UWE Bristol | University of the West of England

Presentation by

Laura Fogg-Rogers

Senior Research Fellow in Science Communication

@laurafoggrogers

Laura.foggrogers@uwe.ac.uk

Curiosity Connections

Paired peer learning between engineers and teachers

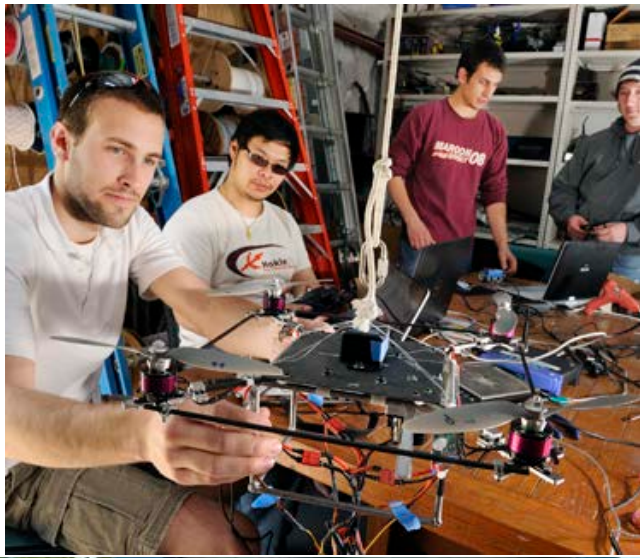
19/5/2017
STEM and Beyond Conference

SCU | science communication unit

Engineering has an image problem

#9%

isNotEnough



Engineering has an image problem

#9%

isnotenough

5%

of primary school teachers have a STEM higher qualification

Gender identity is formed between ages

5-7

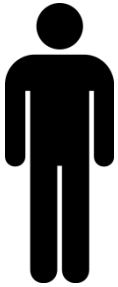
Social Cognitive Theory

“An individual's learning is not only related to their personal capabilities and experience, but also to their observations of others within the context of social interactions, experiences, and outside media influences”.

Fogg-Rogers, L., Sardo, A.M., Boushel, C. (2017)

