

Principles for building diversity through inclusive outreach: an exploration through case studies

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By the end of this session, you will have

- Exemplified and evaluated four approaches to more inclusive STEM outreach
- Considered the principles behind the implementation of intentionally inclusive outreach
- Considered some of the barriers that may be encountered in the implementation of intentionally inclusive outreach

Anticipated timings:

- Description of four case studies 50 minutes
- Break 10 minutes
- Discussion in groups 20 minutes
- Plenary 10 minutes

What do we mean by inclusion?

- Inclusive design aims to remove the barriers that create undue effort and separation. It enables everyone to participate equally, confidently and independently in everyday activities. (Design Council website)



Are there any learners who can't benefit from STEM?

- **No.** *'....there was no evidence at all to suggest science, presented in a suitably modified format, is unsuitable for any learner'. (Essex, 2020: 554)*
- Benefits include skills development (following instructions, rehearsing communication skills, numeracy, thinking skills, social skills) (Essex, 2018; Essex, 2020)
- Increased awareness of employment and leisure choices
- The status of science is seen as a huge benefit IF it's the right sort of science (Essex, 2018)

Case study 1: A very special school



- Who is under-represented? *Pupils with PMLD/CASN*
- Why are they under-represented? *Exemption from National Curriculum expectations; lack of staff expertise/ confidence; mistaken belief that specialist resources were necessary*
- What do they hope to get from participation? *Enjoyment, transferable skills*
- What did I do? *Observed, waited to be allowed to participate, gave curricular advice, provided practical resources, observed*
- How well did the initiative work? *Very well! Higher attainment outcomes, uncovered unrecognised capacities in staff and pupils, provided new ways of assessing pupil capacity. Now bidding to the Royal Society for further funding*



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Outreach Fund



Inclusion requires identification and mitigation of potential barriers. Here they included:

- Science and maths are hard: abstract ideas, technical language, multiple concepts needed at once, dependence on prior understanding
- Some participants may have limited verbal capacity: they may need items coding symbolically or representing photographically . They can demonstrate learning through behaviours (Brooke and Solomon, 2001; Essex, 2020).
- Some participants have shorter attention spans than you might expect; break activities down into smaller 'chunks'. (Essex, 2021).
- Poor memory and reduced processing capacity cause problems. (Essex, 2021). Keep instructions as brief as possible, no more than three things at a time, please.
- Participants can do higher order thinking (application, evaluation, synthesis of ideas) but not reliably, be prepared to 'scaffold' or break down ideas into smaller bits
- Many participants don't investigate in the way you expect, they work very empirically (Essex, 2020)
- Some participants find the unfamiliarity overwhelming; have a breakout room, or a quiet corner (with Molybmod or Lego), or allow camera and mic to be off.
- Some participants may have problems with manipulating apparatus; unbreakable where possible, low hazard and small amounts are recommended (Essex, 2021)
- Social interactions cause a high level of concern, allow time to resolve these (Essex, 2021, in press). But many love meeting a 'real scientist' & rate it as the best thing about the day
- Most staff/ family working with these young people are not scientists and are not confident about doing science (Essex, 2020). Providing a teacher's sheet may help!



Case study 2

Who wants to be a superhero?

