Play-based science learning

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Science from the Start

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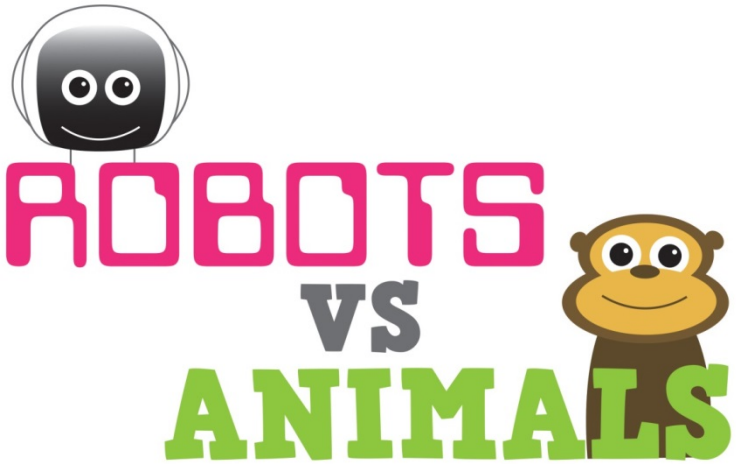
Play-based science learning

The story of Robots vs Animals



http://robotsvsanimals.net

Bristol Robotics Laboratory

Bristol Zoo Gardens
Saving Wildlife Together

UWE BRISTOL
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ROYAL ACADEMY OF ENGINEERING