Direct learning

Experience of success and emotional arousal = mastery

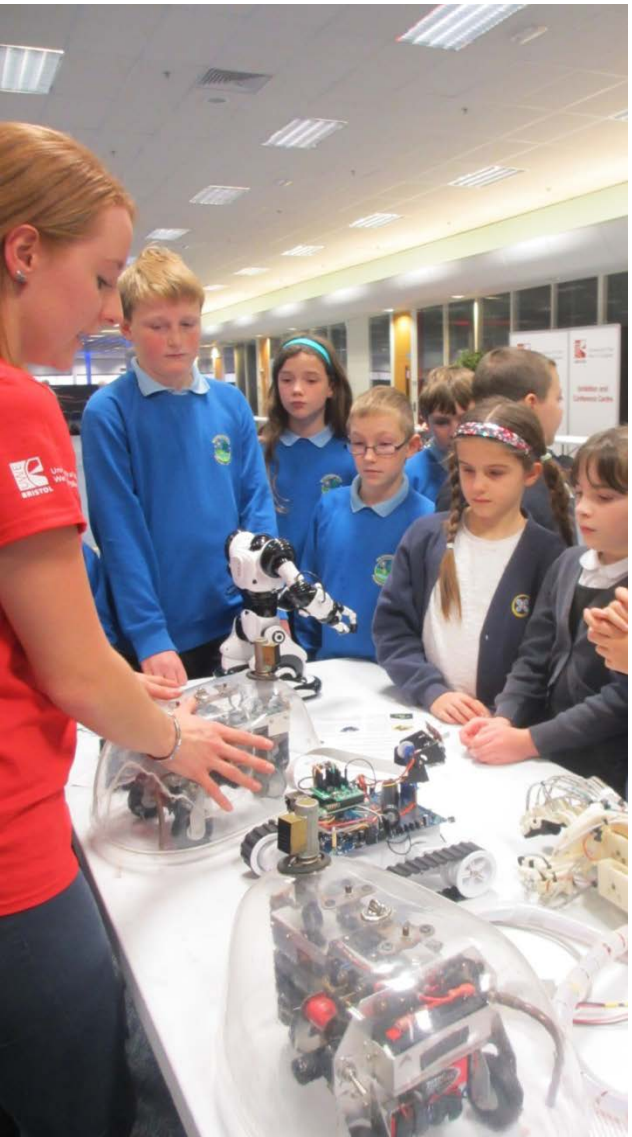


Indirect learning

Social norms and social persuasion

Vicarious experience = role modelling

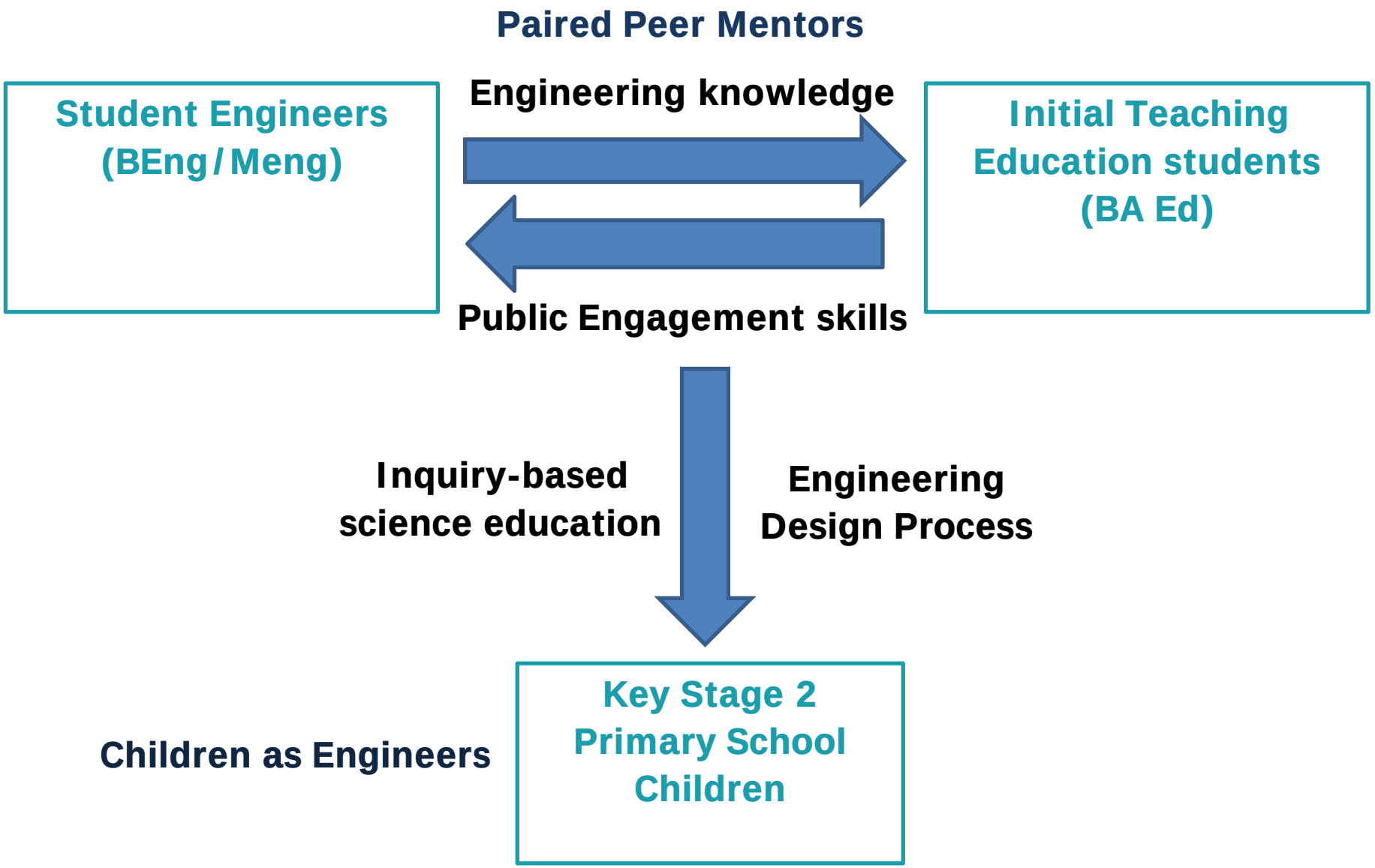
Social persuasion…



STEM engagement... with whom?