How do role models in outreach affect attitudes to STEM Careers

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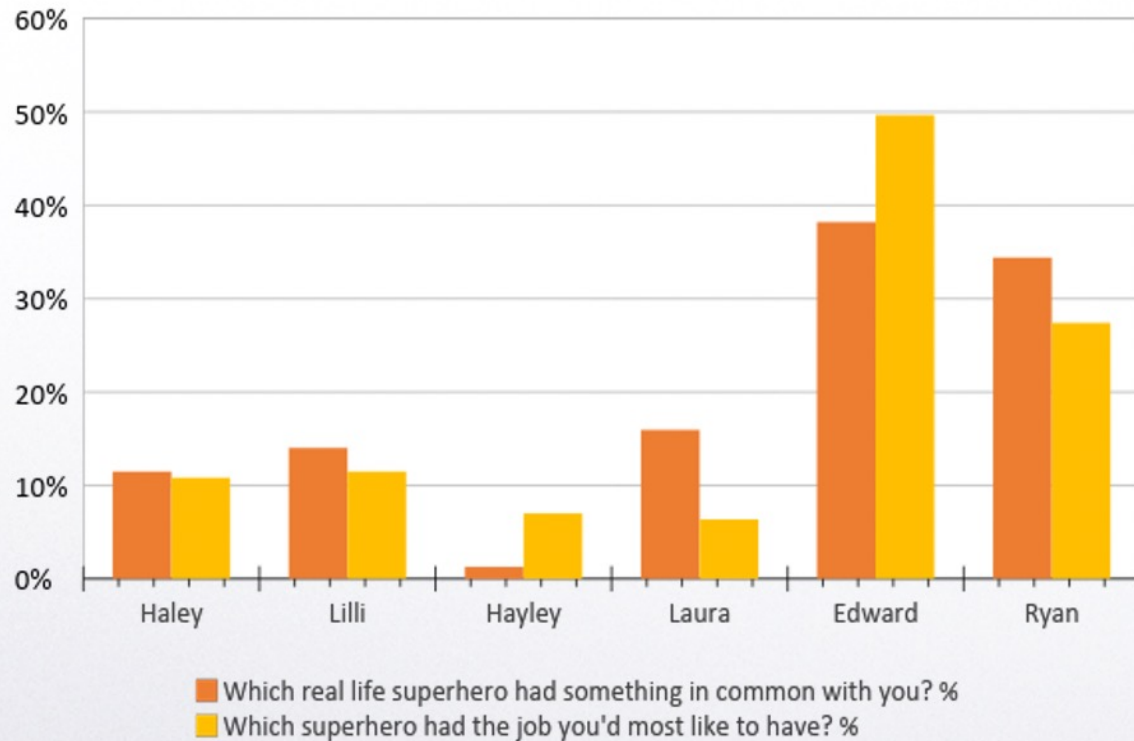
What was done

- Primary school careers in STEM event (show)
- Year 5-6 (age 9-11)
- Six role models - four female
- Pre and post test
- Word association
- Which role models they have things in common with/would like job