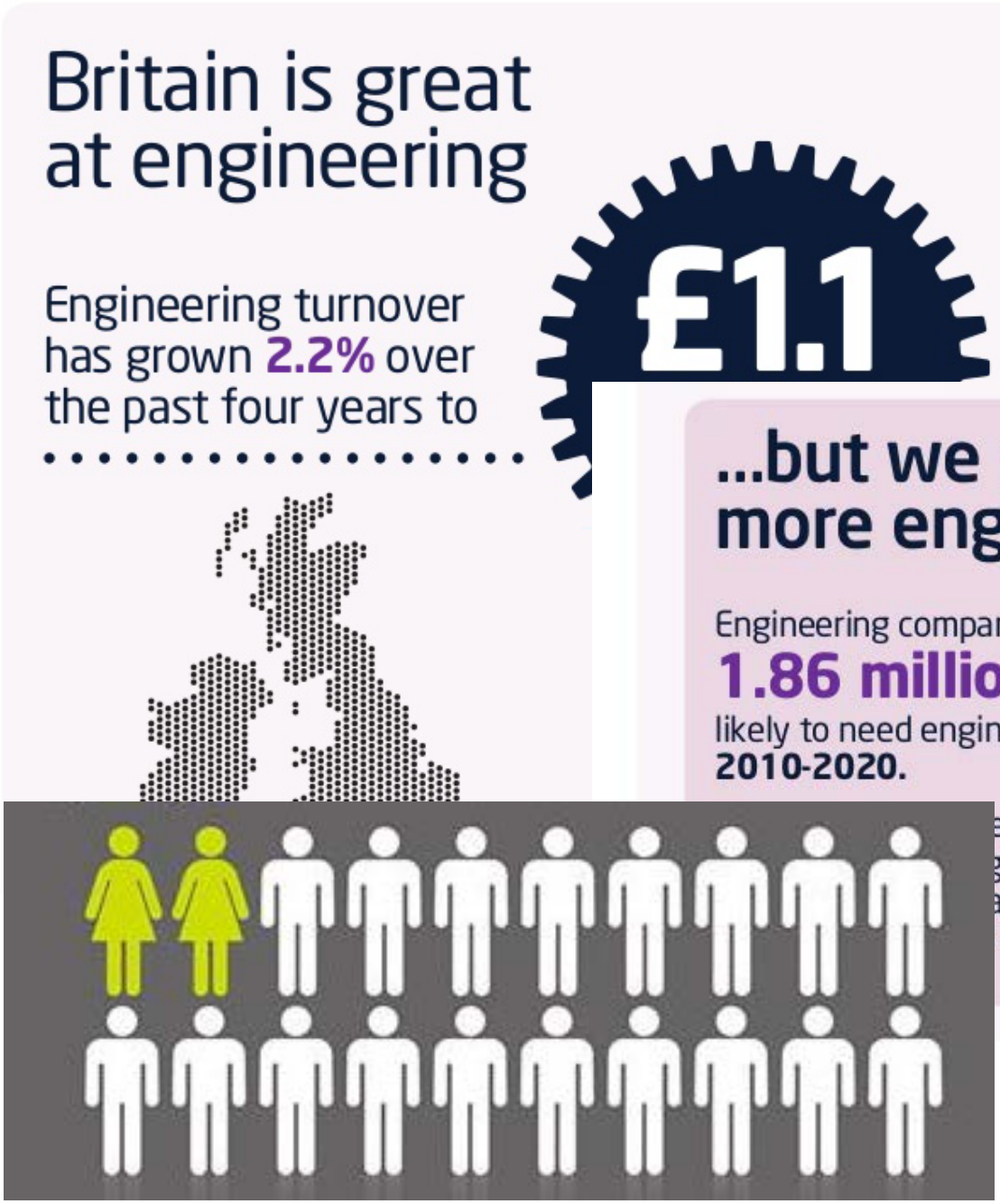
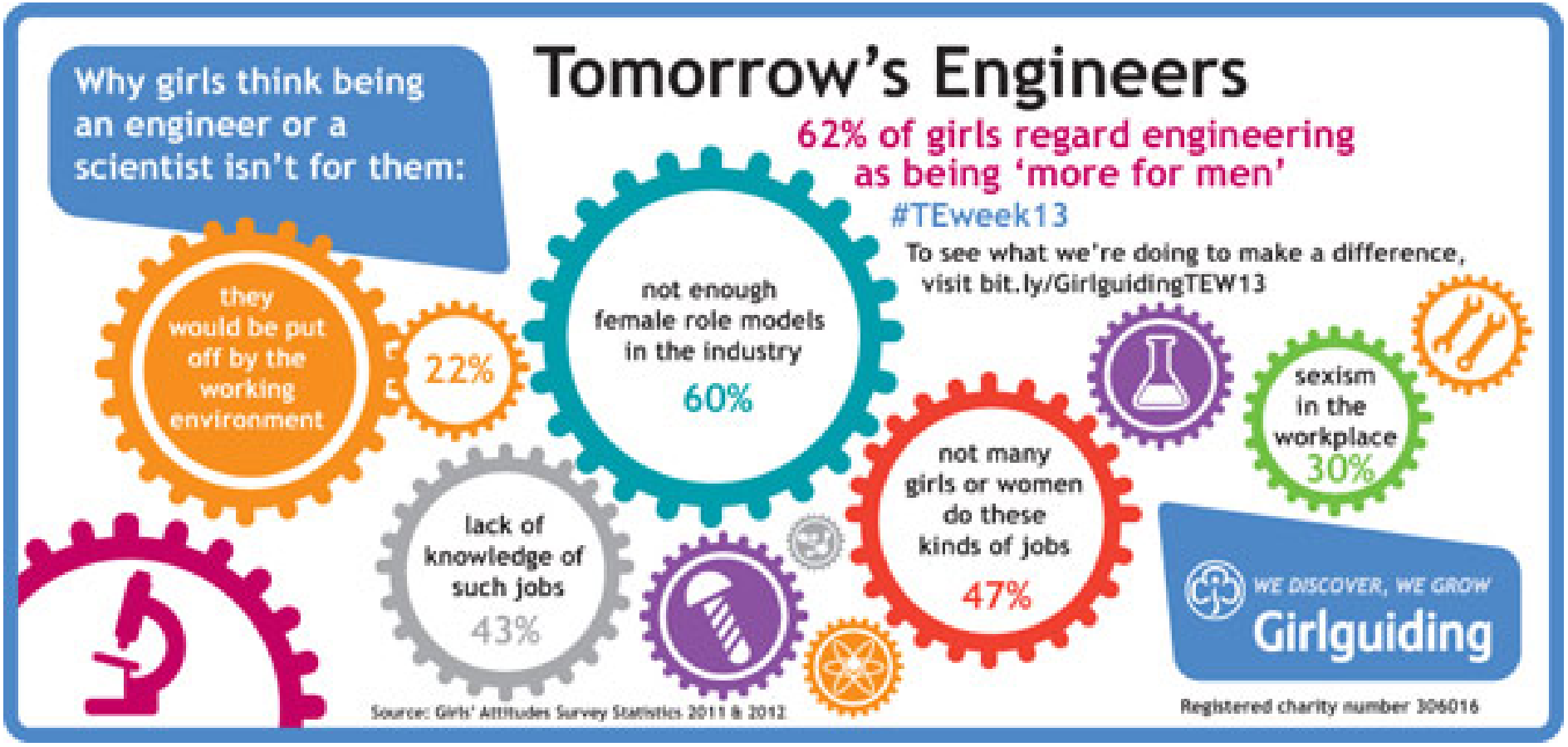