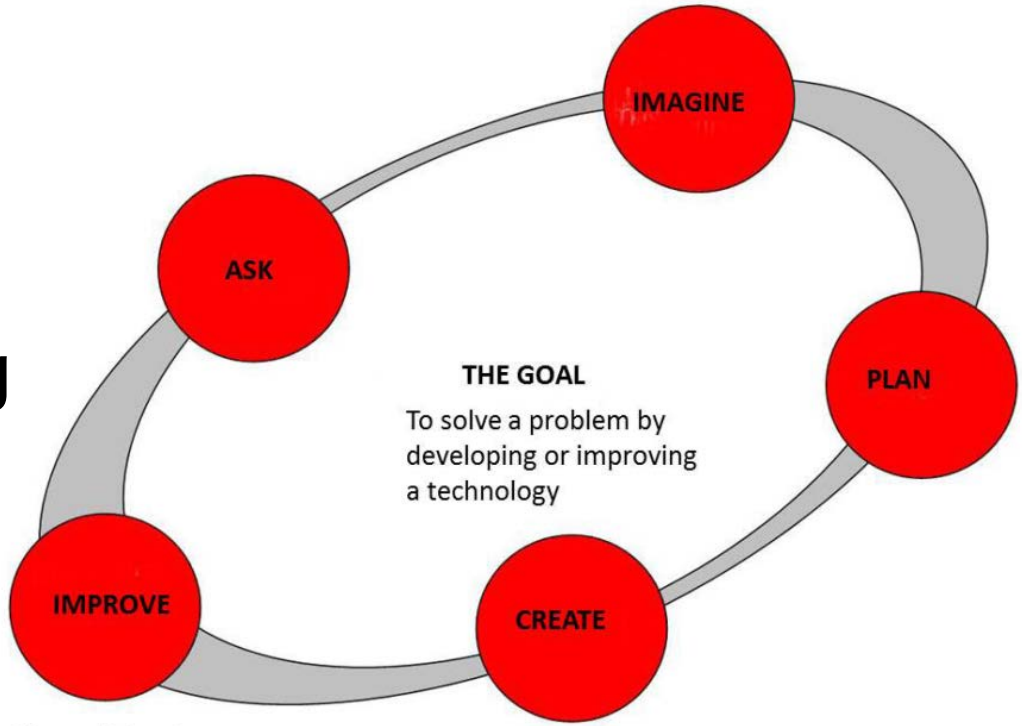
Key Stage 2 Primary School Children	• **Children, particularly girls, decide on the appropriateness of science as a career before age 11 (Archer et al, 2013).** • **Girls like connecting STEM disciplines with relevant real-world problems (High Level Group on Science Education, 2007).**
Initial Teaching Education students	• **50% of primary school teachers identify low confidence and subject knowledge in engineering (ENGINEER, 2014)** • **Initial Teacher Education is key opportunity to embed experience in curriculum.**
Student Engineers	• **Improving public engagement skills is a key aim for engineering professional bodies (EPC, 2014).** • **Recruitment into engineering is needed to meet the employment gap (Engineering UK, 2017).**

Paired peer learning model



Engineering Design Process

- Force and Balance
- High Flyers
- Mechanics
- Sinking and Floating
- Electricity



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www.engineer-project.eu

Engineer and teacher training

Engineer training:

- Communication skills
- Pedagogical theories

Teacher training:

- Engineering Design Process
- STEM concepts

Project in schools

Paired peer development of ENGINEER module

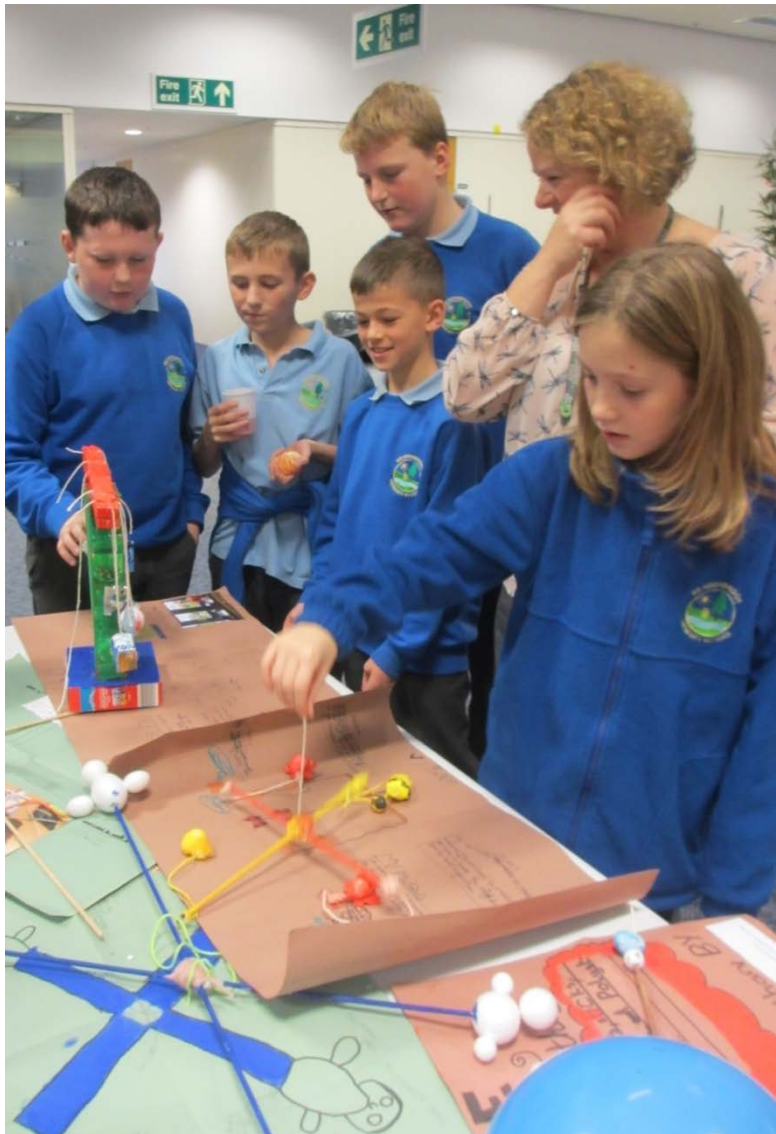
N=11 engineers

N=10 teachers

Two half days spent in primary schools

Four schools

N=269 children



Researching conference

Evaluation Design

Student Engineers

Open response questionnaires

Reflective diaries

Perceptions questionnaire

Engineering Outreach Self-Efficacy Scale

Pre-Service Teachers

