



## You Can Engineer It: Engineering Outreach for Females Aged 4–12

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Proceeding Paper

# You Can Engineer It: Engineering Outreach for Females Aged 4–12<sup>†</sup>

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**Abstract:** This document discusses a delivery method employed by South Eastern Regional College (SERC) to provide engineering outreach opportunities for young females, funded by the Institution of Engineering and Technology (IET). College students developed resources and assisted on the day, making the event more engaging for participants. Feedback from the event showed that parents and children gained a greater understanding of engineering and that there is a need for sustained engineering extra-curricular events in the local area.

**Keywords:** engineering education; outreach; females; gender; student volunteers

## 1. Introduction

Engineering is still largely seen as a male discipline [1], and these biases are deep rooted in society and are very complex.

According to the DfE NI [2], we have a “leaky pipeline” in STEM education, with significantly less females choosing STEM subjects after GCSE, going from 47% (GCSE) to 25% (A Level/L3). GCSE choices are made in Year 10 (age 13–14), and few girls in the UK pick engineering subjects (engineering, design and technology, physics) for GCSEs (Engineering GCSE—10%) [3]. There is no mention of engineering specifically in the NI primary school curriculum [4], with science and technology competing with geography and history in “The World Around Us” topic.

Perhaps the lack of interest in engineering careers amongst young females in NI is a foregone conclusion, when we consider how little exposure they receive before choosing GCSEs at age 13 or 14. Perhaps in the short term, the only way to improve this situation is to provide engineering exposure outside the classroom. Research suggests that extra-curricular activities increase the likelihood of young females pursuing engineering careers [5].

## 2. You Can Engineer It

Using IET funding, SERC facilitated some free family engineering events, dubbed “You Can Engineer It”. Six events were conducted across three campuses in the southeastern region of Northern Ireland, with 60 families attending (110 children).

### 2.1. Target Audience

As outlined in the introduction, there is a lack of engagement in engineering-related activities in primary school; therefore, the main target audience was 4–12 year olds. The sessions were advertised as primarily for females; however, males (particularly siblings) were welcome to attend.

A mailshot was sent to local primary schools; however, the open rate on 169 emails was 11%. Many attendees found out through informal networks such as friends, PTA



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WhatsApp groups and personal social media posts. Instead of standard corporate imagery, the team used an image specially designed by one of our art lecturers (Figure 1). Several parents commented that the imagery was what drew their attention to the event.



**Figure 1.** The image created to represent the event.

### 2.2. Design of Sessions

When SERC applied for funding from the IET, the plan was to deliver an all-day session in each of three main campuses. However, it was recognised that this would be a long day for younger children; therefore, it was redesigned as 2 half-day sessions.

Some literature supports the notion that parents have a part in forming their children's biases [6]; therefore, there was an intent to inform parents about the breadth of engineering careers and that they are not all "dirty jobs". This was conducted through informal conversations during the events. At least three female engineering staff/students facilitated activities, providing female role models at each event.

### 2.3. Development of Resources

At the beginning of every academic year, all full-time students complete a 2-week problem-based learning (PBL) activity. The incorporation of PBL has a positive impact on student learning [7] and has been used in SERC for approximately 7 years now. During induction in 2022/23, several engineering classes were given a PBL challenge to design a resource pack for an engineering activity for primary school children. They were asked to ensure that the resources be cost-effective to produce, have low environmental impact and be reusable where possible. As a result, several ideas for the family event were delivered using mainly home-grown, affordable resources.

Three stations were set up based on the activities developed by the students—Structures, Flight and Dynamic Systems.

### 2.4. Students as Volunteers

An engineering society was formulated by a group of SERC higher education (HE) students at the start of the 2022/23 academic year. The group was asked to help at the "You Can Engineer It" event, and eight students volunteered to assist. The use of the student body to facilitate outreach is well developed for STEM in the USA [8].

It was considered that having young people help with the event would result in a more energetic environment and that young helpers could better relate to the audience; however, there is no research to support this notion. According to the recent literature, there is much to be gained for student volunteers. Aside from finding volunteer work rewarding [9], many students gain improvement in social value [10] and employability skills [11] from such experiences.

### 2.5. On the Day

Not every family who booked tickets attended; however, this is an issue to be expected with free events. Stations were set up in a sports hall and were well spaced out, with groups of participants cycling around the stations at intervals. Facilitators explained the principles behind the activities in simple terms to parents and young people alike. Whilst station

timings were loosely adhered to, the participants had time to experiment organically and explore freely.

### 3. Feedback

Feedback was overwhelmingly positive, with parents asking for more events of this nature in the future (62% of attendees completed a survey). Feedback showed that all children and most of the parents learned something new (See Table 1). Of the attendees, 100% enjoyed the event.

**Table 1.** Attendee feedback.

| Factor   | % Agreed |
|--|----------|
| Greater understanding of any engineering topic—adults      | 89%      |
| Greater understanding of any engineering topic—children    | 100%     |
| Greater appreciation for the value of engineering—adults   | 95%      |
| Greater appreciation for the value of engineering—children | 100%     |

Feedback from student volunteers indicated that 100% of them found the event very fun and rewarding and would be keen to repeat. The Engineering Society has recognised that they can be role models for young children, and they have included engineering outreach as part of their charter going forward.

### 4. Conclusions

There is an appetite for engineering extra-curricular activities for young females in the region. However, one-off events do not make a fundamental change in mindsets [12] for girls in STEM. Taking a similar but sustained approach, we could see an increase in understanding, interest, and uptake in engineering subjects at GCSE and beyond. Therefore, SERC is now seeking funding to provide a regular engineering after-school club for young females. There is an opportunity to develop the student volunteer model further and provide formal training as an additional incentive for those who become involved.

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