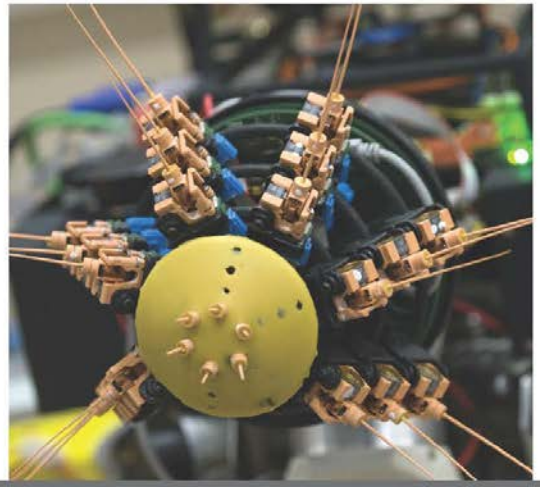
Image:
- Engineering UK
- Eureka Magazine

6-8% of engineers in the UK are female (Engineering UK)


Why girls think being an engineer or a scientist isn't for them:
Tomorrow's Engineers
62% of girls regard engineering as being 'more for men'
#TEweek13
To see what we're doing to make a difference, visit bit.ly/GirlguidingTEW13
they would be put off by the working environment
22%
not enough female role models in the industry
60%
lack of knowledge of such jobs
43%
not many girls or women do these kinds of jobs
47%
sexism in the workplace
30%
Source: Girls' Attitudes Survey Statistics 2011 & 2012
WE DISCOVER, WE GROW
Girlguiding
Registered charity number 306016

ROBOTS VS ANIMALS

Over millennia of evolution, animals have developed senses way beyond human capabilities to adapt to their environment.



Now in the age of high-tech robotic engineering, the science of biomimetics seeks to copy and improve these skills to develop futuristic robots.

But which are better, robots or animals? You decide!

http://robotsvsanimals.net/teaching-materials/

SCU | science communication unit

Project outcomes

Experience for engineers

- 29 engineers
- Training and experience in public engagement

- Informal/Non-formal learning
  - Face-to-face education sessions for 11-14 year olds
  - Face-to-face encounters for families
  - Online materials