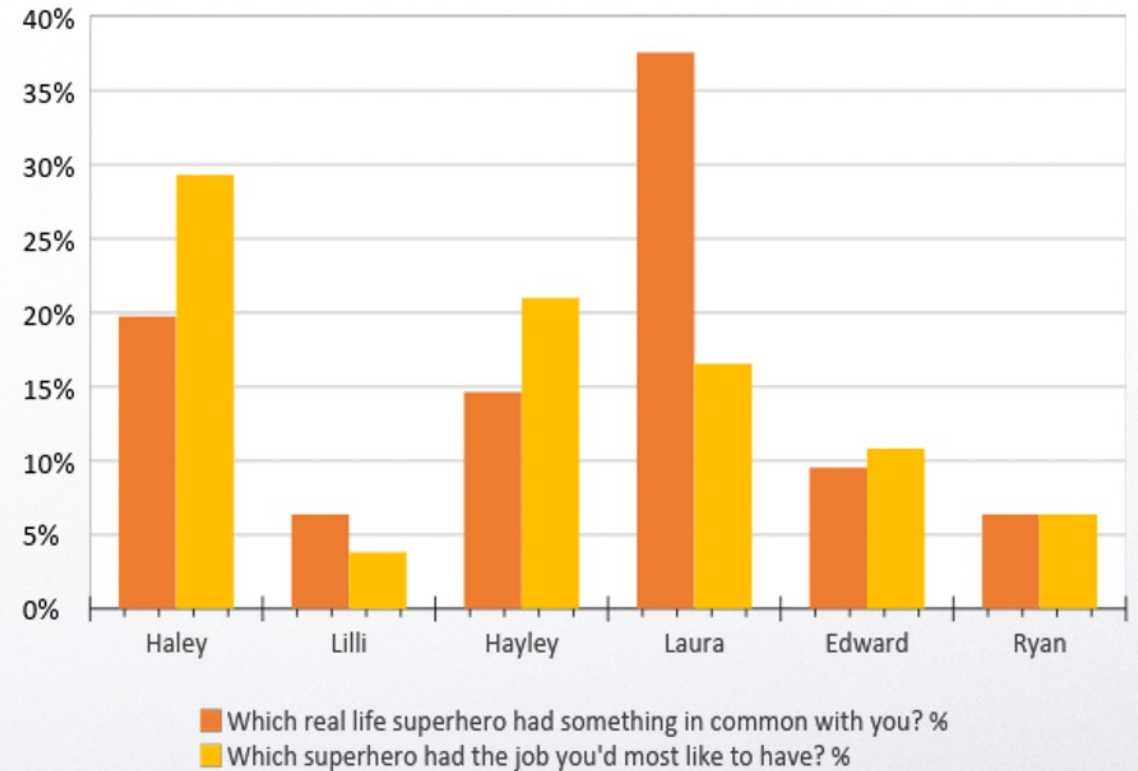
Name	Profession	Superpower
Haley	Astrophysicist	X-ray vision
Lilli	Civil Engineer	Strength
Hayley	Medical Engineer	Saving lives
Laura	Environmental Scientist	Saving the planet
