

UNIVERSITY OF THE WEST OF ENGLAND, BRISTOL

Royal Society Education Outreach Evaluation

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THE
ROYAL
SOCIETY



University of the
West of England



“My ultimate aim is to get across the idea that science is for everyone, everyone who is interested in it. So to break down the barriers that this is an elite subject, or it’s something that girls don’t do, or it’s something that you have to go to a private school to do, or any of those stereotypes that people might have”.
Research Fellow

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Executive Summary

This evaluation explores the perceptions of Royal Society Research Fellows to education outreach and the drivers that stimulate them to undertake it. The evaluation followed a pilot training scheme in education outreach, organised by The Training Group and covering a wide variety of topics including; theoretical information about learning styles and the UK education system, discussion activities for the Research Fellows, and activities to brainstorm and test potential outreach activities.

The evaluation used a variety of data collection methods to elicit the views of the participating 37 Research Fellows and three Royal Society staff and was conducted by the Science Communication Unit at the University of the West of England, Bristol. The report presents the indicators for impacts from education outreach, the methods and toolkit for undertaking the evaluation, and the results and recommendations from the evaluation.

Key Conclusions

- The Royal Society Education Outreach Training Course appears to be a valuable addition to the public engagement training landscape.
- The training course significantly improved how well equipped the participating Research Fellows felt to undertake education outreach in the future.
- The Research Fellows perceived education outreach as a worthwhile activity to improve the enjoyment of pupils in STEM subjects, particularly for under-represented groups such as girls.
- Time pressures mean that many Research Fellows find it difficult to conduct education outreach and balance their requirements for research outcomes.
- The Royal Society was positively viewed by the Research Fellows as an influential and respected organisation, and was urged to continue lobbying for the improved status of education outreach in academia and research.

Key Recommendations

- The Royal Society should continue to provide an Education Outreach Training Course in a residential format.
- The Royal Society should continue to advocate and lobby for the greater perceived value of education outreach for academic and research career paths, by working with governments, funding bodies and Higher Education organisations.
- The Royal Society should consider a wider range of funding grants including smaller grants, or grants for outreach work taking place outside schools.

1. Introduction

This report explores the perceptions of Royal Society Research Fellows to education outreach and the drivers that stimulate them to undertake it. In this first section we detail the definitions and context for education outreach, and the potential impacts we can expect from such activities. Later sections detail the results from this evaluation, and the conclusions and recommendations for further work.

1.1. Learning Outcomes from Education Outreach

Education outreach focuses chiefly on enhancing and improving education in schools, homes and communities. In this context we use it to refer to researchers engaging with young people aged 5-18 years old. Researchers are increasingly being urged to participate in education outreach programmes as part of the public engagement agenda, to connect society with science (Research Councils UK, 2010b). Although often taking place in a formal educational context, education outreach programmes can share many of the characteristics of informal science learning opportunities, in that they are not bound by the constraints of the curriculum and school timetabling and can provide access to resources (people and equipment) which are not otherwise available in schools. As such, we will first examine three constructs influencing informal science education (ISE) to highlight outcomes which could be achieved for young people, schools, and researchers through education outreach.

