ENGINEERING IS OPEN TO EVERYONE

August 15, 2023

My Journey Thru STEM

70's: 8th grade

80s: Museum of Science (Boston)
  – *Minds-on, Hands-on*

90s: WGBH (PBS)
  – Habits of Mind

10s: DiscoverE
  – Engineering Design Process

Making Engineering Open to Everyone.

MYTH

Engineering is basically the same thing as science, and you're already teaching science.

DISCOVER ENGINEERING

TRUTH

They are different and complementary:

- Science answers questions through experimentation.
- Engineering solves problems through design.

ENGINEERING MYTHS AND TRUTHS

MYTH

Only certain kinds of kids are going to become engineers—*they're born not made*—and there aren't that many of them.

ENGINEERING MYTHS AND TRUTHS

DISCOVER ENGINEERING

TRUTH

Exposing students to the wide range of opportunities in engineering gets many of them really excited about becoming engineers.

ENGINEERING MYTHS AND TRUTHS

Engineering: A Focus on the Pipeline & Messaging

- 1952:   First Engineers Week celebrated

- 1957:   Sputnik Crisis

- 1980s: Emerging recognition of workforce shortages and need to actively
recruit and diversify the profession

- 1990:   First nationwide call asking engineers to visit classrooms
and afterschool programs during Engineers Week

- 2002:   *Raising Public Awareness of Engineering*

- 2005:   *The Gathering Storm*

- 2010:   *Rising Above the Gathering Storm*

- 2008:   Changing the Conversation & Engineer Your Life

- 2023:   Messages Matter

Engineer Your Life
Dream big. Love what you do.

Why aren't more girls choosing engineering and computing?

Here are some of the "theories:"

- girls aren't interested

- they can't do math and science as well as boys

- they are opting out of careers that utilize 'hard science'

What if I told you it's because …. *they don't know what they are?*

What Do High School Girls Think?

- Engineering and computing is for people who **LOVE** both math and science

- Don't know what they are

- Aren't interested in the fields nor do they think it is "for them"

"Someone who excels in math and science.... Someone who is motivated, dedicated, and who doesn't mind sitting in a cubicle all day."

Engineer Your Life
Dream big. Love what you do.

What We Tell Young People

- It is stressful and challenging

- They stress the importance of **SUPERIOR** math and science abilities

*"It's not easy—but if you're the type who when faced with a problem some would call impossible is even more driven to move mountains to find a solution, then you **might** have it in you to be an engineer."*

Engineer Your Life
Dream big. Love what you do.

What if we told them ...

Engineers are changing the world all of the time. They dream up creative, practical solutions and work with other smart, inspiring people to invent, design, and create things that matter.
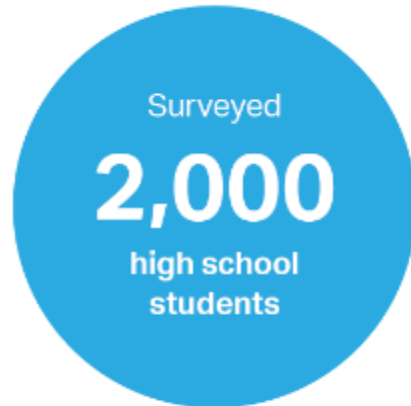
2023 Messages Matter: Research Findings

Methodology

Global Strategy Group conducted two rounds of nationwide online surveys.

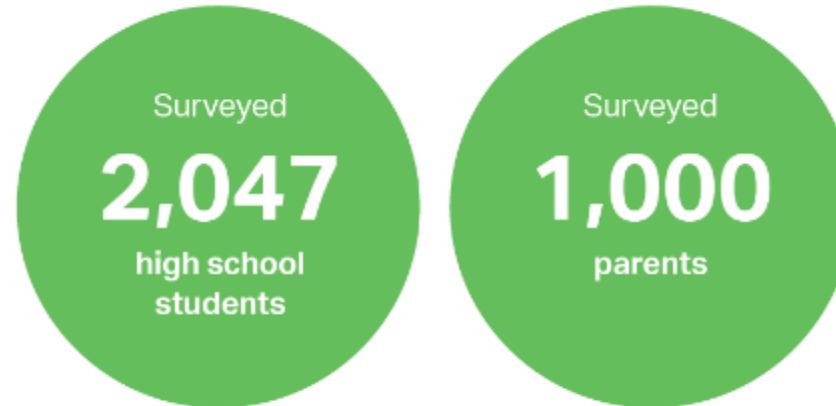### Round One
May 3 – 17, 2022

Surveyed
2,000
high school students

Round Two
October 6 – 13, 2022

Surveyed
2,047
high school students

Surveyed
1,000
parents

Student Surveys:
The margin of error at the 95% confidence level is +/- 2.2%.
The margin of error on sub-samples is greater.

Parent Survey:
The margin of error at the 95% confidence level is +/- 3.1%.
The margin of error on sub-samples is greater.

