DISCOVER ENGINEERING

Messages Matter:

Effective Messages for Reaching Tomorrow's Innovators

Executive Summary

February 2023

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Executive Summary

In 2022, DiscoverE and Global Strategy Group conducted a year-long research project to find out what today's teens and their parents think about engineering.

Here is what we found.

The students most interested in engineering look like the current demographic of engineers. But our research shows that **targeted messages and profiles** of engineers who look like them doing things that they are interested in, can **spur interest in engineering** among the very groups that will ensure a more diverse future for the field.

While engineering has a **"concrete" image** and **gender divide** (24% of males and 11% of females are very interested in the field), when we use **appealing messages alongside engineering profiles** that reflect a student's gender or racial affinity we can increase their interest in engineering.

Parents have a **positive view of engineering** (58% say it's a very good career choice). They are their child's most trusted advisor, though role models who work in a field a student is considering are tied for third place alongside close friends. Parents can be **allies in encouraging** their child to consider engineering.

Students and their parents **prioritize going to college** over starting a career right away. **Financial security** is a top career concern for both.

It is **news to most students and their parents** that many careers in engineering **don't require a bachelor's degree.**

Purpose & Research Goals

"A professed interest in STEM careers is a more accurate predictor of pursuing an education and subsequent career than test scores.[1]"

In the early 2000s two projects, *Changing the Conversation* (CTC) and *Engineer Your Life* (EYL), looked at how the engineering community was portraying itself, how the public and college-bound girls perceived engineering, and how engineering aligned with their professional priorities.

This work resulted in an "a-ha moment" where it became clear that how the engineering community was talking about themselves (engineers solve problems using math and science) neither illustrated the critical work being done by engineers nor aligned with career or personal aspirations for students, their parents, or teachers.

This research led to a wholesale change in the way the engineering community presented itself with newly tested messages and tag lines that emphasized the creativity of the field, the teamwork aspect, and how engineering shapes our world.

Fast forward to the year 2022. The girls and boys surveyed between 2004 and 2007 are now in their early thirties. Today's teens are being shaped by different world events as well as being the first generation to grow up while being constantly online and plugged in. With this as the backdrop, DiscoverE wanted to know how the messages and themes identified in the EYL and CTC initiatives were holding up. Are they still relevant and meaningful? What is important to today's students? How do today's teens view engineering and a potential career in STEM? What resonates and motivates them to consider engineering?

Research Goals

Gauge students' and parents' level of understanding and interest in engineering

Assess general career motivators and values

Evaluate current messages

Explore new messaging and opportunities

Identify differing attitudes and messaging opportunities by race, gender, and self-identified disabilities

1A. Goodwin. The development of a measure of engineering identity. June 2016. American Society of Engineering Education

Who We Are

DiscoverE is a nonprofit dedicated to providing global resources, programs, and connections between K-12 students and engineers and STEM professionals. We have a special focus on reaching girls and underrepresented and underserved students. DiscoverE is the backbone organization behind some of the earliest and most broadly adopted STEM and engineering programs available. They are free or low-cost to all students, remaining true to our guiding principle of Access for All.

DiscoverE was a key organizing and outreach partner in the Changing the Conversation and Engineer Your Life messaging projects. Global Strategy Group (GSG) conducted the research for both projects.

DiscoverE contracted GSG for the Messages Matter research. GSG is a full-service research, public affairs, and communications agency, working with top Fortune 100 companies at the center of some of the nation's most complex and exciting challenges. We wish to thank James Delorey, Alex Ivey, and Gillian Pentheny from GSG.

A working group, representing diverse perspectives and expertise, generously volunteered to provide ongoing guidance and review of the survey instruments and findings. We wish to recognize and thank:

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NSPE

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SWE

Patti Jo Rosenthal
ASME

Ershela L. Sims
WEPAN

Laureen Summers
AAAS

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Methodology

Global Strategy Group conducted two rounds of nationwide online surveys.

