# “STEM for Girls”
# Engaging girls in mixed group STEM challenges

This programme has been funded by

**Thomas Gerald Grey Charitable Trust**

smallpeice
Dare to imagine

# Key challenges to address

## The STEM skills gap

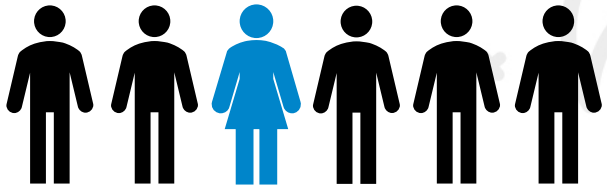
“The UK economy suffers a loss of £1.5bn per year due to STEM skills shortages. This not only represents a loss in terms of the UK’s prosperity but also for young people and adults of learning skills, working in more skilled employment, and potentially pioneering new technologies.

It is upon all of us to ensure every person can reach their potential by providing them with the right skillset.”

Source: theiet.org/impact-society/factfiles/innovation-and-skills-factfiles/addressing-the-stem-skills-shortage-challenge

## Addressing gender diversity

Women make up just 16.5% of the engineering workforce – that’s 1 in every 6 people.



smallpeice
Dare to imagine

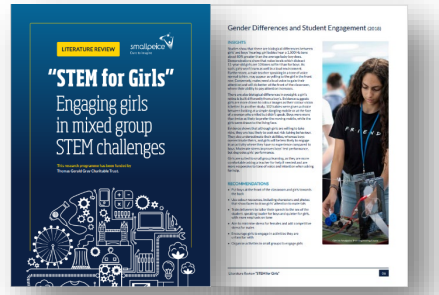
# The “STEM for Girls” research

- A practical research programme, focused on engaging girls in mixed group STEM challenges, which aims to:
  - ✓ Understand current research around girls in STEM
  - ✓ Identify activities and methods of engagement for girls
  - ✓ Give girls a more positive view of STEM
  - ✓ Encourage girls to pursue a career in engineering

**Limitations:** uncontrolled variables, scale

## Phase One: Literature Review

April 2023 – August 2023




## Phase Two: Primary Research

September 2023 – May 2024

## Phase Three: Report

June 2024 onwards

smallpeice

Dare to imagine

# Summary of Literature Review Recommendations

## Start young

Intervene early in girls' lives before negative stereotypes and low self-confidence in STEM subjects are embedded.

## Look at activity design and delivery

1. Design resources in a way that will engage girls
2. Use specific techniques when delivering content
3. Directly address gender stereotypes
4. Engage a range of female role models
5. Emphasise the social applications of STEM

smallpeice
Dare to imagine

# Study Design (October 2023 – February 2024)

1. Design resources to engage girls

2. Delivery techniques

3. Directly address gender stereotypes

4. Engage a range of female role models

5. Emphasise the social applications of STEM

**Test One:**
Update STEM Day with design and delivery recommendations, directly addressing gender stereotypes

**Test Two:**
Look at the impact of role models

**Test Three:**
Reframe around social impact

**Test Four:**
Create a new STEM Day designed with all recommendations incorporated.

CONTROL: previous STEM Day evaluation data.

smallpeice
Dare to imagine

# Fieldwork (March – May 2024)

24 days of field work with over 1,000 students aged 8 to 14 years of age, including 500+ girls

| Research Area | Primary Schools | Secondary Schools |
|---|---|---|
| Test One: design & delivery | 3 | 3 |
| Test Two: role models | 3 | 3 |
| Test Three: social impact | 3 | 3 |
| Test Four: new format | 3 | 3 |
| Total (days) | 12 | 12 |
| Total (av. students) | 540 | 660 |

Minimum / average group size:

- Primary School: 25 minimum / 45 average
- Secondary School: 45 minimum / 55 average

smallpeice
Dare to imagine

# Test One: Design and Delivery

## What were we aiming to do?

- Design resources in a way that will engage girls
- Use specific techniques when delivering content
- Directly address gender stereotypes

## How did we do it?

- Used colour and imagery of girls and women
- Incorporate spatial training exercises into STEM content
- Encouraged girls to try new activities and to make guesses based on judgement calls
- Explicitly highlighted gender steryotypes in engineering and challenged them

smallpeice
Dare to imagine

# Test One: Design and Delivery

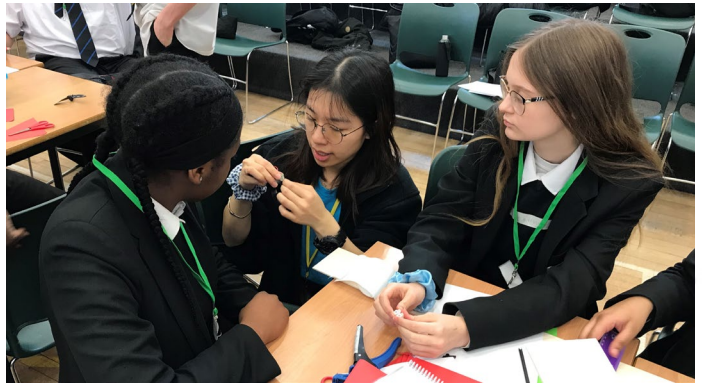
## What did we learn?

