

A beginner's guide to evidencing the impact of outreach

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Emma and Wendy are academics with expertise in educational research, informal learning and science communication, although they have different subject backgrounds in neuroscience and physics. Both authors recognise that this is a challenging time for the Higher Education sector. They are concerned that important work in outreach could easily slip off the academic agenda unless it is carefully considered, recognised and valued. This is why meaningfully measuring the impact of outreach is important, so that its value (which is often life changing) can be clearly captured and communicated. In this short article, we will consider why outreach is undertaken and how you can meaningfully measure the impact of outreach activities. We understand that different readers may have different starting points, varying levels of expertise and various levels of access to resources, so we will guide you through different outreach approaches that acknowledge these differences.

Our beginner's guide to evidencing the impact of outreach is designed to be a helpful and useful resource that empowers and encourages you to play your part and do what you can in the wonderful world of outreach.

What do we mean by outreach?

Traditional examples of outreach usually involve academics - or those with specialist knowledge - disseminating that knowledge to more diverse and non-specialist audiences. This might be through school assemblies, public talks, or online videos for example. 'Outreach' can sometimes be perceived as a 'deficit model' which places academic knowledge on a pedestal that should be disseminated to the masses for their "own good". But this very one-directional view does not sum up the huge range of motivations, methods and models used across the outreach world and the wider benefits which outreach can bring to society. In our view, outreach is more about reaching *further* with your message—reaching new and different audiences, and working with people, including people who may not initially think science is for them. To know that you are achieving this you need to be clear *who* you are trying to reach. Once you know this, how you measure the impact should become clearer - although the rigour of the evaluation and impact you are able to measure will depend on your time, resource and capacity.

Motivations for outreach... Why?

Very often, we are so caught up in *what* we are doing that we rarely stop to reflect on *why* we are doing it. We want to

consider the varied and important reasons that people have for sharing their academic knowledge and skills through outreach. While specific motivations for outreach will vary, they could broadly include personal, organisational or societal reasons (Figure 1).

Personal motivations for outreach may be shaped by lived experiences, although they could also include reconnecting with individual core purpose and values and reminding yourself why you love your subject and what a joy and privilege it is to be able to help people understand and learn complex topics. In considering our personal outreach motivations, it is also important to recognise our own privileges, how they have shaped us and the opportunities that we have had. There may also be personal motivations for undertaking outreach work in terms of transferable skills development opportunities. We know that many Science, Technology, Engineering and Mathematics (STEM) graduates will move away from pure STEM careers and continue into other disciplines (Smith and White, 2019); therefore, broad transferable skills such as communication, presentation and teaching, which are often developed through outreach (Andrews et al., 2005), can be fundamental to future careers. It is also important to recognise that outreach activities can themselves be fun and enjoyable (as well as incredibly hard work); scientists describe a general desire to contribute to society as well as enjoying outreach experiences as strong motivating factors (Andrews et al., 2005). Furthermore, outreach

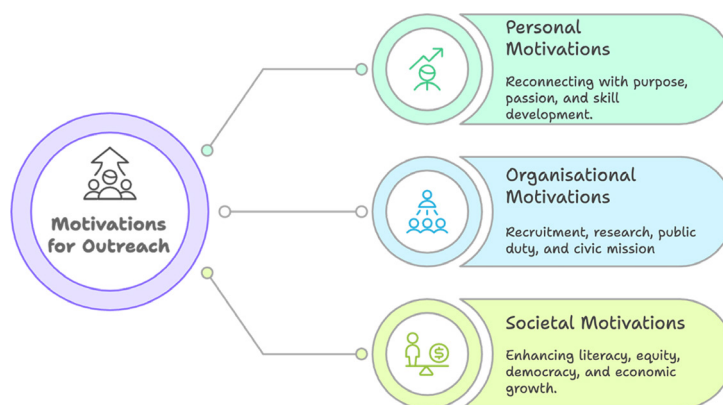


Figure 1. Schematic illustrating different motivations for undertaking outreach activities. Motivations for completing outreach activities can broadly be split into three categories: personal, organisational and societal. Relevant illustrative examples are given for each category. Original image produced using Napkin.ai.

can provide an opportunity for creativity and innovation, skills that may be traditionally perceived as contrasting with academic and scientific disciplines (Morgan et al., 2023).