DISCOVER ENGINEERING

Perceptions of and Interest in Engineering

1 Engineering has a **"concrete" image** and a **gender divide** when it comes to students' interest.
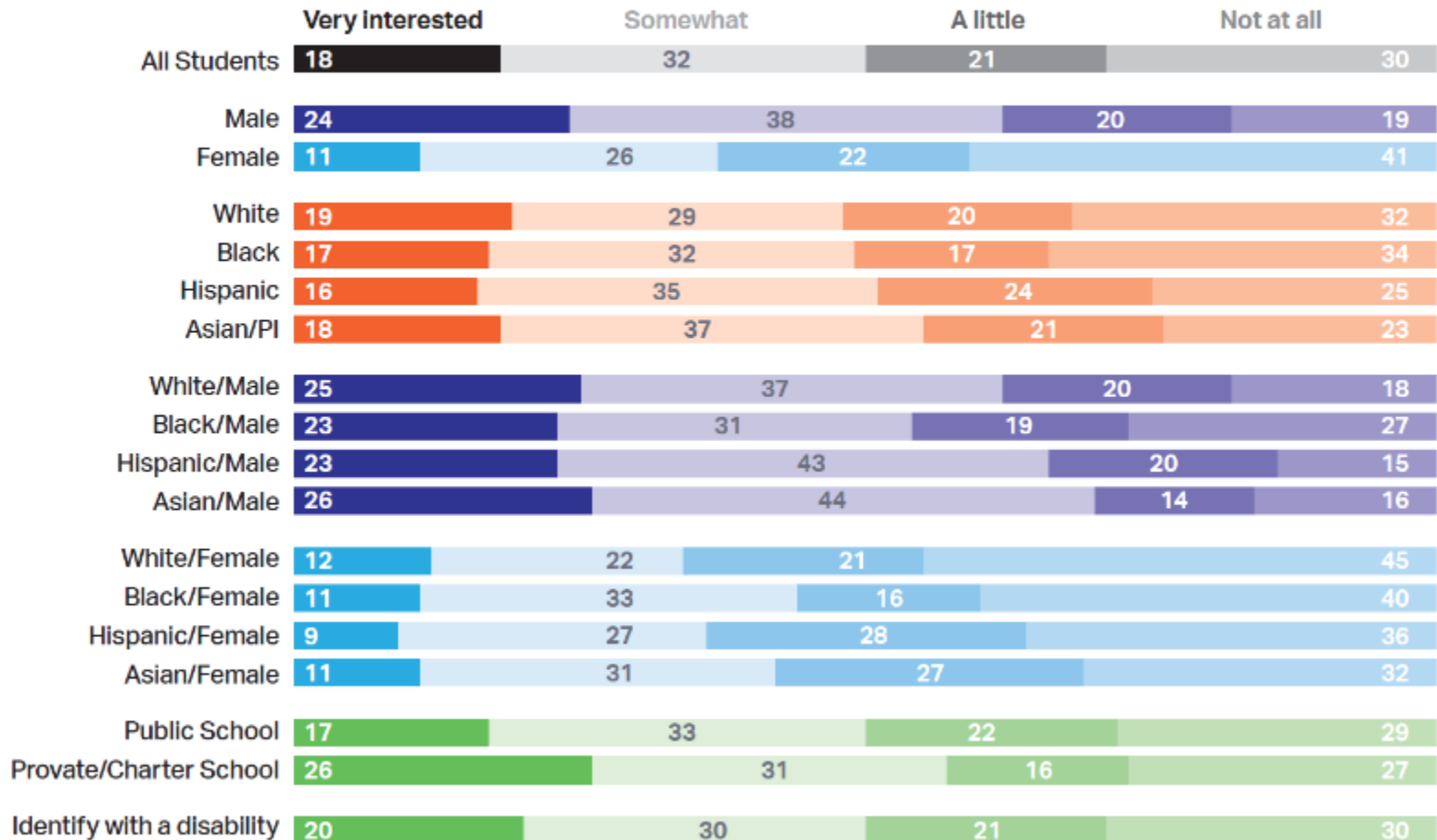
2 **18% of students are very interested in a career in engineering**

- 53% are somewhat or a little bit interested
- 30% are not interested

Student Interest in Engineering Demographic Breakdown

How interested are you in pursuing a career in the field of engineering?

|	Very interested	Somewhat	A little	Not at all
All Students	18	32	21	30
Male	24	38	20	19
Female	11	26	22	41
White	19	29	20	32
Black	17	32	17	34
Hispanic	16	35	24	25
Asian/PI	18	37	21	23
White/Male	25	37	20	18
Black/Male	23	31	19	27
Hispanic/Male	23	43	20	15
Asian/Male	26	44	14	16
White/Female	12	22	21	45
Black/Female	11	33	16	40
Hispanic/Female	9	27	28	36
Asian/Female	11	31	27	32
Public School	17	33	22	29
Provate/Charter School	26	31	16	27
Identify with a disability	20	30	21	30

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3 **Students think engineering is hard and requires skills they may not have.** Their top three descriptors are:

- Good at math and science
- Smart
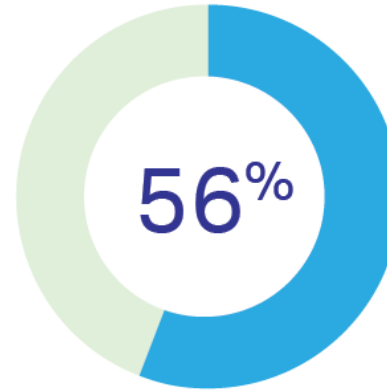- Builds, constructs, and makes things
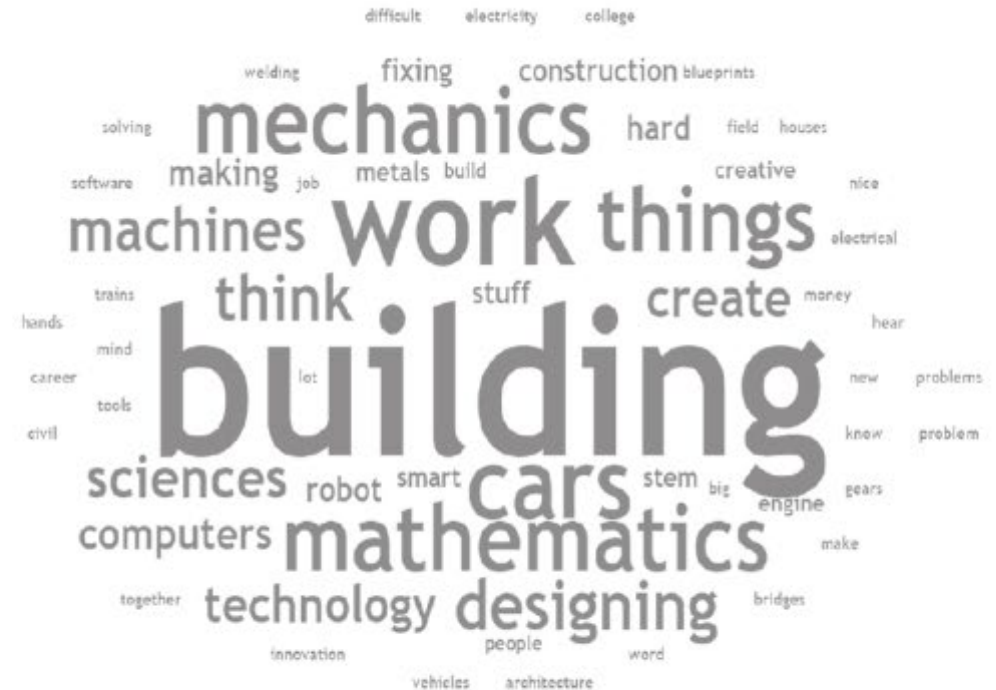
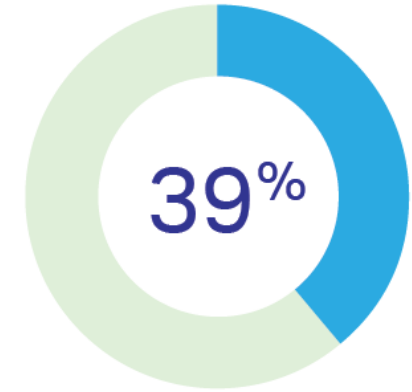Words students use to describe engineering.