- Challenging steryotypes made students more openminded and changed their view of engineering
  - ✓ *"I became more openminded"* – female secondary student
  - ✓ *"Engineering is not what I thought"* – female secondary student
  - ✓ *"I learned everybody can do it"* – male primary student

- **13.2%** increase in secondary girls saying they would consider a career in engineering compared to the control

| Female Secondary Feedback | Test 1 | | Control |
|---|---|---|---|
| I enjoyed the STEM Day | **95.9%** | ↑ | 95.4% |
| I learned something new | **95.9%** | ↑ | 93.6% |
| I've gained new skills | **89.2%** | ↑ | 87.1% |
| I now understand engineering better | **91.9%** | ↑ | 86.7% |
| I now have a greater appreciation of engineering | **86.5%** | ↑ | 82.7% |
| I would now consider a career in engineering | **59.5%** | ↑ | 46.3% |

| Female Primary Feedback | Test 1 | | Control |
|---|---|---|---|
| I had fun doing this activity | **97.4%** | ↑ | 96.9% |
| I learned something new | **94.7%** | ↑ | 93.8% |
| I can now do things I couldn't before | **86.8%** | ↑ | 80.9% |
| I understand what I did | **97.4%** | ↑ | 91.2% |
| I know what engineers do | 89.5% | | 91.5% |
| I would like to be an engineer when I am older | 21.1% | | 35.1% |



smallpeice
Dare to imagine

# Test Two: Role Models

## What were we aiming to do?

- Engage female role models of a range of ages and life stages
- Bridge the gap between girls and the women they will become

## How did we do it?

- Invited in-person role models to attend STEM days
- Used female engineering videos
- Used female engineering case studies


smallpeice
Dare to imagine

# Test Two: Role Models

## What did we learn?

- Sharing who a role model is as a person makes them more relatable
  - ✓ *"Made it relatable to us – she showed us the similarities engineers have to us"* – female primary student
  - ✓ *"No matter what you like you can still become an engineer"* – female primary student
- An in-person role model who participates in the day has more of an impact
  - ✓ *"I liked having a real engineer helping and talking to us"* – female primary student
  - ✓ *"I like that she stayed and helped us during the day"* – female secondary student
- Videos and in person talks are more engaging than written case studies
- Using a range of role models means students are more likely to see a career route they are interested in
  - ✓ *"I thought 'I might want to do that'"* – female primary student
  - ✓ *"Everyone knows planes are engineering, but the video of the engineer at Lush: I didn't think an engineer did that"* – female primary student
  - ✓ *"I liked how they showed different routes into engineering"* – female secondary student

| Female Secondary Feedback | Test 2 | | Control |
|---|---|---|---|
| I enjoyed the STEM Day | **95.9%** | ↑ | 95.4% |
| I learned something new | **94.6%** | ↑ | 93.6% |
| I've gained new skills | 85.1% | | 87.1% |
| I now understand engineering better | **90.5%** | ↑ | 86.7% |
| I now have a greater appreciation of engineering | **90.5%** | ↑ | 82.7% |
| I would now consider a career in engineering | **60.8%** | ↑ | 46.3% |

| Female Primary Feedback | Test 2 | | Control |
|---|---|---|---|
| I had fun doing this activity | **96.4%** | ↑ | 96.9% |
| I learned something new | **95.2%** | ↑ | 93.8% |
| I can now do things I couldn't before | **89.2%** | ↑ | 80.9% |
| I understand what I did | **91.6%** | ↑ | 91.2% |
| I know what engineers do | **96.4%** | ↑ | 91.5% |
| I would like to be an engineer when I am older | 32.9% | | 35.1% |

smallpeice
Dare to imagine

# Test Three: Social Impact

## What were we aiming to do?

- Raise awareness of the breadth of careers in STEM
- Raise girls' awareness of the social applications of STEM careers
- Emphasise the counter-stereotypical skills required, such a teamwork, communication and social skills, in STEM careers

## How did we do it?

- Used role model videos showcasing broad engineering careers with a social application
- Framed day around a social impact theme
- Highlighted the 'soft skills' needed in each challenge


smallpeice
Dare to imagine

# Test Three: Social Impact

## What did we learn?

- Students had a greater understanding of the social value of engineering
  - ✓ *"I learnt about the impact of engineering on Earth"* – female secondary student
  - ✓ *"I learnt why engineering is important"* – female secondary student
  - ✓ *"I learnt the ways engineers can change the world"* – female secondary student