Organisational motivations are important considerations, as many employers and job roles/descriptions may require or actively encourage outreach; this may even form part of their organisational social responsibility objectives, public duty or larger contribution to society. Outreach initiatives have been shown to enhance student recruitment in terms of overall number and improving the diversity of people who are recruited (Gumaelius et al., 2016). Furthermore, outreach can also be used as a means of increasing recruitment and participation in research studies. This is particularly important to ensure that research is fully reflective of the communities that it is designed to help.

Finally, there are significant and wide-ranging societal motivations for conducting meaningful scientific outreach work. Examples may include enhancing global scientific literacy, tackling misinformation and promoting critical thinking. Enhancing equity in STEM subjects is also important, as we know that more diverse groups of people make better decisions. Furthermore, it has been shown that the more STEM graduates there are in a country, the larger its gross domestic product growth rate (Podobnik et al., 2020).

Fundamental to evidencing the impact of outreach is the question of “why?”. So, we invite you to (non-judgementally) reflect on your “why”. What are your motivations for outreach? Are they personal, organisational or societal? Maybe they are a mixture of all three. There are no wrong answers, but considering your “why” is important, as it can be factored into the measures you use to evaluate the impact of your outreach work. Now that you have your *why*, let us think about *what* outreach is.

Where to start...

Quantitative and demographic measures

The easiest way to get started with measuring the impact of outreach is to monitor with some basic quantitative data. For example, if you are running a summer school for local school children to come into your department, it would be helpful to be able to report some demographic data about the people who came to the event (providing you comply with the relevant data protection laws) —how many people there were, their ages, genders, etc. If people are booking to come to the event, there is an opportunity to capture this data when they register, but for drop-in events (e.g., if you are running a stand in a festival or shopping centre) you may need to consider more creative and agile ways to do this. To measure the overall number of people who took part in an activity, you can give them stickers when they complete the activity and then count how many stickers you gave out or you could use mechanical counters. You could also consider asking people to place a token or counter into an interactive bucket, which evaluates the event or poses a question about the activity to the audience.

The data you are seeking to collect should strongly link to the purpose of your outreach work and will depend on your “why”. For example, if your aim is to reach under-represented schools, you will need to evidence this with the appropriate data. Building from basic numerical data, you could collect broad demographic information to demonstrate who attended. If schools are part of your audience, you can use publicly available demographic data about the pupil representation of the school. For example, most schools publish their free school meals percentages, which give an indication of the populations they serve, or you can look at POLAR data, which shows you what proportion of students from that school go on to higher education.

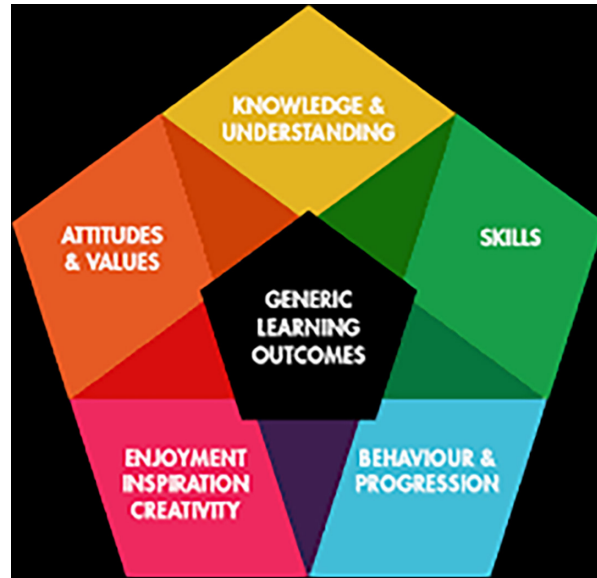


Figure 2. Generic learning outcomes illustration. An illustration of the five “generic learning outcomes” as developed by the informal and museum learning sector originally developed by Hooper-Greenhill et al., 2003. Graphic taken from: https://www.publicengagement.ac.uk/sites/default/files/2023-08/generic_learning_outcomes_checklist.pdf

If you want to show the general geographical reach of attendees, you could have data collection tools such as a map where people stick a dot on showing where, or even a target-based graphic where they show how much they learnt (or how much they enjoyed it) by how close to the bullseye they stick their dot. These physical methods of data collection have an element of interactivity and can be more fun, interactive and engaging than traditional data collection methods such as surveys or polls and therefore people may be more likely to complete them, which will give you richer data. Thinking carefully and creatively about your data collection methods and embedding them within activities can enhance and improve outreach activities, leading to mutually beneficial outcomes.