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5 **Parents have a positive view of engineering.**

58%
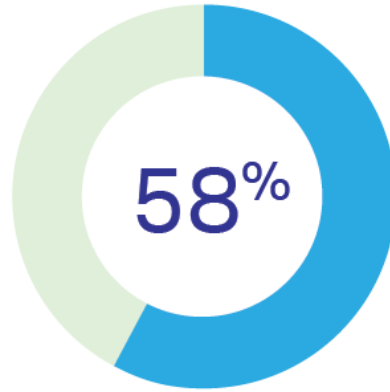
parents say engineering is a very good choice

56%

parents say software engineering is a very good choice

39%

parents say technician or technologist is a very good choice

Both engineer and software engineer outpace doctor as a very good choice, and technician/technologist ties with veterinarian and nurse.

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Career Influencers and Priorities

1 **Parents can be allies** in promoting careers in engineering.

2 **Parents** are students' **most trusted career advisors.** Adults who *"work in a field I would consider"* and close friends are the third most trusted career influencers.

DISCOVER ENGINEERING

3 Both students and parents **prioritize going to college** over starting a career right away.

- 70% of students and 75% of parents consider going to college more important than starting a career right away.
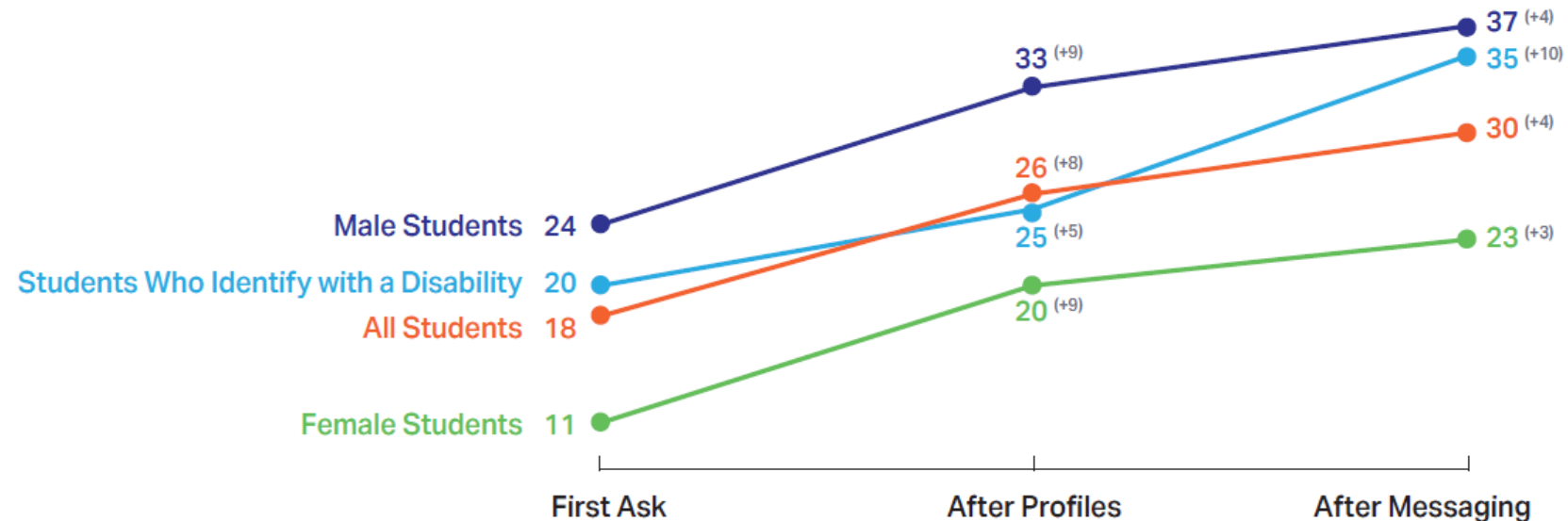
4 **Financial security** is the top career concern for both parents and students.