Round One

May 3 – 17, 2022

Surveyed
2,000
high school students

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

Round Two

October 6 – 13, 2022

Surveyed
2,047
high school students

Surveyed
1,000
parents

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

Key Findings

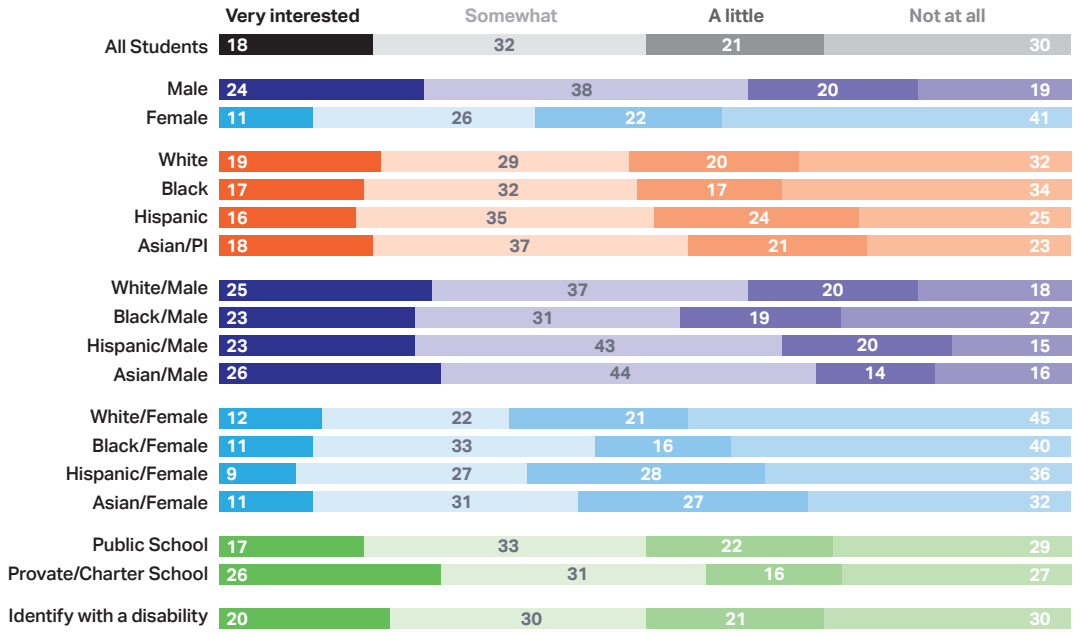
Perceptions of and Interest in Engineering

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

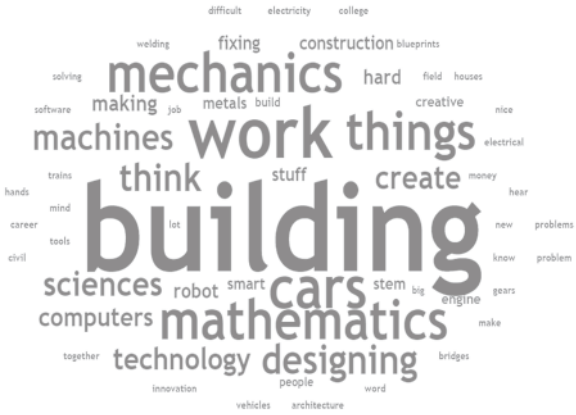
Student Interest in Engineering Demographic Breakdown