Open response questionnaires

Reflective diaries

Perceptions questionnaire

Engineering and Science Subject Knowledge Confidence Scales

Teaching Engineering and Science Self-Efficacy Scales

Children

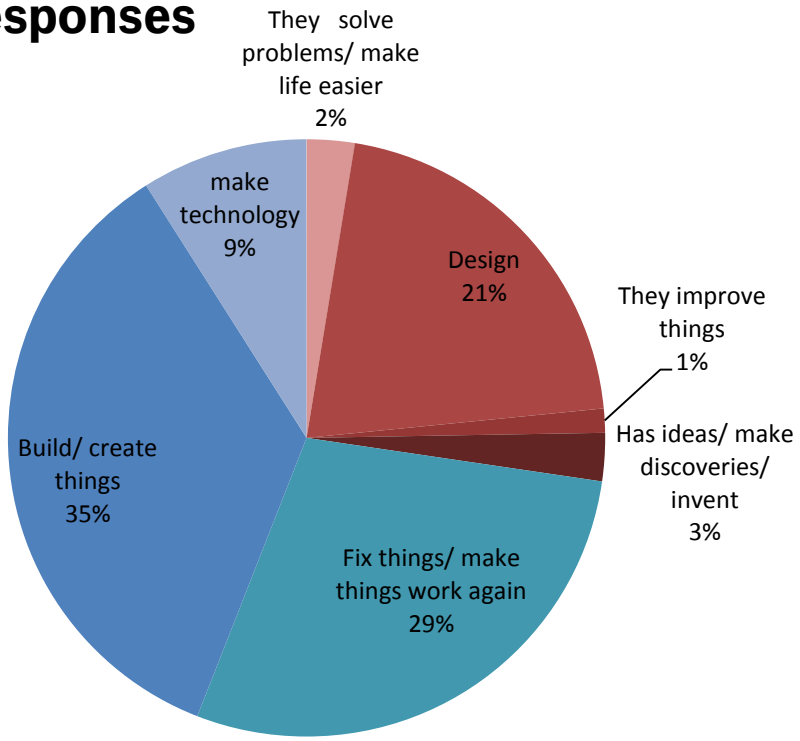
Open response questionnaires

Perceptions questionnaire

Post-it note feedback wall

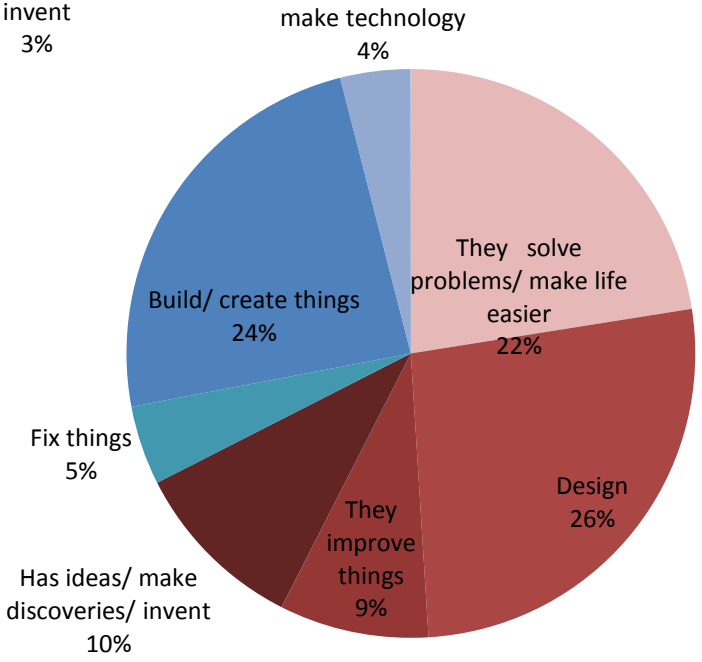
Children's responses

Pre responses

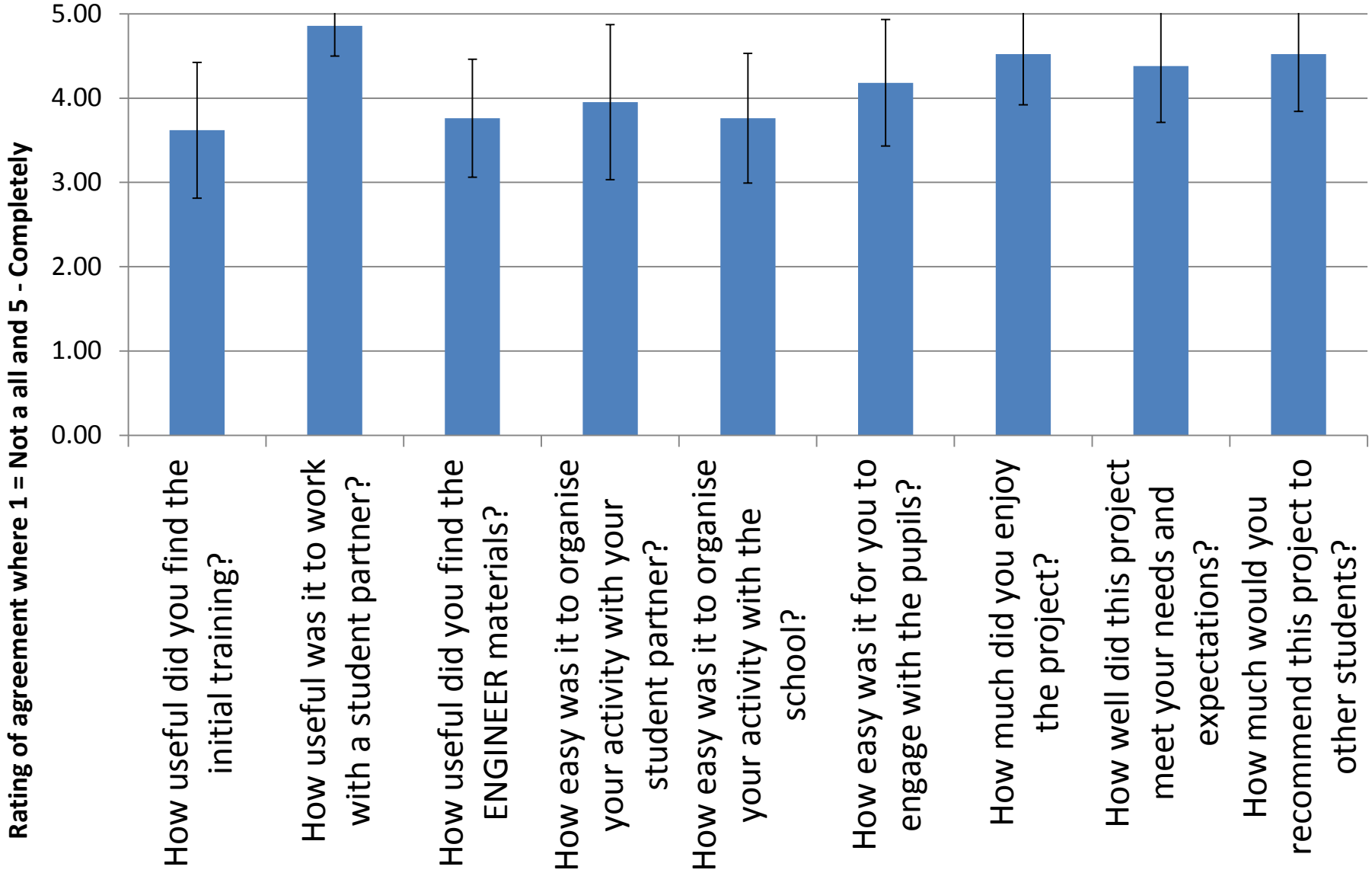


What do engineers do?