- Opportunities for growth, work-life balance, plays to my strengths, and interesting work are tied for second for students
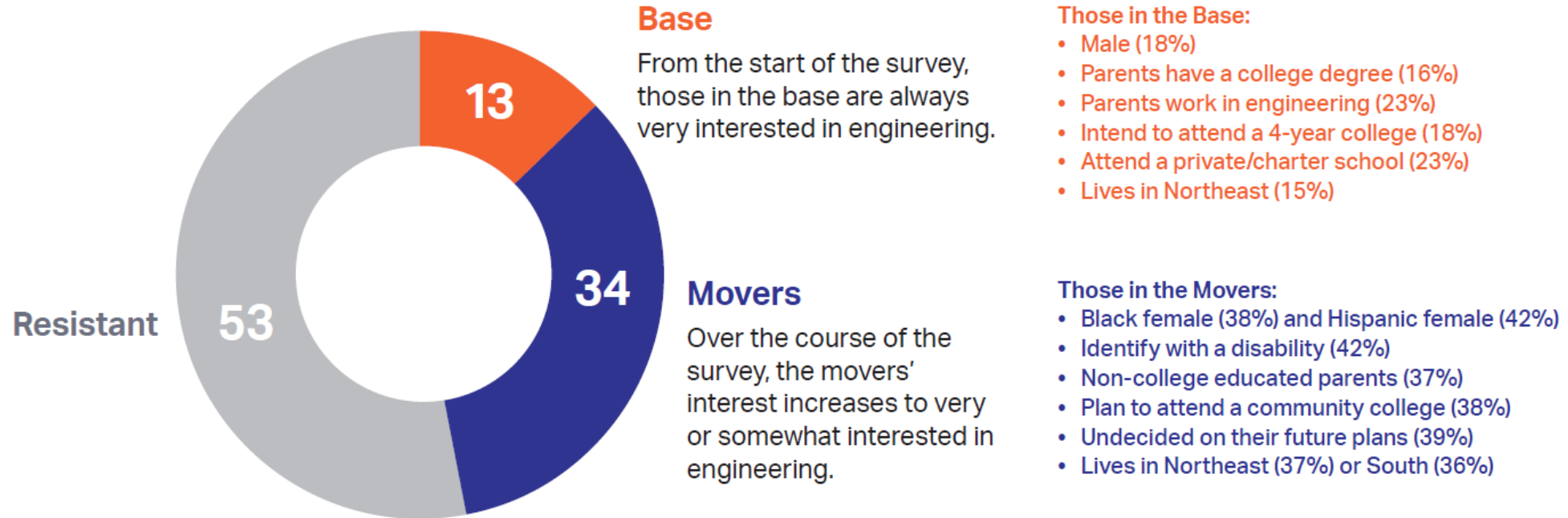
Appealing Messages, in Combination with Engineering Profiles, Increase Student Interest

How interested are you in pursuing a career in the field of engineering? %Very Interested

Male Students 24 → 33 (+9) → 37 (+4)
Students Who Identify with a Disability 20 → 25 (+5) → 35 (+10)
All Students 18 → 26 (+8) → 30 (+4)
Female Students 11 → 20 (+9) → 23 (+3)

First Ask — After Profiles — After Messaging

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→ **The Movers – students whose interest increases with exposure – are made up of historically underrepresented groups in engineering and tech.**

13

34

Resistant 53

Base

From the start of the survey, those in the base are always very interested in engineering.

Movers

Over the course of the survey, the movers' interest increases to very or somewhat interested in engineering.

Those in the Base:
- Male (18%)
- Parents have a college degree (16%)
- Parents work in engineering (23%)
- Intend to attend a 4-year college (18%)
- Attend a private/charter school (23%)
- Lives in Northeast (15%)

Those in the Movers:
- Black female (38%) and Hispanic female (42%)
- Identify with a disability (42%)
- Non-college educated parents (37%)
- Plan to attend a community college (38%)
- Undecided on their future plans (39%)
- Lives in Northeast (37%) or South (36%)

Ahmed and Khalil Abdullah are brothers and video game designers who founded multi-aware winning game company Decoy Games after both studying computer science at UMass Amherst. Using their combined computer science knowledge, and online tutorials about video game development, they created their first video game *Swimsanity!*.

"Because **I have a brother** and we are really close and we **love playing video games** and **we wish we could create our own someday**."
— Male, Black, age 15

"I enjoy video gaming and didn't **realize that engineering was behind it**."
— Male, Hispanic, age 17

"They **look like me and people in my community** and I love the gaming part as I love gaming with my friends."
- Male, Black, age 15, identify with a disability

Most interesting to:
- **Male students**
- **Black and Hispanic male students**
- Students who **identify with a disability**

DISCOVER ENGINEERING

Jade Raymond is a video game designer and computer engineer known for her work on The Sims Online and for leading the team that developed Assassin's Creed. She is the CEO of Stadia Games and Entertainment, and the founder of Ubisoft Toronto, and Motive Studios.

"**Her job includes video games which I love**, and she's created a couple games that I love. **She's also a woman** so I thought that was cool and her experience was good too."
– Female, Asian, age 15

"**Her job would be so much fun**, designing video games though I know it's hard would allow you to be **creative** and have fun with it."
– Female, White, age 16

"**Because I am physically handicapped**, the idea of designing video games is appealing because it **wouldn't be such a physical job**."
– Male, White, age 14, identify with a disability

Most interesting to:
- **Mover target group**
- **Students who Identify with a disability**

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1. **Engineering is a career that is "open to everyone"**

   While highly appealing across all demographic groups, but not everyone believes that it is true.

2. **Engineering is a "well-paid and prestigious field" that "sets students up for success"**

   Is both appealing and believable and speaks to concerns that both parents and students have about finances.

3. **Engineers can make "a world of difference"**

   A top testing message from Changing the Conversation, the updated message is still an appealing and believable message for both parents and students.

Not all paths to a career in engineering require a degree. This is news.

- Over half of students and parents initially believe that a Bachelor's degree is necessary for a career in the field of engineering

DISCOVER ENGINEERING

Considerations for Targeted Messages

For Girls

- **Elevate biographies of female engineers**. Using profiles and messages together is more effective than traditional messaging alone, which is harder to relate to or believe. When girls see profiles of women in engineering, they can visualize themselves in those careers and say...

  "I liked the story of someone who looks like me, makes me feel I can do the same thing."

  "Engineering is a field that has always been shown to me as some kind of 'traditional' and 'boys only' field so to see someone in the field that is not only a woman but a political activist is inspiring to me."

- **Emphasize "meaningful" work** over "personally rewarding" work, though this is a narrow preference.