1.2. Scientific Literacy

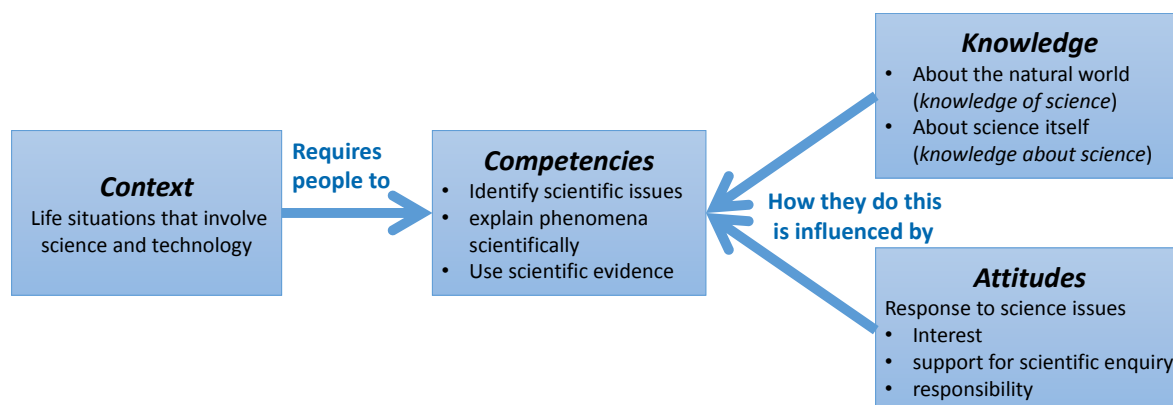
Scientific literacy is a term used to refer to a body of knowledge thought to be necessary to engage with scientific information and issues throughout life (Bauer, 2015). While debates exist in the science communication literature about the validity of this construct, it is widely used in formal education pedagogical research to determine the level of an individual's knowledge of and about science. Teachers and schools work towards scientific literacy to develop scientifically engaged citizens. The construct highlights that literacy is influenced by context, attitudes and competencies, and not just knowledge. We have included information on the way that scientific literacy is typically constructed in Figure 1, as this sheds light on the potential impacts of impacts of education outreach and how these might occur.

The Programme for International Student Assessment (PISA) definition of scientific literacy is (OECD, 2006 p23):

- Scientific knowledge and use of that knowledge to identify questions, acquire new knowledge, explain scientific phenomena and draw evidence-based conclusions about science-related issues
- Understanding of the characteristic features of science as a form of human knowledge and enquiry

- Awareness of how science and technology shape our material, intellectual, and cultural environments
- Willingness to engage in science-related issues and with the ideas of science, as a reflective citizen

Figure 1: Inter-related Aspects of Scientific Literacy (OECD, 2006)



1.3. Generic Learning Outcomes

Another method for assessing how interactions may have an impact on the audience is described in the 'Generic Learning Outcomes' (GLO) framework, which are utilised within informal learning contexts (such as museums or science centres). 'Learning' may involve the development or deepening of skills, knowledge, understanding, values, ideas, and feelings (Museums Libraries and Archives Council, 2014), as detailed in Table 1. Different interactions will have different outcomes; not every outcome can be achieved through each interaction and the GLOs are designed to be adapted for different contexts.

Many education outreach activities are short-term or one-off interventions, but there is an assumption that these individual fragments of engagement will coalesce into something more substantial; for example a positive impact on young people's aspirations and achievement in science. Indeed, it is argued that the informal learning sector is well placed to embed scientific ideas within a wider context (Stocklmayer, Rennie, & Gilbert, 2010), which is important for consolidating and contextualising learning (Bandiera & Bruno, 2006). Studies suggest that science outreach activities can increase interest and engagement with science and change pupils' views of scientists (Wilkinson & Sardo, 2013), while teachers also value expert contributions to scientific knowledge (Laursen, Liston, Thiry, & Graf, 2007).

Table 1: Generic Learning Outcomes from ISE (Museums Libraries and Archives Council, 2014)

GLO domain	Example of outcomes
Knowledge and Understanding	<ul style="list-style-type: none"> ▪ Knowing what or about something ▪ Learning facts or information ▪ Making sense of something ▪ Deepening understanding ▪ Making links and relationships between things
Skills	<ul style="list-style-type: none"> ▪ Knowing how to do something ▪ Being able to do new things ▪ Intellectual skills ▪ Information management skills ▪ Social skills ▪ Communication skills ▪ Physical skills
Attitudes and Values	<ul style="list-style-type: none"> ▪ Feelings ▪ Perceptions ▪ Opinions about ourselves (e.g. self-esteem) ▪ Opinions or attitudes towards other people ▪ Increased capacity for tolerance ▪ Empathy ▪ Increased motivation ▪ Attitudes towards an organisation ▪ Positive and negative attitudes in relation to an experience
Enjoyment, inspiration, creativity	<ul style="list-style-type: none"> ▪ Having fun, ▪ Being surprised ▪ Innovative thoughts ▪ Creativity ▪ Exploration, experimentation and making ▪ Being inspired
Activity, behaviour, progression	<ul style="list-style-type: none"> ▪ What people do ▪ What people intend to do ▪ What people have done ▪ Reported or observed actions ▪ A change in the way that people manage their lives

1.4. Education Outreach as Public Engagement

The Concordat for Public Engagement has been pivotal in encouraging Higher Education Institutions to engage with a range of publics (Research Councils UK, 2010a). However, debate exists about the style of public engagement undertaken, with dialogue between researchers and the public generally favoured over one-way transmission from researchers to audience (the latter has come to be known as the 'Deficit Model') (Bucchi, 2008).