Frameworks for evidencing the impact of outreach

Generic Learning Outcomes

You could also structure the evaluation measures of your outreach activity using existing questions that are designed to measure aspects of impact. For example, the Generic Learning Outcomes (GLO) framework (Hooper-Greenhill et al., 2003) was developed in partnership with informal education experts in the museums sector and it recognises that knowledge and enjoyment are not the only useful outcomes to measure for outreach activities (Figure 2).

The GLO framework has various existing question banks you can use to prevent you from having to create and validate your own surveys, saving time and resources. Using established metrics can also allow you to benchmark

your events against national averages or compare a range of your own outreach events to show different impacts. Questions asked might be as simple as “Would you come to another event like this in the future?” From the categories shown in Figure 2, this would relate to the GLO of “activity, behaviour and progression”. You may not have the resource or capacity to cross-reference that the attendee does attend another event in the future, but showing that the intent exists is an indicator that the audience has felt comfortable and empowered in the session and would do it again.

Science capital

One of the largest studies of young people’s attitudes to STEM is the [ASPIRES study](#), which has been collecting data since 2009 from over 47,000 students to assess how views on STEM change between the ages of 10 and 22. It gives us an incredibly rich resource on what young people think, and the study has been tracking students long enough to see what aspects might be most influential on their career choices. This research has led to a new perspective on how we measure impact using something called “Science Capital” (Figure 3). Science Capital is defined as the sum of all the science-related knowledge, attitudes, experiences and resources that an individual builds during their lifetime. It includes family and friends who might work in STEM, out-of-school activities, engaging with science as a hobby or consuming science media. The ASPIRES study showed that by far the strongest indicator of whether a young person feels STEM is for them or not comes down to their level of “Science Capital”. Beyond being just a measure of the connectedness to STEM, this model

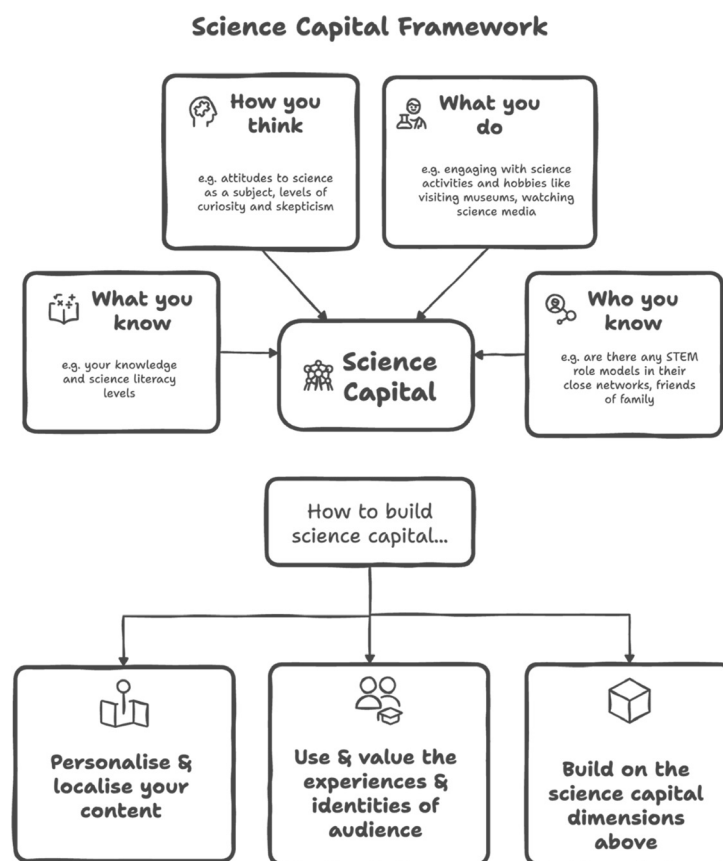


Figure 3. Science Capital schematic. An illustration showing the elements that make up the level of science capital of an individual as well as the techniques that can be used to build science capital with audiences.

has evolved to advise how we can embed approaches in outreach that will help to build science capital for our audiences. By using this science capital teaching approach you can build the level of science capital in your audience through outreach activities (Godec, S., King, H. & Archer, L. 2017). By ensuring that you develop activities that are relevant and adapted to your audience by working with them to understand their unique needs rather than going in with your own static or pre-defined examples.