For Black Boys and Girls

- **Emphasize opportunities** for meaningful work, financial security, and making a difference in the world (over making a difference in one's community).

- **Introduce profiles of Black engineers**, and where possible **match the gender of the engineer to the target audience**. Black girls, in particular, are more likely to become interested in engineering as a result:

  "It truly just is encouraging to see a fellow woman of color in the STEM field. Seeing this pushes me to continue in the field as well."

  "They look like me and people in my community."

For Asian Boys and Girls:

- **Boys are particularly receptive to profiles of software engineers, video game developers, and computer programmers.** The "world of difference" and "pay" messages appealed to this group.

- **Among girls, highlight profiles of female engineers to boost interest in engineering.** Profiles of female engineers working in varying engineering roles appealed the most to this group, and the "multiple career paths" and "engineering is for everyone" messages resonated best with girls.

For Native American Boys and Girls

- Among Native American students, we have a smaller sample size, but these students are similarly **interested in profiles that allow them to imagine themselves as engineers** doing interesting things. In their own words:

  "If Dana Bolles can do it pretty much anyone could! She gives me a lot of hope and is inspirational!"

  "Jade Raymond works on games I really enjoyed as a kid and is probably making more."

Students with a Disability

- **Use messaging to strengthen profiles** to boost interest in engineering. Highlight the themes around **"pay"** and **"health, happiness, safety"**.

- In targeted communications to students with a disability, note that the message **"engineering is for everyone"** is both the **most appealing message and also the least believable**. Use this "for everyone" language only if you are able to back it up with believable evidence that it is true for this target group.

For Hispanic Boys and Girls

- Among boys, note opportunities to make a **difference in the world over their community**, and reemphasize through messaging that it is a field with competitive compensation:

  "[She is doing] life changing work, not just for an individual but the world as a whole."

- Among girls, **introduce bios of female engineers** and note that it is a **"creative"** field:

  "I thought her career was meaningful and had a purpose of making a difference."

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Download The Message Matter Report

DiscoverE.org/messages-matter

Keys to Building a Student's STEM Identity

- Increase their interest

- Nurture curiosity with a positive attitude

- Help them see the value in STEM and how it aligns with their values and goals

- Build their confidence in their STEM skills

- Provide strong support networks

- Help them feel a sense of belonging
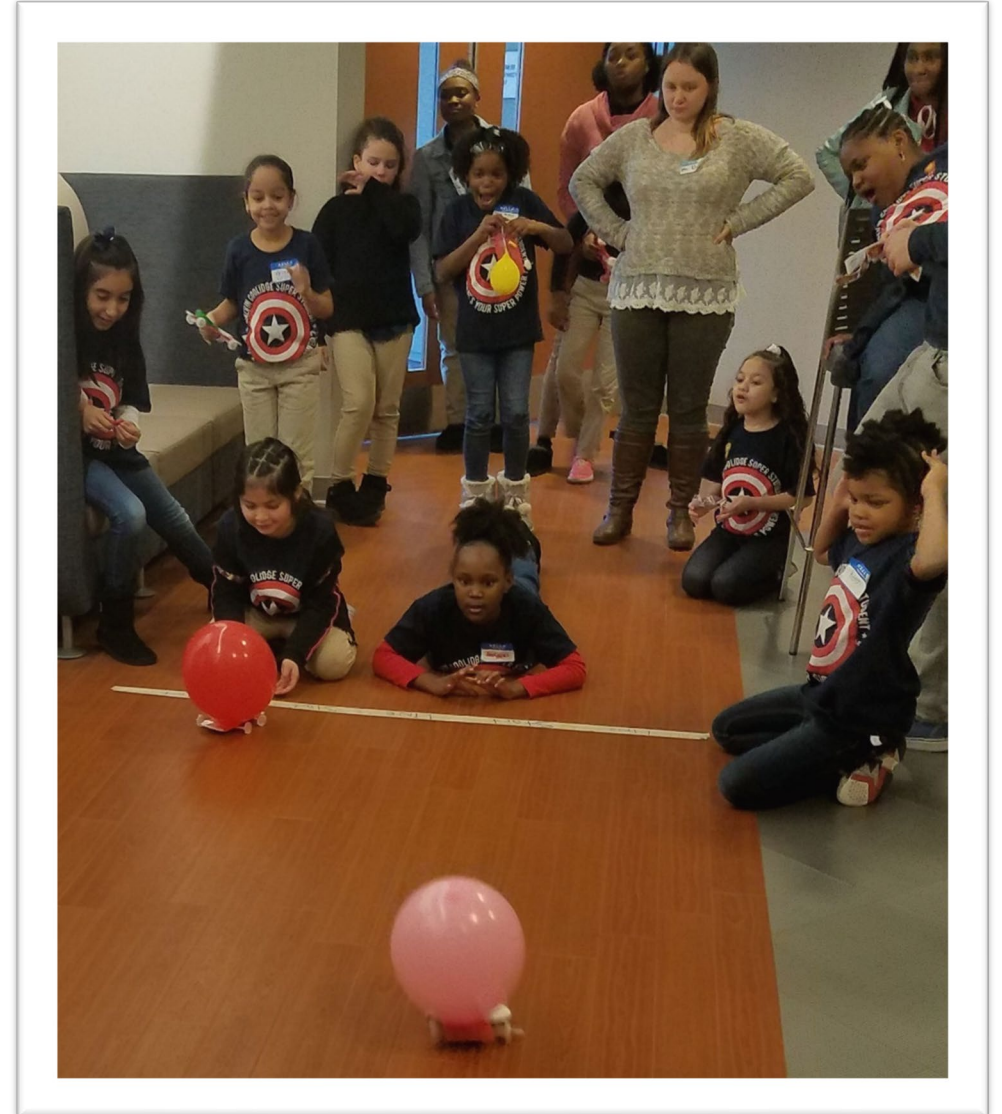
Formula for Success

Share positive engineering messages

+

Do Hands-on Activities & Active Facilitation

+

Support Interactions with STEM Role Models


= STEM Positive Students

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Talk About Engineering & Tech

Most students don't know what engineering is.