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



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

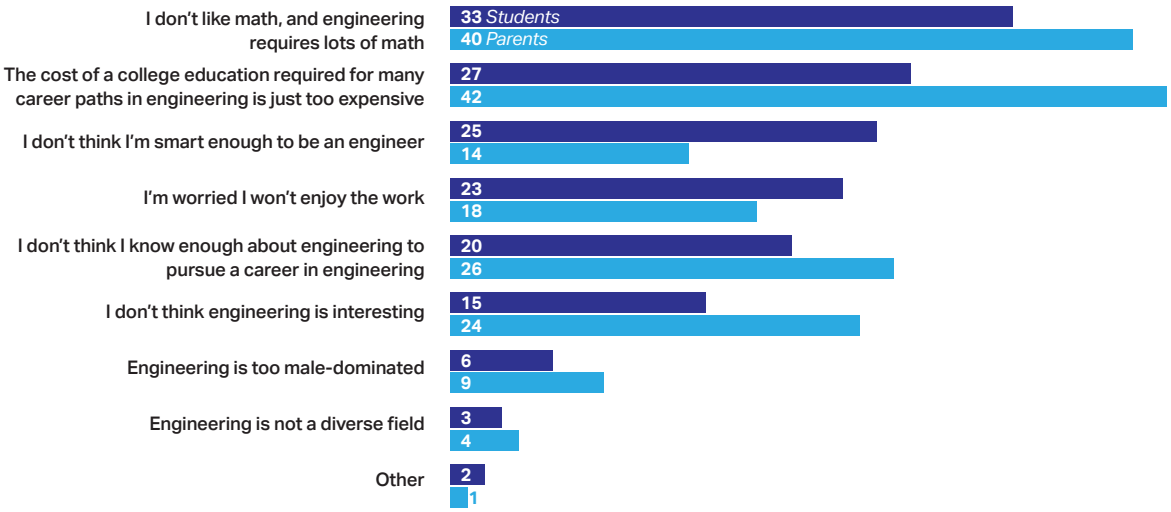
- Good at math and science
- Smart
- Builds, constructs, and makes things



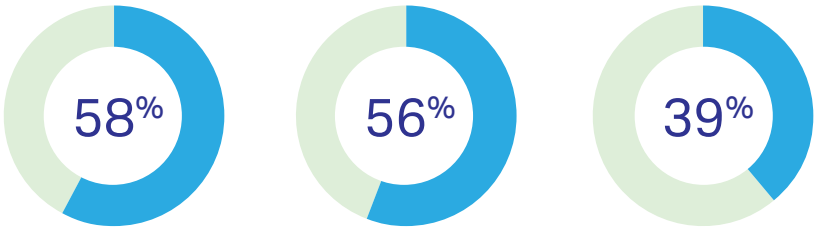
Words students use to describe engineering.

4 Students identify math as the #1 reason for not pursuing engineering; parents are more concerned by educational debt.

Below are some reasons students have identified for not pursuing a career in engineering… select the top two most convincing reasons to you [your child] to not pursue a career in engineering.



5 Parents have a positive view of engineering.



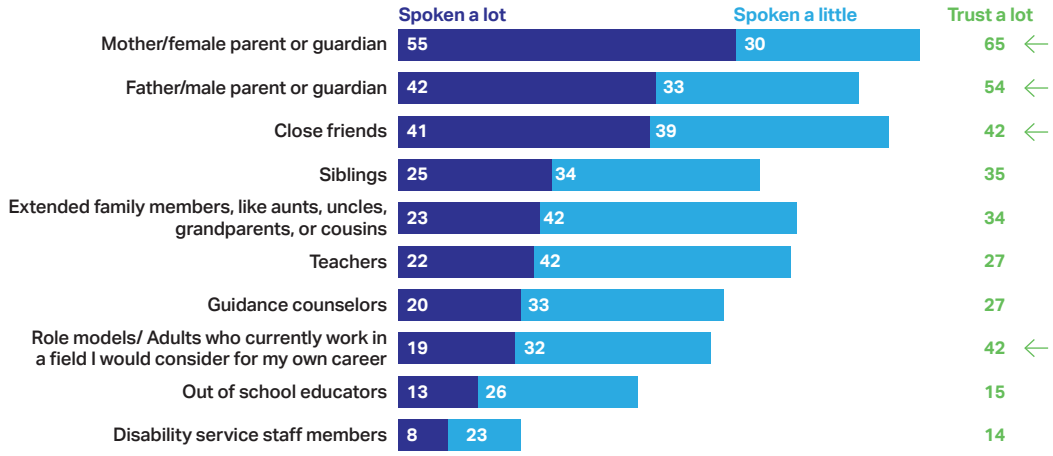
Both engineer and software engineer outpace doctor as a very good choice, and technician/technologist ties with veterinarian and nurse.

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.

How much have you spoken to each of the following people about careers or what you might do in the future for a career?