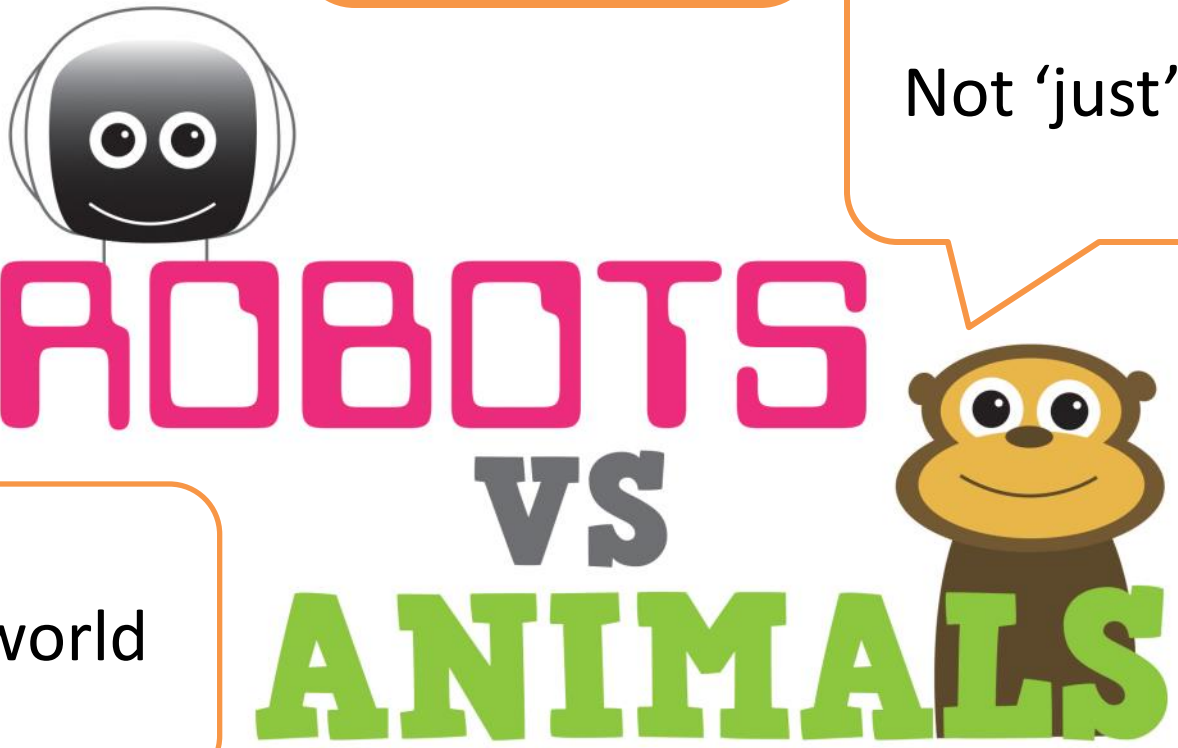
Biomimetic stories

Five stories about the special skills of animals, and the creative engineering design process taken to mimic them.

http://robotsvsanimals.net/2015/07/30/pee-for-the-future/

Role models

Not ‘just’ robots



Their world

“You’re an engineer”

Storytelling training

Emotions

Make people care about your research – surprise or conflict

Characters

Relatable and relevant science and engineering

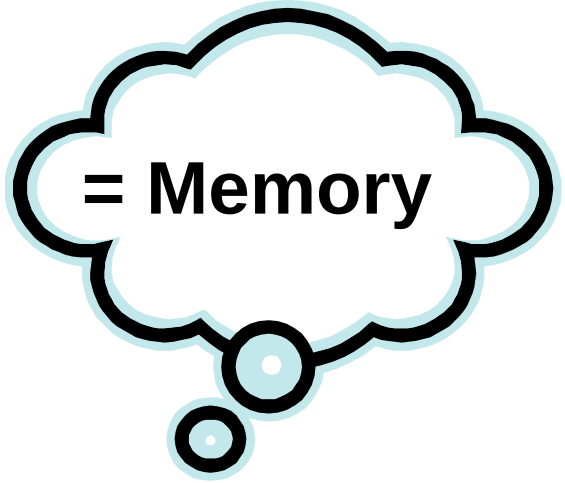
Blending

Provide a bridge between what you know and what they know using a story structure or well-known topic

