nustem

Engineering for Families 2016 – 2017

Summary Report

Project Description

Funded by the Platton Fund at the Community Foundation, Engineering for Families is a 6-week family-learning course developed for primary school children and their parents/carers in Blyth and Ashington in the North East of England. During each weekly afterschool session, families explore a different engineering career and discipline through hands-on practical activities, career case studies and real-world examples. Working collaboratively children and adults investigate, design and make structures which explore the wide number of pathways into engineering, particularly those most relevant in the North East of England (structural, mechanical, marine and aeronautical engineering). The project was delivered in 6 primary schools in Northumberland.

The course was developed in response to IET research that found many parents lack the confidence, knowledge and skills necessary to support their children with Science, Technology, Engineering and Maths (STEM). Therefore the underlying principles in the design of Engineering for Families was for an accessible programme which:

- Explored engineering through careers based challenges
- focused on working together with your family
- used materials that you may have lying around at home

The course design therefore provides numerous opportunities for parents and carers to work alongside their children to learn about the importance and applications of engineering. This shared experience of hands-on, careers-focused engineering challenges was designed to strengthen the science capital of the families, and increase the confidence of parents to support their children in STEM learning at school and home. Additionally the programme intends to show careers in the engineering sector as more relevant and accessible to the children and their parents.

The legacy of Engineering for Families was an important consideration, and so a key element of the course was the 'train the trainer' CPD offered to staff at primary schools participating in the programme. This model equips schools with the knowledge and skills to run their own Engineering for Families course for families and wider community of the school in future years. The CPD was also designed to develop the subject knowledge of the primary teachers.

Outline of the Course

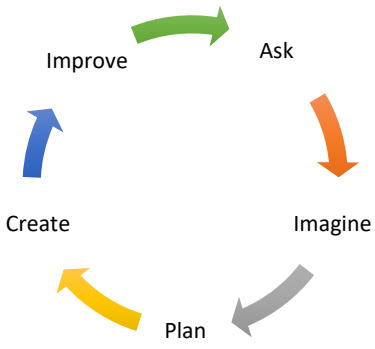
Each week of course focused on a career within a different discipline of engineering:

Session 1: The Structural Engineer (Focus on the design and building of towers)
Session 2: The Marine Engineer (Focus on the design and building of boats)
Session 3: The Civil Engineer (Focus on the design and building of bridges)
Session 4: The Automotive Engineer (Focus on the design and construction of vehicles)
Session 5: The Aeronautical Engineer (Focus on the construction of gliders)
Session 6: Engineering Challenges (Drawing together the learning from the previous weeks)

Each session begins with an introduction to the career and uses a striking photograph of a counter-stereotypical person in that career.

Photos by ThisisEngineering RAEng on Unsplash

Families then work together to complete engineering activities related to the career. The Engineering Design Cycle (Ask – Imagine – Plan – Create – Improve) is used to explain the principles underlying the different engineering disciplines and guide the structure of the sessions. At the end of the sessions families are invited to complete a follow-on activity at home and bring a photo of the completed activity or task to the next session.



Monitoring and Evaluation of Engineering for Families

The Engineering for Families course was piloted and evaluated using qualitative questionnaires, satisfaction ratings and course completion rates, before being revised, improved and rolled out to the other 5 schools. It was intended to undertake qualitative pre- and post-evaluation of the roll out in the five schools, however the post data was

not returned and therefore comparisons are not possible. Therefore this section will look firstly at engagement and retention numbers, before exploring the success of the pilot programme in achieving each of its four intended outcomes.

Participation and Retention

The pilot phase worked with 8 families in one school, and the additional sessions worked with 40 families in five primary schools, making a total of 48 families (with 61 children in total) who participated in the Engineering for Families programme in 2017.

Retention rates were excellent in the pilot, with the 10 children and 8 parents/carers who attended the initial session, continuing to attend all of the remaining sessions within the course. Attendance rates continued to be good through-out the course in the other 5 schools, particularly where the programme had the support and introduction of the Head Teacher of a member of Senior Management Team.

Additionally this programme has trained 20 teachers to deliver 'Engineering for Families' courses as part of their school curriculum and parental engagement programmes, thus ensuring the legacy of this project.

Families have a positive and enjoyable learning experience

All families of in the pilot reported that they enjoyed the sessions. Participants reported to have enjoyed both the activities themselves and the experience of working on projects together with their families. Some of the participants' comments include:

> *"It has been a great experience that I would recommend to others"*
> *"Engineering is much more fun than we ever thought!"*
> *"It is very fun and creative"*
> *"Yes, we enjoyed spending time together and problem solving"*
> *"Overall, the 6 weeks have been an enjoyable experience, learning about the different types of engineering. We enjoyed the civil engineering making bridges the most."*

The enjoyment of the individual sessions within the programme were also evaluated. All of the different sessions were picked out as 'favourite' by some of the participants.

Strengthening science capital in participating families

It was not within the scope of this evaluation programme to attempt to measure science capital of participating families. However participant comments show how the course's success in changing perceptions of 'who engineering is for' and building parents/ carers support for their child to continue with STEM:

"I thoroughly enjoyed the sessions. It isn't something I was encouraged to do at school. I came from a: girls do cookery, boys do computing background. It is great to see my daughter enjoying the STEM subjects".

Increasing the confidence of parents to support their children in STEM learning at school and home

Before the sessions over 69% of parents/carers reported low levels of confidence in response to the statement '*I would know how to support my child if they were interested in engineering*' highlighting the need for an intervention in this area. Comments from participants attending Engineering for Families shows they particularly praised the design of the interventions in allowing them opportunity to work together as a family group,

"It was great to have the time to work together with my child on these projects."
"It was great that we were given the time to develop our ideas but had input when we needed it from the NUSTEM team."

And they describe the impact this has had on their desire and intention to work together on future learning projects:

"We have continued the team work into other activities".
"It has really encouraged us to work/do more things at home as a family."
"Using cheap and easily accessible resources has been a great idea and certainly encouraged me to think about engineering projects we can do at home."

Raising STEM related career aspiration amongst participating primary aged children and their families

Before the sessions, 81% of parents/ carers reported negatively to the statement '*I would like my child to be an engineer when they are older*'. While we were not able to measure changes in career aspirations of participating children as part of the evaluation of this programme, participants' comments do show that Engineering for Families had some success in showing STEM careers more relevant and accessible to children:

"My son now wants to be a civil engineer"
"It has changed my thinking of engineering because it shows you what you can build out of everyday materials".

Increasing the confidence and ability of primary school teachers to teach science

A great success of this programme has been the uptake of the Engineering for Families CPD course, with 20 teachers taking part in the 'train the trainer' session. Some of the teachers were so enthused by this training, that in two of the 6 schools NUSTEM

supported teachers to deliver the Engineering for Families course to families themselves on completion of the training using NUSTEM's materials, rather than the delivery being undertaken by the NUSTEM team. One school participating in the Engineering for Families programme has now become an NUSTEM partner school. Engineering for Families has therefore supported the development of primary school teachers' confidence and ability to teach science, and deliver family learning programmes.

Participants of Engineering for Families working in The Structural Engineer session.