Share how engineering is:

- Well-paid

- Open to everyone!

- Creative

- All about teamwork

- Making the world a better place.

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Adjusting the Engineering image

Share images of people:

- Girls tend to gravitate toward image of people and female engineers
- Boys more likely to pick images that features "things"

Engineering Is Open to Everyone

DISCOVER ENGINEERING

Formula for Success

Share positive engineering messages

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Do Hands-on Activities & Active Facilitation

+

Support Interactions with STEM Role Models

_____

= STEM Positive Students

WHY TEACH ENGINEERING?

Science

+

Engineering = **Math**

+

Technology
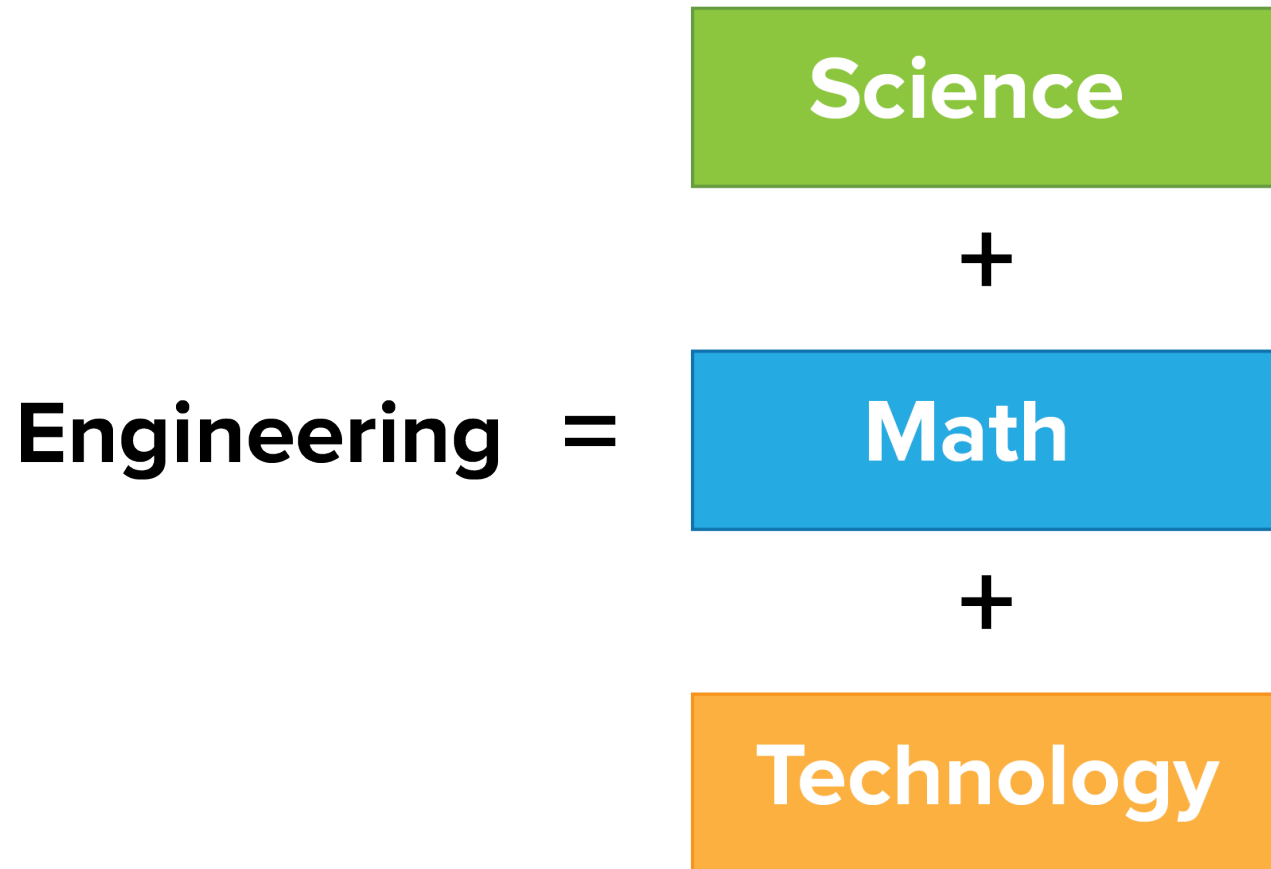
The *E* in *STEM* pulls it all together.