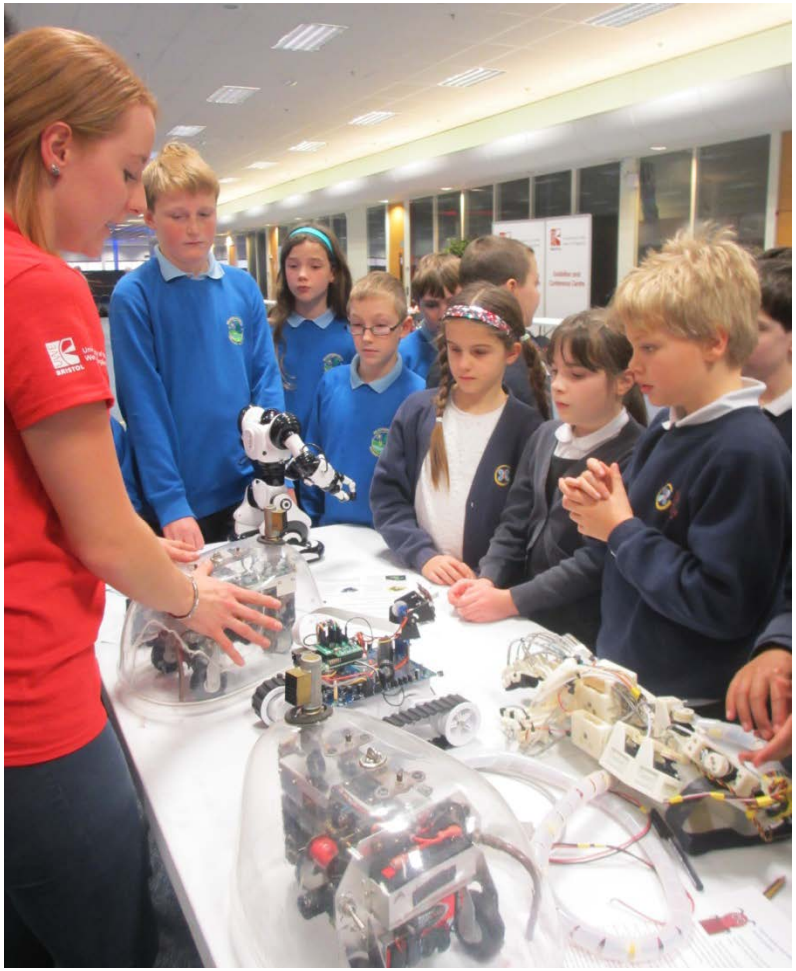
Narrative

Keep it engaging and make ideas ‘sticky’

Stories provide relevance and context to give us meaning



Hands-on



Girls do better when they see female role models (boys don't do worse)

Same applies to BME students: The "Obama effect"

Use historical examples, case studies, photographs, name checks…

Role models in STEM

Improve the impact of your outreach activities

activities should motivate re the audience, as well te them.

rse mix of activity leaders in gy, Engineering and Maths s a proven impact. Female increa they are offered female role models. Male a ations are not reduced by being offered female role models [1]. Female students get better grades when they are exposed to successful female role models or competent female demonstrators [2,3]. The same applies to Black and Minority Ethnic (BME) students, coined as 'the Obama effect' [4].

Selecting more diverse models brings benefits without negati ecting the achievement of and e students [1, 5].

1. **Choose a demographic mix when selecting outreach leaders**
   The more diversity (gender, ethnicities, physical abilities or class backgrounds) you put in the room impacts how many students are seeing 'their future selves' as STEM participants and higher education achievers.

2. **Think about your case studies**
   Where can historical examples or real-life case studies include underrepresented groups? It mig seem small but giving more role models h a difference.

1. Lockwood, P. (2006). "Someone like me can be successful": Do college students need same-g models? *Psychology of Women Quarterly*, 30, 36–46.
2. Marx, D. M., & Roman, J. S. (2002). Female Role Models: Protecting Women's Math Test Perfo *Personality and Social Psychology Bulletin*, 28(9), 1183–1193.
3. Mcintyre, R. B., Paulson, M., & Lord, C. G. (2003). Alleviating womens mathematics stereotype through salience of group achievements. *Journal of Experimental Social Psychology*, 39, 83–90
4. Marx, D. M., Ko, S. J., & Friedman, R. A. (2009). The "Obama Effect": How a salient role mod race-based performance differences. *Journal of Experimental Social Psychology*, 45(4), 953–95
5. Lockwood, P., & Kunda, Z. (1997). Superstars and me: Predicting the impact of role models on t *Journal of Personality and Social Psychology*, 73(1), 91–103.