Edward	Electronic Engineer	Lasers
Ryan	Aeronautical Engineer	Flight

Key findings

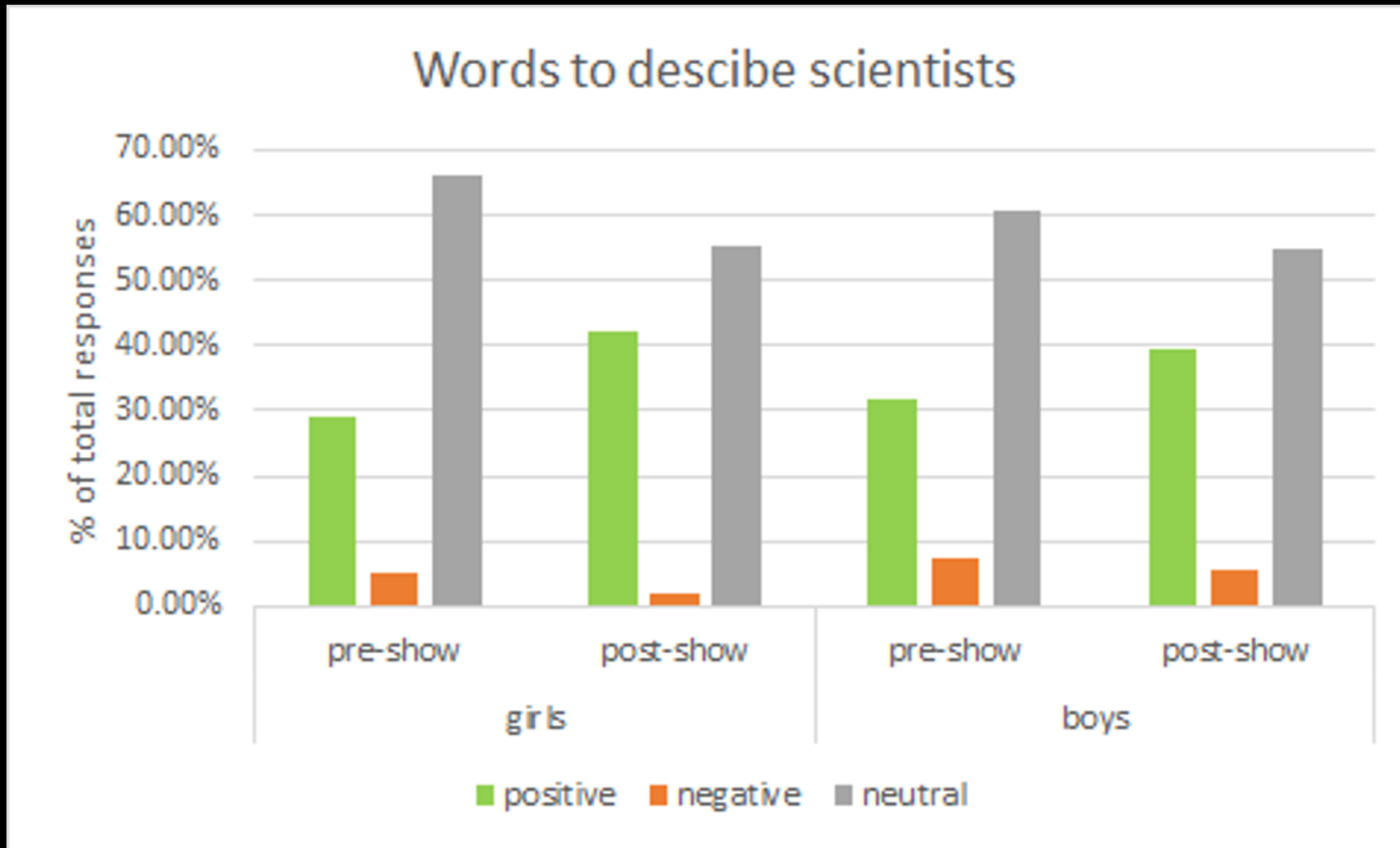
Boys' views on the role models in the show