Engineering Design Process
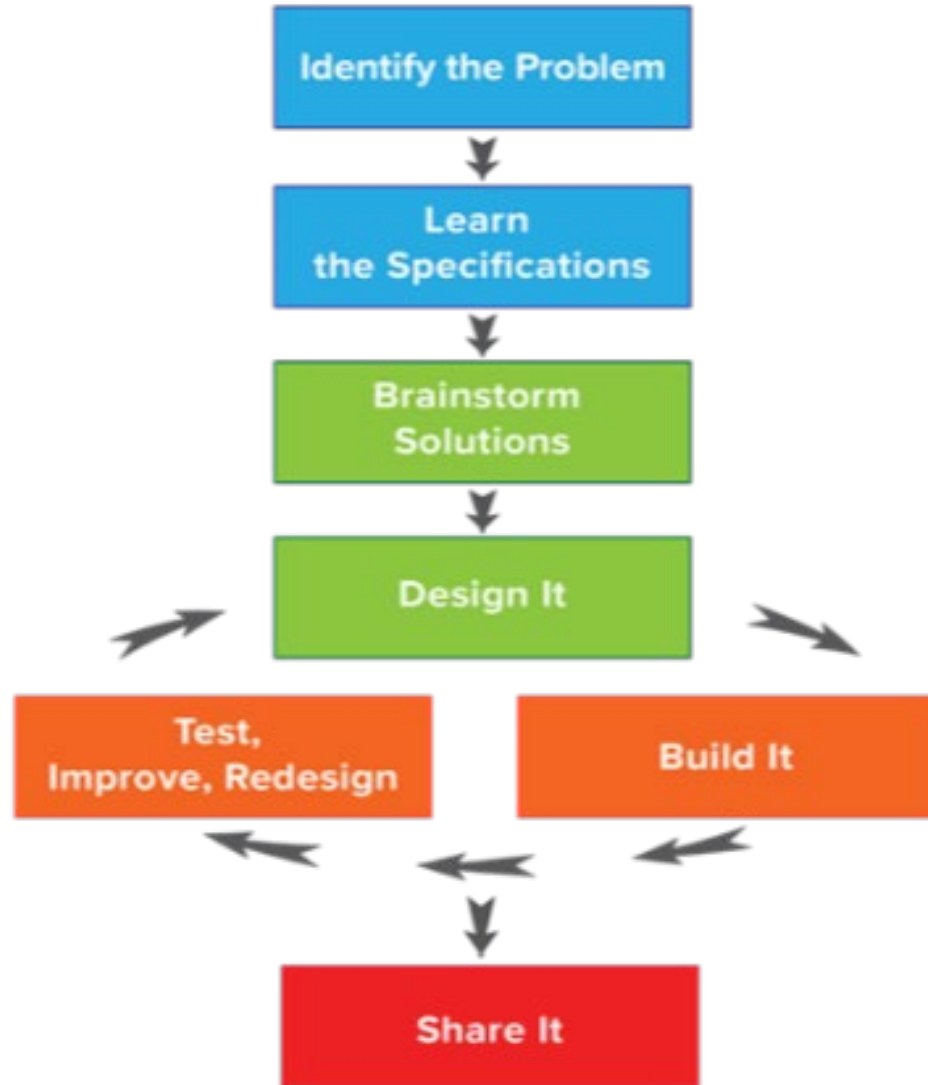
Choosing Activities

- It is a demo or hands-on?

- Is there a purpose?

- Does it follow the Design Process?

- Can you weave in the engineering messages?

CRITICAL LOAD ACTIVITY

The Challenge

Build a house of cards and see how much weight it can support before it collapses.

Engineering Constraints

- Build it in your lap!
- You can only use the index cards and tape

Success Criteria

- At least two levels high
- Holds at least 4 washers before collapsing
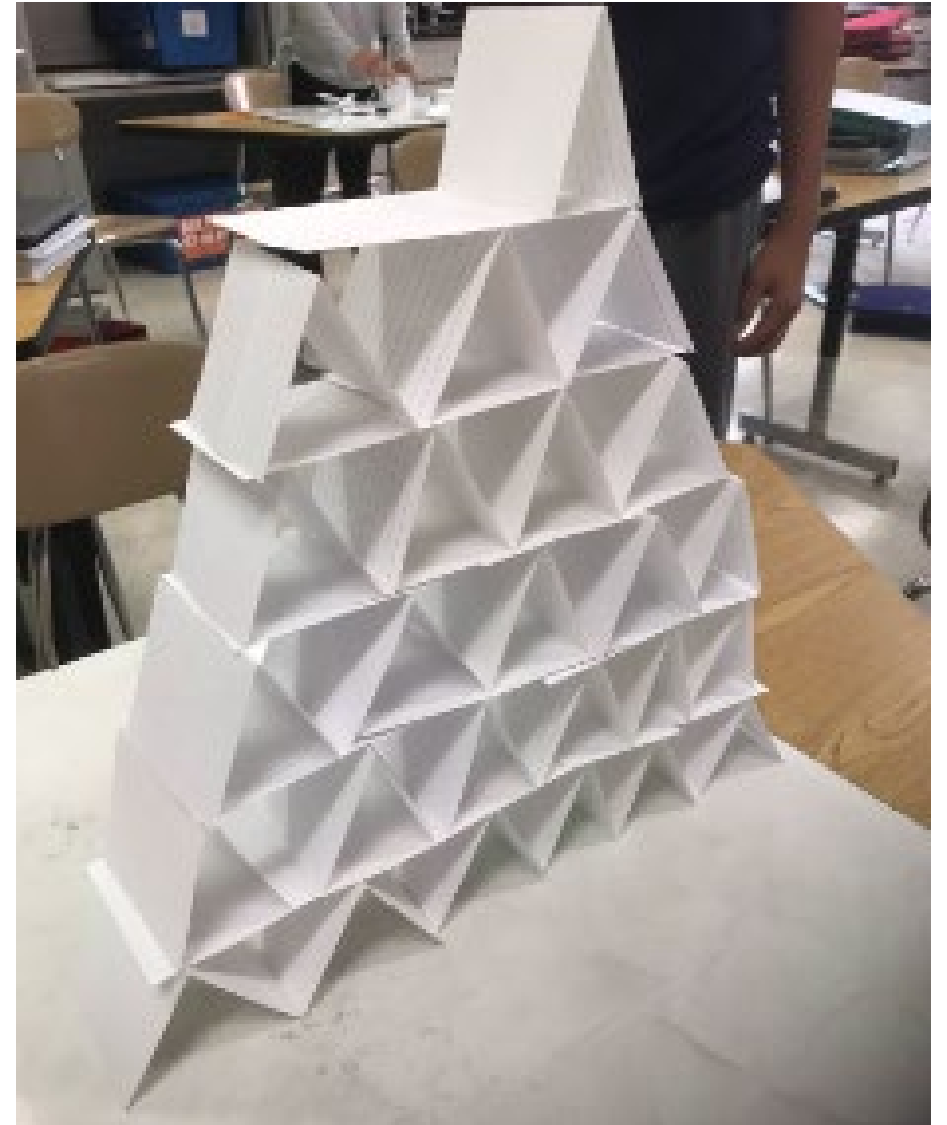
Facilitating an Activity

- Ask leading questions ... rather than telling them what do do.