Reflecting the demographics of the audience when choosing outreach leaders is recommended as best practice by the Royal Academy of Engineering, the Engineering Professors' Council, the EU Commission and Women In Science and Engineering among others. Produced by the Science Communication Unit at UWE. For more information contact corra.boushel@uwe.ac.uk.

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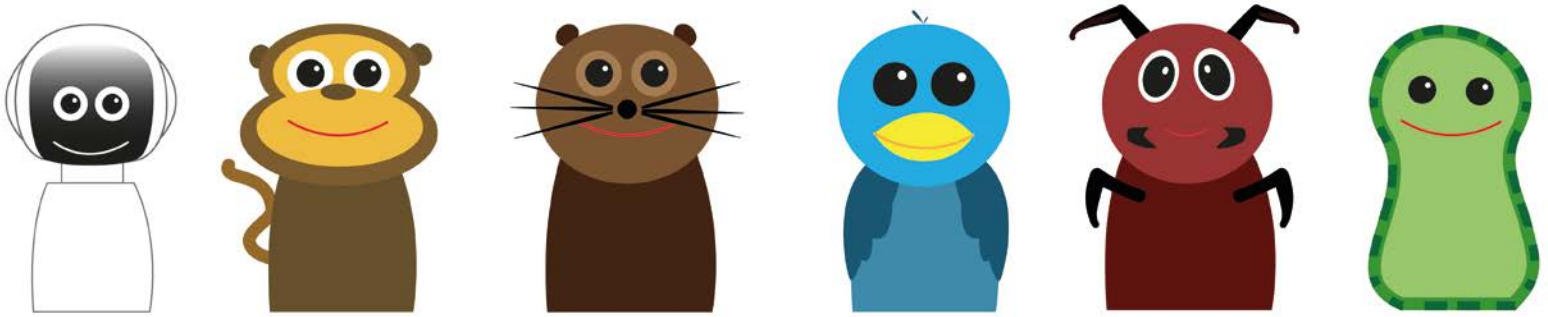
Design your own biomimetic robot:

1. What problem does your robot solve?

2. What animal or animals have you been inspired by?

3. What would your robot be made of? Why?

4. What problems might you need to overcome to improve the design?



Role models in STEM

Improve the impact of your outreach activities

Outreach activities should motivate and inspire the audience, as well as educate them.

Including a diverse mix of activity leaders in Science, Technology, Engineering and Maths (STEM) outreach has a proven impact. Female aspirations increase if they are offered female role models. Male aspirations are not reduced by being offered female role models [1]. Female students get better grades when they are exposed to successful female role models or competent female demonstrators [2,3]. The same applies to Black and Minority Ethnic (BME) students, coined as 'the Obama effect' [4].

Selecting more diverse role models brings benefits without negatively affecting the achievement of white and/or male students [1, 5].

1. **Choose a demographic mix when selecting outreach leaders**
   The more diversity (gender, ethnicities, physical abilities or class backgrounds) you put in the room impacts how many students are seeing 'their future selves' as STEM participants and higher education achievers.

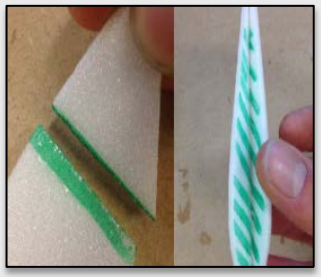
UWE BOXED

Robots vs Animals

Wind turbines from recycled materials

EuRathlon (Robotics)

Geometry in street + medieval art



Building gliders

MFC – electricity from dirty water

Coastal erosion (Geography)

References

Cunningham, C. M., Lachapelle, C. P., & Hertel, J. (2012). *Research and evaluation results for the Engineering is Elementary project: An executive summary of the first eight years.* Boston, MA: Museum of Science

Fogg-Rogers, L. A., Sardo, M. and Boushel, C. (2015) *Robots vs animals: Learning from the ingenuity of nature. Final summary report.* Project Report. Royal Academy of Engineering. Available from: http://eprints.uwe.ac.uk/26062

Haven, K. (2007). *Story Proof: The science behind the startling power of story.* Libraries Unlimited.