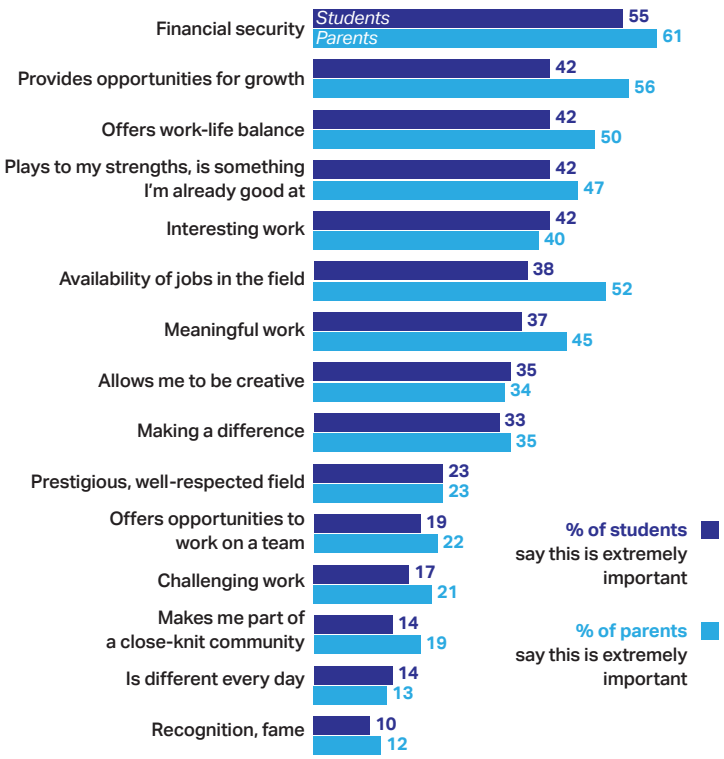
3 Both students and parents **prioritize going to college** over starting a career right away.

- 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

Please indicate how important each of the following is to you in considering which career to get into [for students] or should be to someone starting a career [parents]

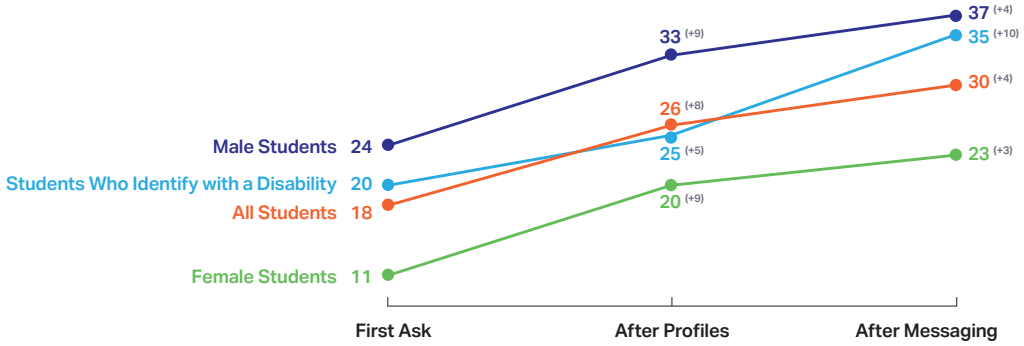


Appealing Messages, in Combination with Engineering Profiles, Increase Student Interest

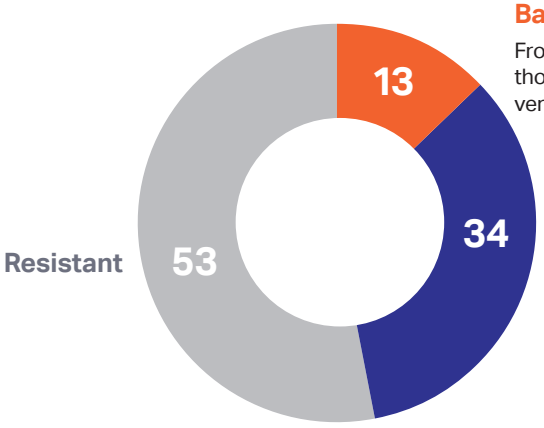
Student interest in engineering grows with exposure to profiles of engineers and key messages.

