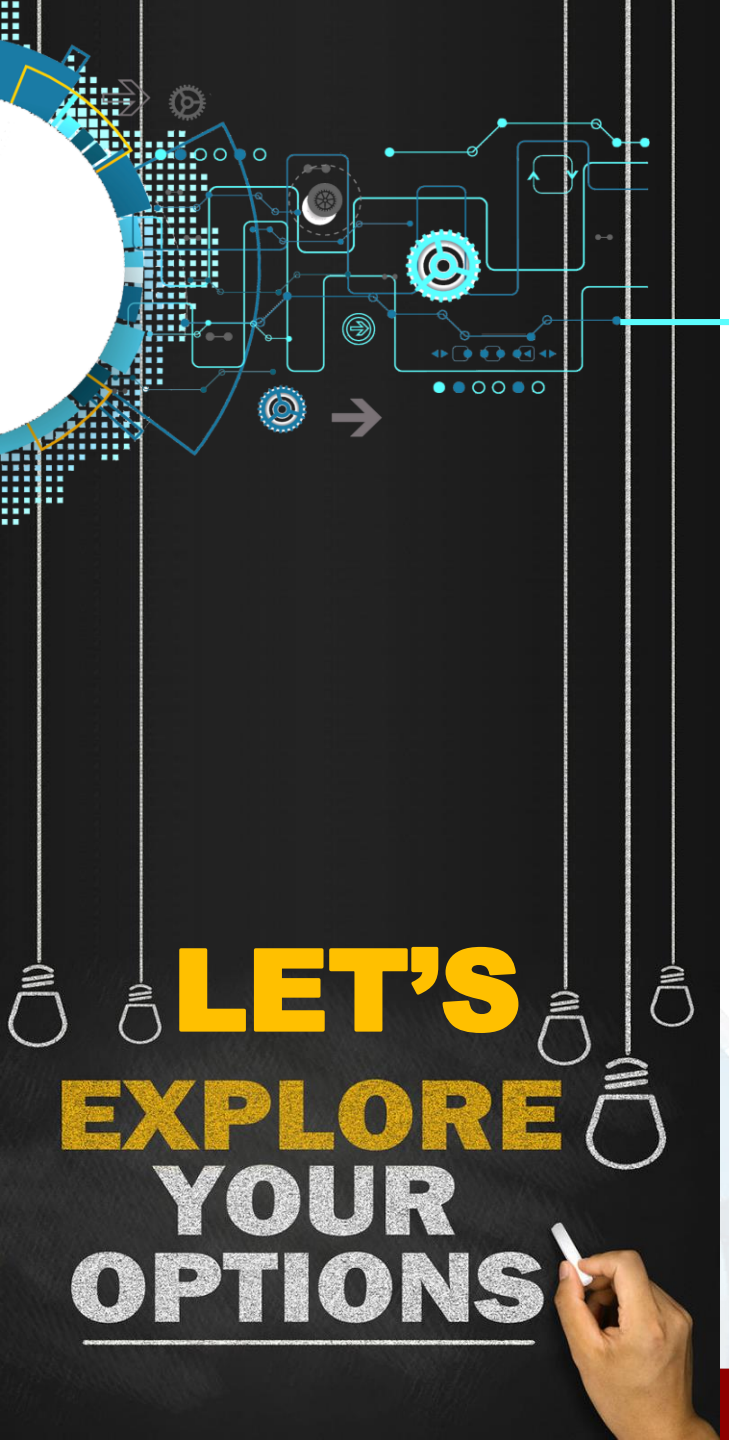
Taking an idea and making it a reality is a challenging engineering skill that requires patience, the ability to learn from failure, and a willingness to explore what's possible...and realize when an idea isn't possible as well. Whether the idea is an app, a mechanical device, or a tool, it will need to be prototyped in order to communicate an idea to co-workers and teammates, test for PoC, and create a final version of an invention.

In this lesson, you'll learn some Tips and Tricks for engineering prototypes!

Communicating Your

Have a great idea? Need to communicate it in a three-dimensional way? Here are some tips:

- **PAPER:** Oftentimes, a hand-drawn sketch of a design, or paper prototype of an app, is an engineer's first step to communicate a concept. Make sure to use pencil-on-graph paper, or a dry erase board and marker so you can make adjustments quickly. Take pictures of your work if you use a dry erase board.
- **SCULPTING CLAY:** Modeling clay can often be used to get a 3-dimensional idea across quickly, usually in a scaled-down way.
- **CARDBOARD:** Try "Cardboard Aided Design." Foam board, corrugated cardboard, and poster board can be used together to create a to-scale version of your idea. Laser cutters and chipboard also work well in this step.
- **OTHER MATERIALS** include duct tape, popsicle sticks, straws, LEGOs, VEX, 3D printer pens, etc!