Self-identity and stereotypes

Another significant culture change highlighted as part of the ASPIRES study is the concept of identity in science. Despite high levels of agreement from students (around 70%) that science is relevant, useful and interesting, a dramatically lower percentage (around 10%) said they would aspire to be a scientist (Archer et al., 2010). This has led to a changed focus in some outreach activities to ensure the focus is on the diverse types of people who work in STEM and not only on the STEM content itself. Focusing on role models can help to dispel the very sticky issue of science being perceived as something that is inaccessible and just for the high achievers or geniuses,

but beware that only showcasing “superstar” scientists can be counterproductive. The importance of discussing barriers and failures in real STEM careers and building the feeling that someone “like me” works in STEM is a vital part of what we need to include within our outreach work. To evidence this approach, we can utilise qualitative data where audiences choose words that describe a scientist before and after an intervention. Research from Northumbria University has shown that a project in schools (called “STEM Person of the Week”) was effective at reducing stereotypes in science and helped primary school students feel more confident that they could also work in STEM (Shimwell et al., 2021). So, if empowering less confident and under-represented students into STEM is one of your “whys”, it could be worth considering how role models and stories of more diverse scientists can help in your outreach work. If you identify as someone from a majority group you can still help to improve diversity in STEM by reflecting on whether your content will help to shift existing stereotypes or unintentionally reinforce them. Ask yourself if your outreach materials and activities reflect wider society, take time to carefully reflect and be an ally to help create change.

Final thoughts...

At a time where outreach has never been more important, we recognise the challenges and tensions that exist across the sector; there is limited time, resource and energy to undertake this vital outreach work. Effective longitudinal studies and following up on audiences in a rigorous way takes expertise from the social sciences and psychology fields and this often beyond the skillset or expertise of the people delivering the outreach. Inter-disciplinary collaborations may help to improve meaningful and robust evaluations of outreach activities. Funders also need to be

aware of the true costs associated with collecting evidence in a credible and meaningful way to support this, will require long term and sustainable investment.

So, the next time you are undertaking outreach work, we challenge you to carefully consider from the outset, how you can evidence the impact that you are having on your audiences. And always remember, this is not an individual endeavour, outreach work is part of a bigger ecosystem; a community of passionate and inspiring people who are helping to change the world for the better, and in order to do that, the impact of outreach must be evidenced. ■

Further Reading

Academic journals:

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- Archer, L., DeWitt, J., Osborne, J., Dillon, J., Willis, B. and Wong, B. (2010), "Doing" science versus "being" a scientist: Examining 10/11-year-old schoolchildren's constructions of science through the lens of identity. *Science Education*, 94: 617-639. <https://doi.org/10.1002/sce.20399>
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- Gumaelius, L., Almqvist, M., Árnadóttir, A., Axelsson, A., Conejero, J.A., García-Sabater, J.P., Klitgaard, L., Kozma, C., Maheut, J., Marin-Garcia, J. and Mickos, H., 2016. Outreach initiatives operated by universities for increasing interest in science and technology. *European Journal of Engineering Education*, 41(6), pp.589-622.
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- Smith, E. and White, P., 2019. Where do all the STEM graduates go? Higher education, the labour market and career trajectories in the UK. *Journal of Science Education and Technology*, 28(1), pp.26-40.

Web references:

- <https://www.officeforstudents.org.uk/data-and-analysis/young-participation-by-area/about-polar-and-adult-he/>
- https://www.publicengagement.ac.uk/sites/default/files/2023-08/generic_learning_outcomes_checklist.pdf
- <https://www.ucl.ac.uk/ioe/departments-and-centres/education-practice-and-society/research/aspires-research>

Links to further reading / references

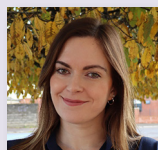
- UKRI – Improving the evaluation of youth engagement with STEM
<https://www.ukri.org/wp-content/uploads/2022/11/UKRI-221122-EvaluatingYouthEngagementWithSTEM.pdf>
- STFC framework for evaluation 2024-2028
<https://www.ukri.org/publications/stfc-public-engagement-evaluation-framework/>

(Continued)

Further Reading (Continued)

- NCCPE (National Co-ordinating Centre for Public Engagement) report on using outreach as part of impact cases (in physical sciences and engineering)
<https://www.publicengagement.ac.uk/whats-happening/blog/reflecting-public-engagement-physics-and-engineering>

Author information



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Ms Wendy Sadler is the CEO and founder of the social enterprise, , which reaches around 70,000 school students and public audiences each year. Science Made Simple's mission is to inspire the next generation of scientists and engineers and ensure that more diverse audiences feel comfortable with Science, Technology, Engineering and Mathematics (STEM) subjects. Wendy is interested in how outreach experiences have the potential to change the identity people have in relation to STEM subjects and how role models can be used more effectively to share this message. Email: sadlerwj@cardiff.ac.uk