In the Royal Society survey on attitudes to science communication, half of all researchers highlighted schools and pupils as a very important audience with whom to engage (Royal Society, 2006). However, the dominant reason for engagement was to 'promote public understanding of science' (34%), which can be aligned with traditional transmission styles of public engagement ('Deficit Model') and techniques to improve 'Scientific Literacy' in formal education contexts. Only 15% of respondents highlighted their aim as to discuss the 'implications, relevance and value of science', which can perhaps be aligned with the dialogue style of public engagement, along with several domains in the GLO.

Researchers may also gain from public engagement; indeed the National Coordinating Centre for Public Engagement define engagement as a two-way process (National Coordinating Centre for Public Engagement, 2014). In this context, the GLO may equally be applied to indicate the domains where researchers may experience benefits from undertaking education outreach.

A series of recent position papers highlight these benefits as:

- Gaining confidence and skills for communicating with diverse publics
 - Widening research horizons and gaining new insights into their research
 - Inspiring the next generation of researchers
 - Securing and sustaining the research base and UK economy
 - Engaging in dialogue on the relevance of research to science and society
- (National Coordinating Centre for Public Engagement, 2010; Research Councils UK, 2010b)

1.5. Impacts from Education Outreach

There is little research evidence combining these three concepts to highlight impacts from education outreach for all participants. In Table 2 we have synthesised the outcomes identified by the different constructs into broad categories; these are then used to identify possible outcomes that could be achieved from participation in education outreach by each of the identified beneficiaries. We would not expect to see evidence of change in every category of impact, and for all participant groups, as education outreach activities vary in their objectives and approaches and hence what they can achieve.

Table 2: Potential outcomes from Royal Society Education Outreach training and activities (table adapted from Dierking (2008))

Category of Impact	Potential indicators of impact		
	Research Fellows	Teachers and school community	Young people (pupils)
<i>Knowledge or understanding of STEM concepts, processes or careers</i>	Knowledge of formal learning and curriculum	Teaching, learning and pupil motivation in non-specialist subjects	Knowledge of specific STEM research area and related curriculum concepts
	Understanding of different views and perspectives on research	Understanding of multi-disciplinary working for relating subjects in the real world	Understanding of different views and perspectives on specific STEM research
	Understanding of communication with different audiences	Knowledge of contemporary science	Enhanced understanding about 'working scientifically', or how science works
<i>Enjoyment, inspiration, engagement and creativity in STEM concepts, processes, or careers</i>	Enjoyment of public engagement	Real-world experience of current science	Enjoyment of STEM subjects
	Creativity in communicating research concepts	Hands-on experience of curriculum concepts	Inspiration for studying or continuing to study STEM subjects
<i>Attitudes and values towards STEM-related topics or capabilities</i>	Awareness of perspectives of science in society	Variety of role models for pupils	Awareness of how the specific STEM research area is viewed in society
	Increased self-efficacy for engagement	Raised aspirations to widen participation for STEM subjects in school and university	Increased self-efficacy for STEM subjects
			Raised aspirations in STEM
<i>Activity, behaviour, progression resulting from experience</i>	Experience of management and team work	Links and collaborations to universities	Involvement with school community around STEM subjects (e.g. parents)
	Public engagement experience	Links and collaborations with community	Participation and progression in STEM subjects
		Participation in STEM subjects throughout school years	Involvement in extra-curricular school STEM projects
		Pupil involvement in extra-curricular school STEM projects	Changes to behaviour (e.g. healthy eating)
<i>Skills based on experience</i>	Communication, facilitation and dialogue skills	Continuing Professional Development for non-specialist subjects e.g. new experiments	Skills for specific activities undertaken