Functional Prototyping

Once you've selected an idea to make into a reality, you'll need to make a functional prototype. Let's explore some of your options!

- Prototyping & Assistive Technology Materials
- Prototyping Tools
- CAD & App Development Programs
- Mechanisms for Motion
- Microprocessors & Power
- Accessories for Personalization

Engineering a Prototype

Taking an idea and making it a reality is an exciting challenge that combines all aspects of STEM. With 3D printers, laser cutters, microprocessors, and app inventors, never in history has it been easier to create (and iterate) a wide variety of prototypes.

Good Luck!

Empathy + Safety Considerations with UCD

©2018 Iterate Innovations

Empathy's Connection to UCD

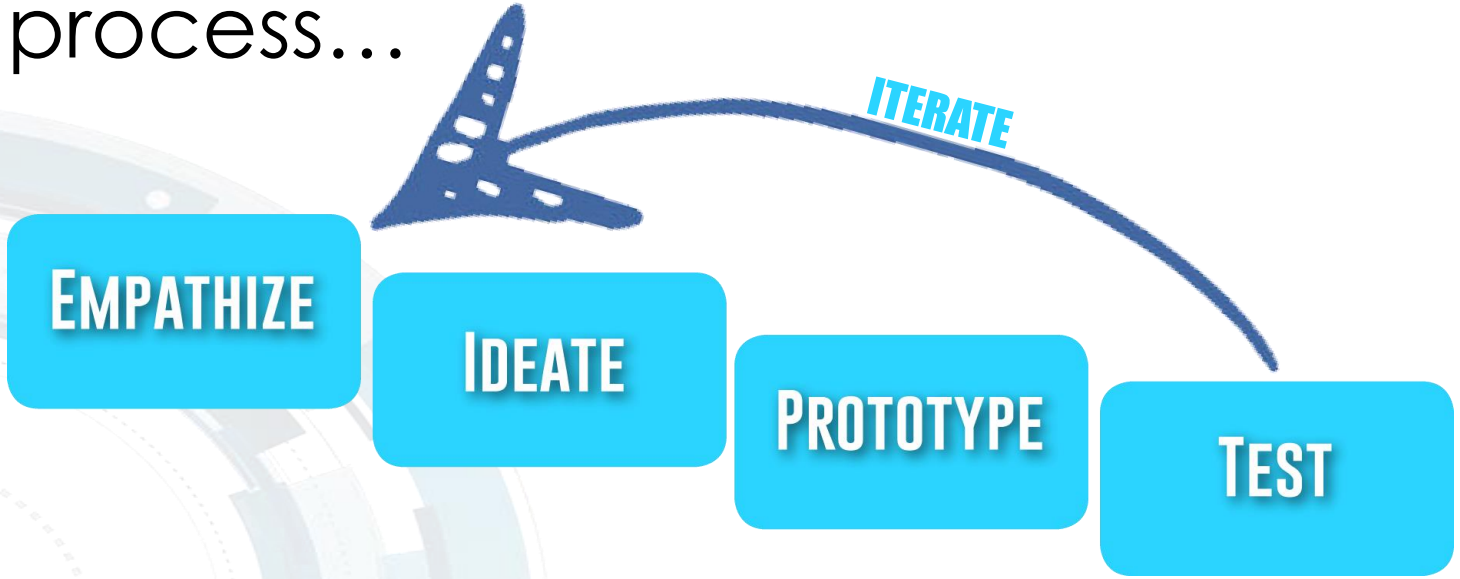
Empathy allows User-Center Designers to put themselves in the shoes of the person for whom they are creating a solution, helping to build a deeper connection and understanding of their User Expert.

Safety is also more likely to be considered when a designer engages in empathy, because it allows the designer to better anticipate any safety concerns and feel a drive to create a safe situation for all involved.

CRITICAL: Empathy and safety should be considered throughout every aspect of User-Center Design.

Steps of User-Centered Design

Let's examine empathy and safety considerations for each step of the User-Centered Design process…



Video Link: https://www.youtube.com/watch?v=hNaXiu8XDUo&t=93s

Team #: 12345

Meet Our Product:

The Kitchen Reacher Kit

Brainstorming STEM PROJECTS for next school year?

- ✔ MUST: Bring STEM skills to life in a real-world, meaningful way.
- ✔ MUST: Inspire students to innovate ways to help their community .
- ✔ MUST: Include pre-made lesson plans, activities, worksheets + slides.
- ✔ BONUS: Earns your school grant opportunities and awards.

Use STEM Skills to Change Lives

Inspire Student Innovation

Scan me

Impactful Design-Thinking Project

Ready-Made Lesson Plans + Slides

Let's REACH Together!