- Start with where, why, how might you

- Praise children for effort.
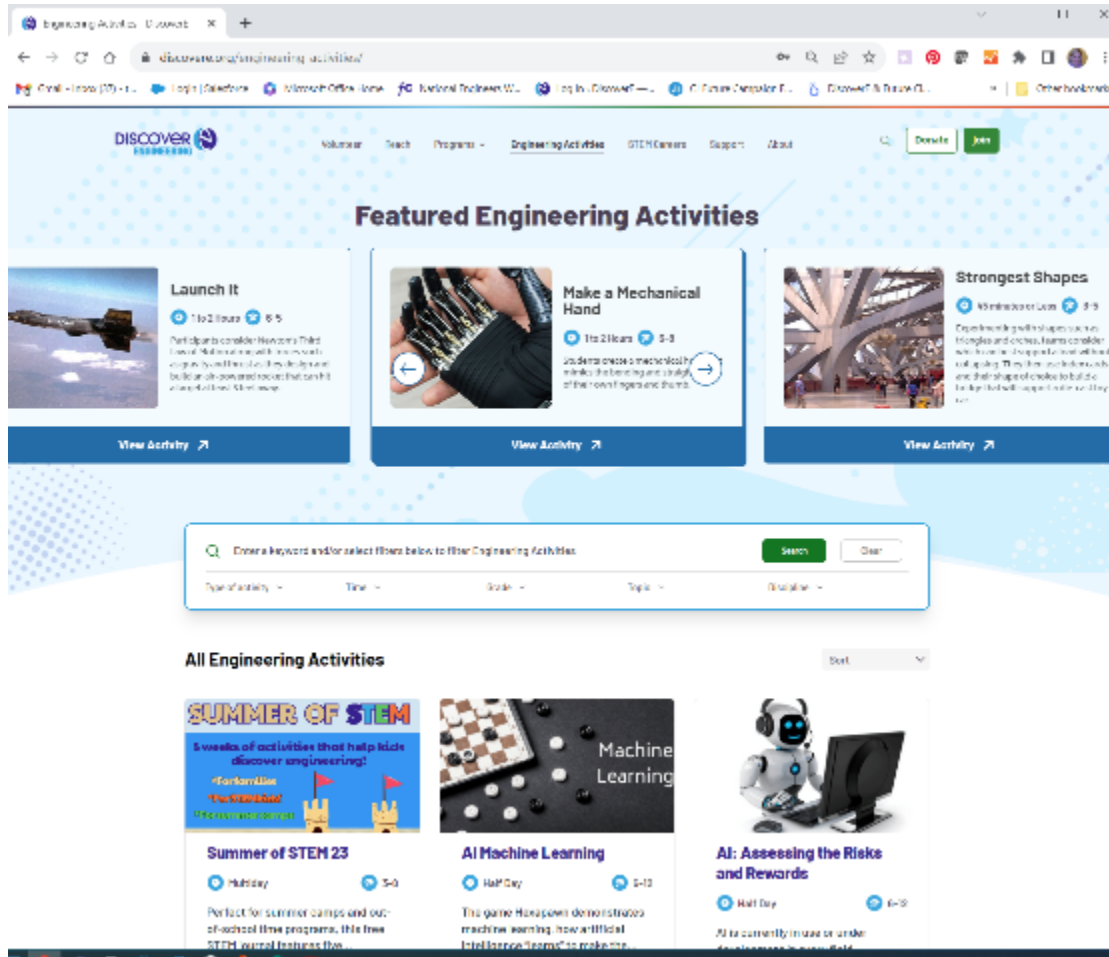
- Highlight the struggle.

Action: Do Engineering Activities

Factors Addressed:

- ✓ Develop confidence
- ✓ Promote interest in STEM
- ✓ Create STEM Identity
- ✓ See value in engineering

Finding STEM Activities – DiscoverE.org

Formula for Success

Share positive engineering messages

+

Do Hands-on Activities & Active Facilitation

+

Support Interactions with STEM Role Models

_____

= STEM Positive Students

Action: Connect Students with STEM professionals

Critical Need

- 74% of educators report that their students do not have many opportunities to meet an engineer or technical professional.

- 84% of educators and 87% of volunteers say it helps their students learn about engineering careers.

Action: Connect Students with Role Models

Factors Addressed:

- ✓ Develop confidence
- ✓ Promote interest in STEM
- ✓ Create STEM Identity
- ✓ See value in engineering
- ✓ Develop networks
- ✓ Create Autonomy

DiscoverE.org/GirlDay

- **Resources**

  - **170 STEM Activities**
  - **Challenge Videos**
  - **Career Pathways**

  - **Posters, Ads & Artwork**
  - **Photo Library**
  - **Outreach Grants**

- Student host interviews engineer
- Meet role models
- Career exploration

Goal: Celebrate engineers and inspire students

Ask: Volunteers and educators engage students & celebrate the work of engineers

Resources: STEM Activities
Training
Invite An Engineer Guide
Planning Guide
Certificates
Social Media Posts & Graphics

DiscoverE.org/EngineersWeek

DISCOVER ENGINEERS WEEK®

2024 Educator Planning Guide

Engineers Week
Feb 18–24, 2024

WELCOME TO THE FUTURE

This year's Engineers Week theme—*Welcome to the Future*—is about celebrating today's achievements and paving the way for a brighter and more diverse future in engineering.

Use the tips below and our extensive library of resources to plan an amazing Engineers Week 2024.

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Goal: Inspire girls to explore engineering

Ask: Engage girls in engineering – year round

Resources: Girl Day Planning Guide
Stickers
STEM Activities

DiscoverE.org/GirlDay

What is Future City?

Students work in teams with an educator and STEM mentor to create cities that exist 100 years in the future.

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2023-24 Highlights

- **Expanding to High School**
  - 20 Educators
  - 100 Students

- **Future World Visions IMAX**
  - Future City featured
  - Team from TX

- **Electrify Your Future Theme**

Get involved!

As an educator
Facilitate your team(s) learning

As a judge
Be amazed at students' innovative solutions

As a mentor
Pass along your professional STEM experience and knowledge

As a volunteer/special award
We can't do it without our volunteers

Visit: FutureCity.org

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ENGINEERING

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