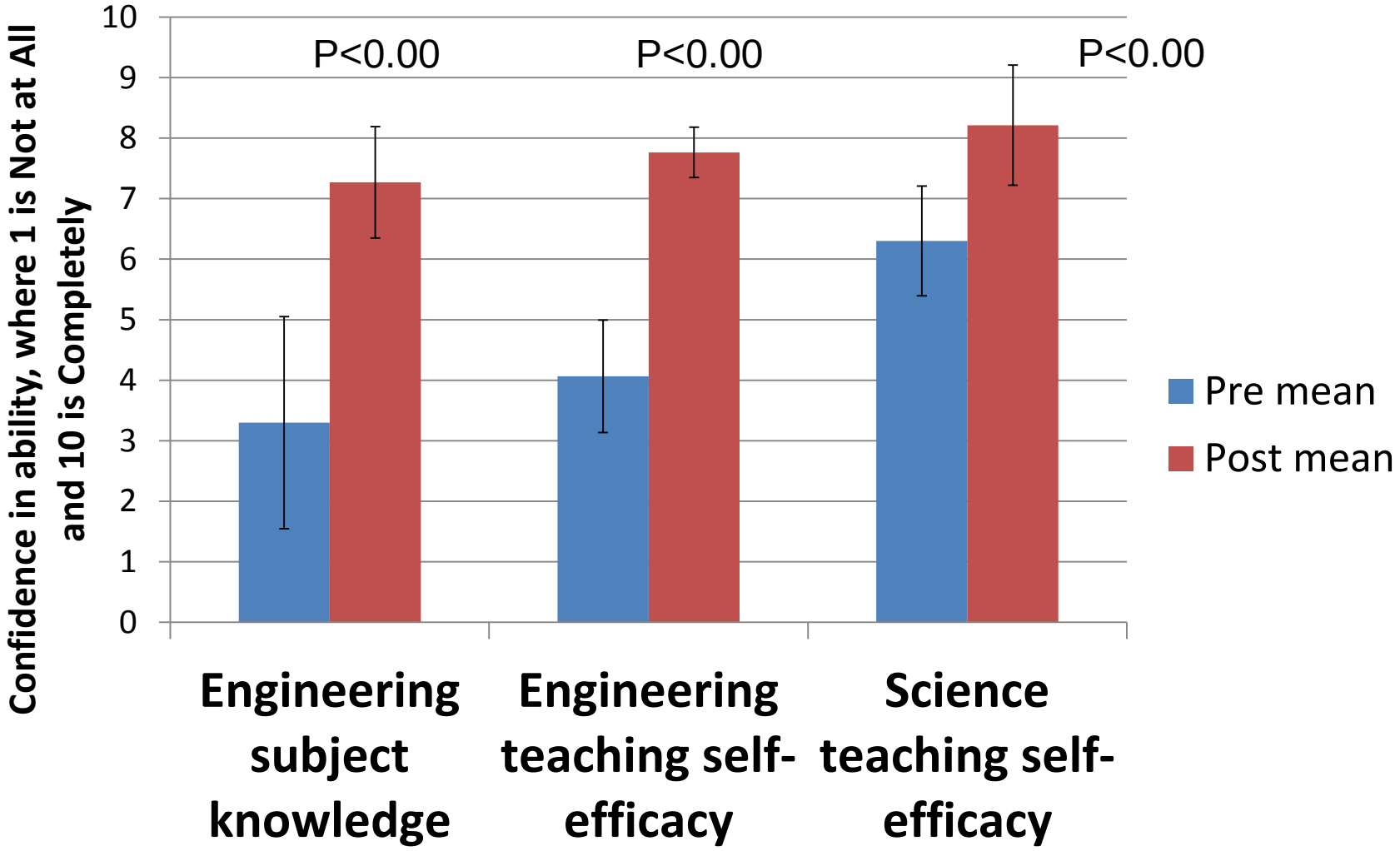
Post responses



Paired Peer Responses



Self-efficacy



Fogg-Rogers, L. A., Edmonds, J. and Lewis, F. (2017) Paired peer learning through engineering education outreach . European Journal of Engineering Education, 42 (1). pp. 75-90. ISSN 0304-3797 Available from: http://eprints.uwe.ac.uk/29111

Inspiring the next generation

Engineer 9: *I've really enjoyed this project because not only did I feel like I was teaching a class, I felt like I was teaching a generation.*

Engineer 6: *I found this project to be tremendously enjoyable and challenging; it forced me to re-evaluate my understanding of mechanical principles so that I could break the subject matter down into lessons that make sense to people.*

Teacher 7: *I am excited and confident that I can effectively give pupils motivation. It is an interesting and engaging way to teach science.*

Children's learning

Engineer 4: *The pupils enjoyed the whole designing and creating process. They also seemed to enjoy the teaching through an activity instead of just talking. I had one pupil say it was their favourite lesson they have done. The teachers were pleased with how much the children enjoyed the activities.*

Teacher 5: *They loved the idea that they were engineers and one child wrote on the poster: "I love science now because it is very fun and not that difficult but my science has improved." Another, "I thought it was epic I'm going to be an engineer. Thanks" and many more lovely comments. They enjoyed the idea of having the engineer there as well which inspired some of them to aspire becoming an engineer.*

Paired peer mentor model

Engineer 10: *Working in a pair was very helpful. There were instances where my engineering knowledge was necessary to speak to the class and equal instances where my partner helped knowing how to speak to the children, control the class etc.*

Teacher 10: *It was useful having an engineer during certain aspects of the teaching lesson, as he was able to explain the scientific terms regarding forces like: lift, weight, mass and thrust.*