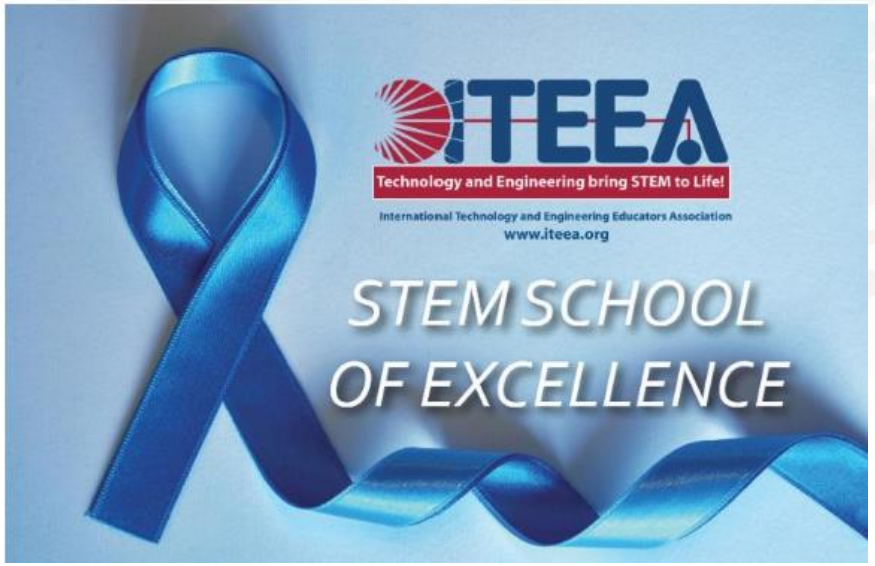
iteea

RE@CH challenge

An Innovative Assistive Technology Challenge for Middle School, High School, and College STEM Students

STEM School of Excellence Recognition Program

- ITEEA has created the STEM School of Excellence Program to annually recognize outstanding schools for their commitment to providing robust Integrative STEM Education programs. By providing information regarding qualifying activities, your school can receive the recognition it has earned as a leader in STEM Education.



- STEM Schools of Excellence will be honored at the 2020 ITEEA Annual Conference in Baltimore and receive a banner and certificate to display in the school. All School Recipients will be proudly posted on our Website Wall of Excellence!

Scan me

- **Apply to be an ITEEA STEM School of Excellence today**!

ITEEA
Technology and Engineering bring STEM to Life!
International Technology and Engineering Educators Association
www.iteea.org

We hope to see you and ALL your colleagues at ITEEA's 82nd Annual Conference in Baltimore, MD

Be a part of ITEEA's STEM Showcase

ITEEA

BALTIMORE

MARCH 11-14, 2020

INTERNATIONAL TECHNOLOGY AND ENGINEERING EDUCATORS ASSOCIATION

www.iteea.org

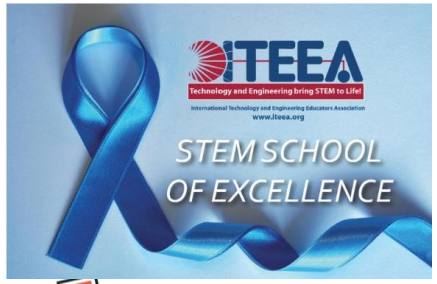
ITEEA
Technology and Engineering bring STEM to Life!
International Technology and Engineering Educators Association
www.iteea.org

STEM School of Excellence

RECOGNITION PROGRAM

Scan me

Apply to be an ITEEA STEM School of Excellence today!



ITEEA BALTIMORE
MARCH 11-14, 2020
INTERNATIONAL TECHNOLOGY AND ENGINEERING EDUCATORS ASSOCIATION

- ITEEA has created the STEM School of Excellence Program to annually recognize outstanding schools for their commitment to providing robust Integrative STEM Education programs. By providing information regarding qualifying activities, your school can receive the recognition it has earned as a leader in STEM Education.
- STEM Schools of Excellence will be honored at the 2020 ITEEA Annual Conference in Baltimore and receive a banner and certificate to display in the school. All School Recipients will be proudly posted on our Website Wall of Excellence!

ITEEA
Technology and Engineering bring STEM to Life!
International Technology and Engineering Educators Association
www.iteea.org

RESOURCE LINKS!

Today's Presentation

Request Preview Access to EbD courses

Or Google "EbD BUZZ Resources" and scroll down to Request for EbD™ Course Review Access

STEM⁴: The Power of Collaboration for Change

ITEEA REACH Challenge for your students!

An Innovative Assistive Technology Challenge + Educator's Toolkit for Middle School, High School, and College STEM

ITEEA STEM School of Excellence Program!

Scan me

Scan me

Thank you!

July 24, 2019 - San Francisco, CA

Technology and Engineering bring STEM To Life

Steven Barbato, Executive Director/CEO

Email: **sbarbato@iteea.org**

ITEEA@iteea.org