Girls' views on the role models in the show



Key findings



- All more career positive after show but increase bigger for girls
- More positive words after the show and less negative
- Danger is off-putting
- Those who know a scientist or engineer more likely to want the career

Case study 3

Reaching more diverse schools

THE VISION

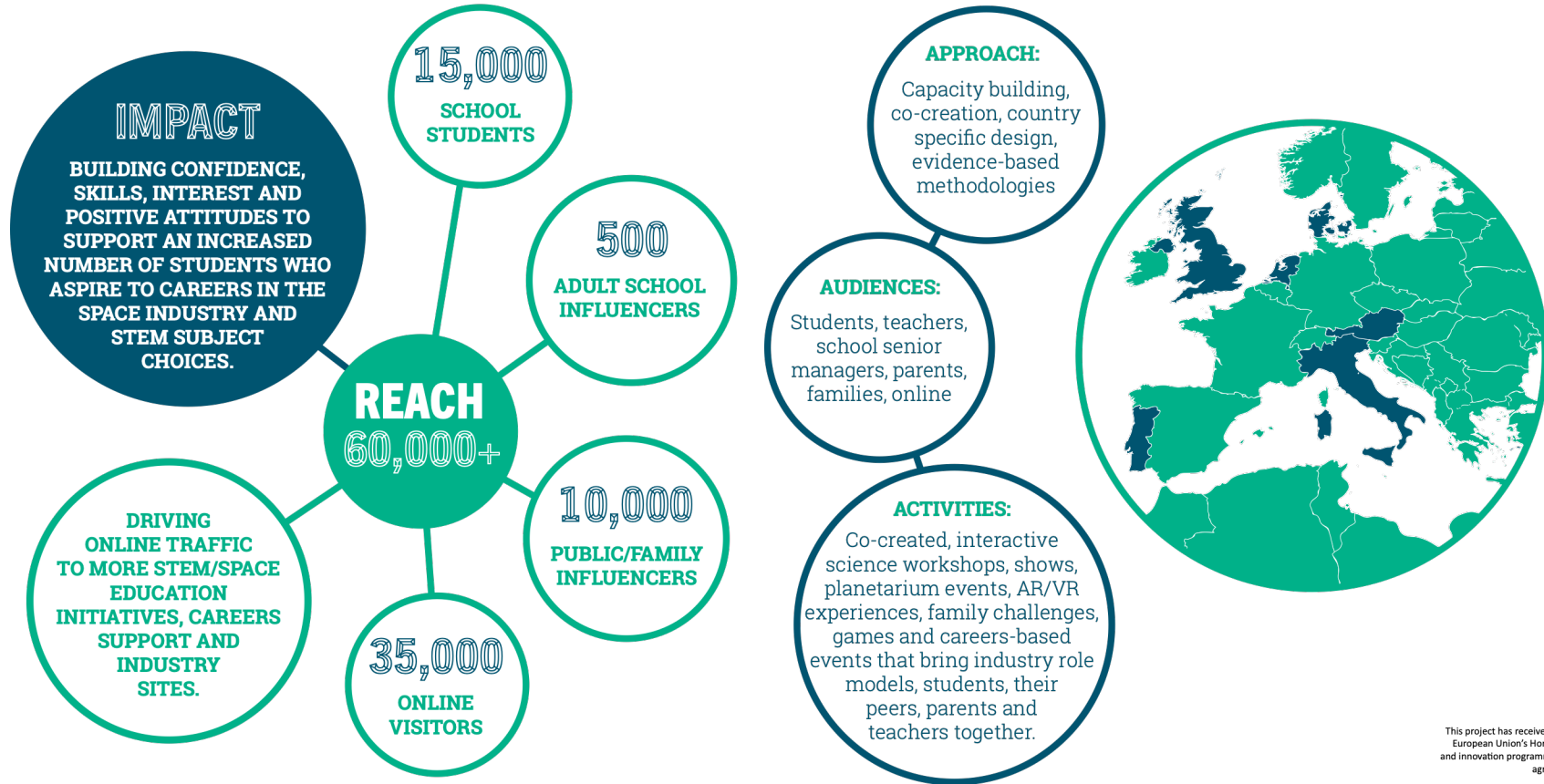
A society which enables and empowers **all young people**, regardless of gender, ethnicity, disability and socio-economic inequality to consider a career related to space science as a **relevant, attainable** and **exciting aspiration for their future**.

THE PROBLEM

The space industry in Europe is strong and growing. Citizens agree that science and technology provide benefits for job opportunities, innovation and for society. But Europe is facing a huge STEM and Space skills deficit, and school students who enjoy science, do not consider it a realistic and aspirational career for their own future.

THE SOLUTION

To take a whole school and whole family approach, to support a shift in thinking for students and their key influencers. To raise awareness of the diversity of space careers and to highlight the personal relevance, the value for everyone and real employment potential of the space industry for all.



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RESULTS BY COUNTRY

POSITIVE

Accessibility of space science.
Desire to learn more.

Accessibility of space science

Interest in space science.
Space science as global industry

Interest in space science

Accessibility of space science



DENMARK



ENGLAND



ITALY



PORTUGAL



WALES

Pursuing a career in space science.

Pursuing a career in space science

Diversity of space science industry
Pursuing a career in space science

Possible selves in space science
Pursuing a career in space science

Pursuing a career in space science

NEGATIVE

Case study4: Sustainable STEM, sustainable communities

- Who is under-represented? Those living on poverty, those with learning disabilities **and** colleagues under-represented on ESPRC bids (LGBTQi, people of colour, women)
- Why are they under-represented? Pupils, for reasons described previously. Staff because of lack of confidence, lack of contacts, lack of infrastructure
- What do they hope to get from participation? Experience of being part of a successful bid writing team; experience of communicating with an unfamiliar audience.
- What did I do? Invited 9 academics in STEM subjects to contribute a teaching/ activity session to a five day summer school for learners with ASN, in an area of high deprivation.
- How well did the initiative work? Anecdotal evidence is very positive from both groups. Evaluation and write up yet to be undertaken.