Teacher 7: *I found it very interesting and also beneficial to learn and also to work with an expert.*

Engineering and Society

New 15 credit module at UWE for third year engineering students:

This module provides a broad comprehension of the importance of professional development, lifelong learning and the competencies and social responsibilities required for 'engineering citizenship' in order to be a professional engineer.

- Science Communication and Public Engagement. Contemporary societal contexts for engineering.
- Pedagogical theories for teaching Science, Technology, Engineering and Mathematics in primary schools.
- Relating at least two taught modules specific to their own academic programme of study (generally at level 2) to societal contexts appropriate for teachers and pupils, and vice-versa.
- Teamwork, partnership working and professional relations.
- Relationships between academe and practice.
- Project and time management.
- Codes of practice, professional standards and workplace ethics.
- Reflective practice and professional development. The practitioner as methodologist – lifelong learning in choosing, using, evaluating methods, techniques, tools and technologies.
- Identification of career and personal goals to support employability.

https://curiositybristol.net

Curiosity Connections Bristol

The network for inspirational primary STEM education in the Bristol region

About Stories Coming up Curriculum Toolkits Contact

Welcome

Welcome to Curiosity Connections – the network for people inspiring primary STEM learning in the Bristol region. Have a poke around and explore what's on offer...

Stories – be inspired by other

Sign up for our monthly email network newsletter

Register for our next network event

Conclusion

Improving self-efficacy for STEM teaching or public engagement requires:

- Mastery opportunities
- Vicarious experience – watching others who are more experienced than you (role modelling)
- Social persuasion from peer group

To encourage girls into STEM we need to change social norms.