- Using a range of short role model videos increased the awareness of engineering careers
  - ✓ *"I learnt engineering is very diverse"* – female secondary student

| Female Secondary Feedback | Test 3 | | Control |
|---|---|---|---|
| I enjoyed the STEM Day | **95.9%** | ↑ | 95.4% |
| I learned something new | **93.9%** | ↑ | 93.6% |
| I've gained new skills | 77.6% | | 87.1% |
| I now understand engineering better | **91.8%** | ↑ | 86.7% |
| I now have a greater appreciation of engineering | **89.8%** | ↑ | 82.7% |
| I would now consider a career in engineering | **66.7%** | ↑ | 46.3% |

| Female Primary Feedback | Test 3 | | Control |
|---|---|---|---|
| I had fun doing this activity | **98.0%** | ↑ | 96.9% |
| I learned something new | **98.0%** | ↑ | 93.8% |
| I can now do things I couldn't before | **87.8%** | ↑ | 80.9% |
| I understand what I did | **93.9%** | ↑ | 91.2% |
| I know what engineers do | **93.9%** | ↑ | 91.5% |
| I would like to be an engineer when I am older | 24.5% | | 35.1% |

**20.4%** increase in secondary girls who would consider a career in engineering – the most significant increase across the project

smallpeice
Dare to imagine

# Test Four: New STEM Day

## What were we aiming to do?

- Design resources to engage girls
- Use specific techniques in delivery
- Engage female role models of different ages
- Directly address and challenge gender stereotypes
- Emphasise the social applications of STEM and the broadness of STEM careers

## How did we do it?

- Used colour and imagery of girls and women
- Explicitly challenged gender steryotypes
- Used a range of in-person and video role models showcasing the broadness of engineering careers
- Framed day around a social impact theme
- Emphasised the social skills being demonstrated in each challenge

# Test Four: New Secondary STEM Day

## What did we learn?

- Less is more
- Including a social impact theme helps students to understand the impact of engineering
  - ✓ *"I learnt engineering can change the world"* – female secondary student
  - ✓ *"I learnt how engineers help us and how engineering affects our everyday life"* – female secondary student
- Showcasing a broad range of careers challenged pupil's view of engineering
  - ✓ *"I learnt there are many careers in engineering"* – female secondary student
  - ✓ *"I learnt that engineering is diverse"* – female secondary student
  - ✓ *"Engineering is more than just mechanical"* – female secondary student

| Female Secondary Feedback | Test 4 | Control |
|---|---|---|
| I enjoyed the STEM Day | 89.3% | 95.4% |
| I learned something new | 91.1% | 93.6% |
| I've gained new skills | 69.1% | 87.1% |
| I now understand engineering better | 83.9% | 86.7% |
| I now have a greater appreciation of engineering | 71.4% | 82.7% |
| I would now consider a career in engineering | 43.6% | 46.3% |

smallpeice
Dare to imagine

# Test Four: New Primary STEM Day

## What did we learn?

- Students were more likely to mention learning counter-stereotypical, social skills like teamwork, resilience and creativity in their feedback
- Including a social impact theme helps students to understand the impact of engineering
  - ✓ *"I learned how engineers impact the world"* – female primary student
  - ✓ *"I learned engineers help people"* – female primary student
- Directly challenging steryotypes changed students' view of engineering
  - ✓ *"Anyone can be an engineer"* – female primary student
  - ✓ *"Any gender can do it"* – male primary student
  - ✓ *"Thank you, you changed my view about engineers"* – male primary student

| Female Primary Feedback | Test 4 | | Control |
|---|---|---|---|
| I had fun doing this activity | 94.7% | | 96.9% |
| I learned something new | 89.5% | | 93.8% |
| I can now do things I couldn't before | 68.4% | | 80.9% |
| I understand what I did | **94.7%** | ↑ | 91.2% |
| I know what engineers do | **97.3%** | ↑ | 91.5% |
| I would like to be an engineer when I am older | 22.7% | | 35.1% |

smallpeice
Dare to imagine

# Key findings

- The feedback data from girls was better across Test 1-3 as this was building upon a solid existing STEM Day activity

- The changes did not have a negative impact on other genders
  - ✓ A higher percentage of secondary boys said they would consider a career as an engineer across Tests 1-4 compared to the control

| Male Secondary Feedback | Control | Test 1 | Test 2 | Test 3 | Test 4 |
|---|---|---|---|---|---|
| I enjoyed the STEM Day | 96% | **98.7%** ↑ | **98.7%** ↑ | **97.9%** ↑ | **96.7%** ↑ |
| I learned something new | 93% | **97.3%** ↑ | **97.5%** ↑ | **95.7%** ↑ | 90.0% |
| I've gained new skills | 88% | **90.7%** ↑ | **94.9%** ↑ | **91.5%** ↑ | 87.8% |
| I now understand engineering better | 89% | **94.7%** ↑ | **94.9%** ↑ | **95.7%** ↑ | **96.7%** ↑ |
| I now have a greater appreciation of engineering | 85% | **93.3%** ↑ | **89.9%** ↑ | **93.6%** ↑ | **91.1%** ↑ |
| I would now consider a career in engineering | 64% | **76.0%** ↑ | **82.1%** ↑ | **74.5%** ↑ | **75.6%** ↑ |

smallpeice
Dare to imagine

# Next Steps

- Incorporate findings into our existing STEM day projects
- Use Test 2 findings to train future STEM role models
- Consider how we implement research in the future
- Review our evaluation questions
- Further research into fun in failure and anxiety in learning

smallpeice
Dare to imagine