Does 'hard to reach' really mean 'we don't know how to engage'?

- Identify barriers: concern about being ridiculed, inability to provide a packed lunch, need for a place to undertake personal care during the day (Essex, 2018)
- Think about the opportunities inherent in their situation: few if any alternative invitations, unmet needs for involvement, status (Essex, 2018)
- Be aware of 'hidden signals' e.g. what you call the event. How can potential participants know that you are doing more than merely being legally compliant? What do your means of recruitment say about the event?
- Think about what aspects of your message are core and what can be compromised? e.g. empirical evidence, technical vocabulary, high levels of numeracy?



Group discussions

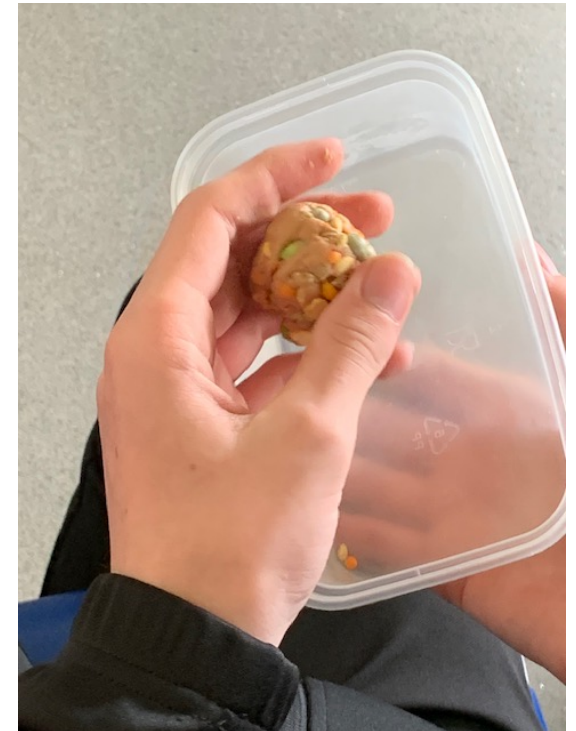
- In your group, discuss which under-served audiences you would like to reach.
- Think about why, what barriers you perceive, what mechanisms could you use to make it happen, what experience you would like to offer participants.
- How different is the proposed outreach from your usual outreach practices?
- Are there any other questions to pose about the proposed inclusive provision?
- How might you evaluate the impact of your provision?
- What educational or other values underpin your proposed provision?

Plenary and overarching considerations



The principles of inclusion are universal

- Learner-centred, not teacher-focused
- Draws on learners' aptitudes, interest, strengths
- Generally constructivist, allowing for diverse approaches and solutions
- Builds flexibility in from the start of the planning process
- Does not see difference as a problem but an asset
- High expectations coupled with commensurate support, if needed/ wanted



Limitations and opportunities

- Diverse notions of inclusion
- When outreach blends into public engagement, different conceptualisations
- Lack of staff confidence with an unfamiliar audience
- Access to target audience, facilitating enrolment
- Funding, may need/ be able to get different sources
- Will it 'count' as impact for institution?
- Limits of protected characteristics approaches to inclusion, inclusion is NOT simply ticking a checklist!

Benefits to STEM communicators of working inclusively

- You are likely to get uptake because there may be less competition in this sector of the market **and** the gatekeepers (parents, teachers) are reassured by an explicitly inclusive approach.
- You don't really know your subject deeply until you can make it accessible without loss of significance!
- A fantastic way to extend the impact & reach of your work
- You will be hugely appreciated.
- The creativity and laterality of diverse participants; many volunteer to come back year after year
- Opens up new collaborations (and, possibly, new funding streams)
- Opens your eyes to new ways of learning, even if you're a highly experienced public engagement practitioner (Brooke and Solomon, 2001)

References

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