Over the course of the survey, we introduced students to 12 different engineers and technicians via short profiles and pictures, and presented 13 different messages. At three points during the survey—the beginning, after seeing engineering profiles, and after hearing engineering messages—the survey assessed their interest in engineering. Marked increases were seen across all demographics.

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



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



Base

From the start of the survey, those in the base are always very 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%)

Movers

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

Those in the Movers:

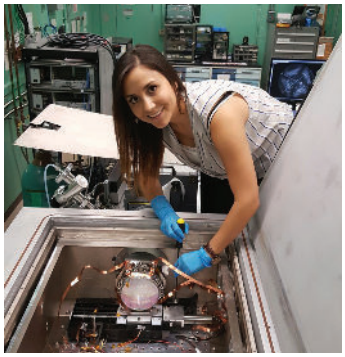
- Black female (38%) and Hispanic female (42%)
- Identify with a disability (42%)
- Non-college educated parents (37%)
- Plan to attend a community college (38%)
- Undecided on their future plans (39%)
- Lives in Northeast (37%) or South (36%)

Show students what a career in engineering looks like by showing them engineers who look like them.

When students see images and profiles of engineers who look like people they may aspire to be they're more receptive to the idea of pursuing a career in engineering.

Ahmed and Khalil Abdullah are brothers and **video game designers** who founded the 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!*.

67% of Black males rated this profile as very appealing



Dr. Margaret Dominguez is an **optical engineer** at the NASA Goddard Space Flight Center. At NASA her work has contributed to the new James Webb Space Telescope, the largest optical telescope in space. She is also working on the Roman Space Telescope in development at NASA, designed to document planets outside of our solar system, and offer insights into how dark energy shapes our universe.

45% of female movers rated this profile as very appealing

Dana Bolles dreamed of becoming an astronaut where she could work in an environment without her wheelchair. She pursued a career in mechanical engineering and earned a master's degree in Rehabilitation Engineering and Technology. She works at NASA, and over the course of her career, has built an internal website on the Exploration of Life beyond Earth and led a team of astrobiologists to develop a tool to help NASA better prepare the public for an eventual announcement of finding life.

46% of movers found this profile very appealing

Use messages that appeal to students.

Below are the **top three** of 13 messages that students found most appealing:

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

You don't need to graduate from a four-year university to have a successful career in engineering.

40% of all students	**68%** of the base	**55%** of the movers

found this **very appealing**

28% of all students	**49%** of the base	**30%** of the movers

found this **very believable**

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

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

Engineering is in high demand with companies these days because they value people who can build new things. Even though it's becoming harder to afford the cost of living in America, studying engineering gives you financial freedom.

39% of all students	**73%** of the base	**51%** of the movers

found this **very appealing**

42% of all students	**70%** of the base	**49%** of the movers

found this **very believable**

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

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

From everyday things like elevators, TV, and electric lights – to newer innovations like self-driving cars and spaceships – they have helped build the world around us, and get us to new ones in the future.

36% of all students	**76%** of the base	**45%** of the movers

found this **very appealing**

53% of all students	**77%** of the base	**59%** of the movers

found this **very believable**

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.
- The message that "engineering is a career that is open to everyone. You don't need to graduate from a four-year university to have a successful career in engineering," appeals to both parents and students.

Things to Consider when Developing Targeted Messages

The following trends were identified in the data set. There is more work to be done in future research to further refine the messaging.

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 Boys

- **Educate about opportunities to work in engineering without going to college**. Boys appear to be especially responsive once informed of these alternative entry points into the field. Profiles that show individuals in careers in engineering who have taken a less traditional route break through pre-conceived notions of engineering:

  "He was able to get a career regardless of struggling in math, which is what I struggle in."
- **Emphasize "personally rewarding" work** over "meaningful" work, though this is a narrow preference.
- **Elevate video game development as a career option**, as this appears to be particularly compelling for boys:
  "I enjoy video gaming and didn't realize that engineering was behind it."

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 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."

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 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."

Recommendations / Opportunities for Impact

Increasing interest in engineering among a diverse pool of students is the first step in diversifying the engineering workforce. But this is not the only issue impacting why there are so few women and people of color in the field. The following recommendations represent a holistic approach to addressing this critical issue.

Launch a multi-year national messaging campaign.

What's challenging about these results is how little students' perceptions about engineering have changed since the *Changing the Conversation (CTC)* and *Engineer Your Life (EYL)* campaigns. This led to a spirited discussion among the *Messages Matter* advisory committee when reviewing the findings, with general agreement that this is not surprising given our work to date has not included a sustained, multi-year national campaign to change the perception of engineering like the *"This is Engineering"* campaign currently being led by the Royal Academy of Engineering in the United Kingdom.

Established in 2018, the Royal Academy and its partners have committed over £5 million pounds to support an annual, national engineering messaging campaign aimed at their country's teens. Each year they produce a new messaging campaign, evaluate its impact, and adjust the next year's campaign, messages, tone, and delivery platform based on the findings.

When considering a national campaign in the U.S., it leads to the following questions.

- Is there enough interest and support to do this in the U.S.?
- What would it take to create a sustained multi-year campaign?
- Who would lead it and who would fund it?

Make "Engineering Is for Everyone" believable.

There is an exciting opportunity for the engineering community to make this message believable, and it requires a community-wide effort to:

- **Expand how we present engineering.** An interesting Messages Matter finding is that both students and parents did not know there are careers in engineering that do not require a four-year degree. Technical jobs like providing support for water-quality testing, supervising and testing modifications to a manufacturing process to design out waste, and evaluating a new food additive to find out if it improves the texture of a breakfast cereal can all be done with a two-year associate degree. When we showcase the full depth of jobs and careers in engineering and technology, it benefits us all.
- **Create a welcoming and inclusive STEM environment in K-12 schools, colleges and universities, and the workplace.** Initiatives at the collegiate level like Founding Dean and Professor of Engineering at Campbell University and President of the American Society of Engineering Education Dr. Jenna Carpenter's *Weaving In, Not Weeding Out* and national and regional outreach programs like DiscoverE's Future City Competition and Introduce a Girl To Engineering Day, North Carolina School of Science and Mathematics' Step Up to STEM summer institute, NSBE's SEEK camps, and the SWENext Clubs are just a few examples.

Engage Parents, Families, Caregivers, and Communities

Create more opportunities to educate and engage parents and caregivers on the many different types of careers in engineering, the various levels of education needed, and and ways they can support their student's success. Models like SHPE's Equipando Padres program and the National PTA's STEM + Families® program that engage parents alongside students are two examples of how we can do this.

Support and Educate K-12 Teachers and Out-of-School Time Educators to Include Engineering in STEM Programming

While there are many effective STEM programs happening around the country, we'd like to see a greater emphasis on differentiating engineering from the sciences and math and ensure that engineering is either visible or at the core of the programming. A few approaches STEM program providers and trainers can take are to:

- name activities engineering rather than using the STEM catch-all;
- facilitate activities that are structured around the engineering design process;
- invite engineering and technical role models to work with the students either in-person or virtually; and,
- share engineering educational pathways and career information.

Use Effective Messages and Role Models

A key lesson from the CTC and EYL campaigns was the importance of everyone – from individuals to multinational corporations – using consistent and effective messages. The Messages Matter research further confirms that positive engineering messages are strengthened when accompanied by diverse profiles of engineers and technicians that allow youth to see themselves represented. And while all role models and profiles are effective, role models with the same demographic, racial, and ethnic background as the students are the most powerful. Furthermore, it is imperative that we reach out to students where they are and not expect them to come to us, we need to use multiple avenues of communication, and align our communications with their interests and goals.

Visit DiscoverE.org/Messages-Matter

There you can download:

- The Messages Matter Executive Summary
- The Messages Matter Full Research Report
- The Messages Matter Outreach Toolkit (available early summer)

DiscoverE
1520 Belle View Blvd #3413,
Alexandria, VA 22307
DiscoverE.org

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Los Angeles • Nashville • Seattle
Globalstrategygroup.com

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