2. Training Course

The Education Outreach Training Course pilot scheme was organised by The Training Group and covered a wide variety of topics including; theoretical information about learning styles and the UK education system, discussion activities for the Research Fellows, and activities to brainstorm and test potential outreach activities. There were three two-day training courses offered, and in total 37 Research Fellows received some training. The training course aimed to: *Inspire Research Fellows to engage with schools, teachers and young people by equipping them with relevant skills, connections, and resources and providing the support to develop their own activities.*

3. Evaluation

3.1. Methods

Mixed methods (pre/post questionnaire and interviews) were employed to explore varying perspectives of the training course and education outreach. Ethics consent was received from the University of the West of England Research Ethics Committee. All Research Fellows were contacted via the Royal Society Education Outreach Team.

A pre and post online or paper questionnaire was completed by consenting Research Fellows before and after their two day training course, which featured demographic, rank list, Likert scale, and open questions. Quantitative questions were analysed using descriptive statistics in Microsoft Excel; qualitative questions were analysed using Thematic Analysis in QSR nVivo 10 (Braun & Clarke, 2006). The pre and post questionnaires can be seen in Appendix A.

Telephone interviews were also conducted with consenting Research Fellows and Royal Society employees. Audio recordings were transcribed verbatim and analysed using Thematic Analysis in QSR nVivo 10 (Braun & Clarke, 2006). The interview schedule can be seen in Appendix B.

3.2. Sample Characteristics

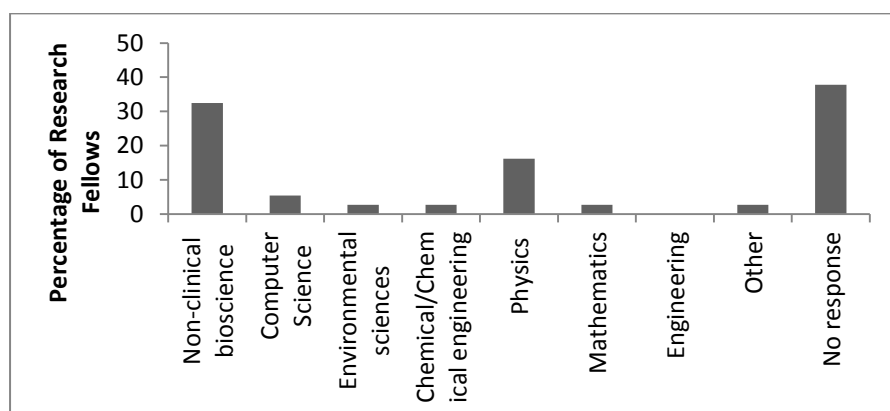
3.2.1. Research Fellow questionnaire

In total all 37 of the Research Fellows completed at least one of the questionnaires; 30 completed the pre questionnaire and 22 completed the post questionnaire. Where the Research Fellows completed both questionnaires ($N = 10$) their responses were linked using their date of birth. From the total pool of 37 Research Fellows, the pre questionnaire response rate was fairly high at 81%; however, the post questionnaire response rate was 59%.

The questionnaires indicated the demographics of the Research Fellows sampled. All percentages are calculated from the total sample of 37.

- Gender: 35% female; 38% male; 27% no response.
- Ethnicity: 35% White British; 22% White Other; 8% Chinese/Asian/Mixed; 38% no response.
- Experience: 19% had held their PhD for less than 10 years; 46% had held their PhD for over 11 years; 38% no response. The length of Royal Society Research Fellowship ranged from one to nine years, with a mean of 4.1 years.
- Field of research: 32% came from non-clinical bioscience, while 16% came from physics. Other fields were also represented as seen in Figure 2.

Figure 2: Research Fellows' research disciplines



3.2.2. Interviews

All Research Fellows were asked for an interview; interviews were conducted with the seven Research Fellows who responded. This sub-sample had different characteristics to the main sample; with five being female, six being White British or White Other, and being in receipt of their Research Fellowship for a mean time of 4.0 years.

Interviews were also conducted with three members of Royal Society staff involved in public engagement, education outreach and communicating with the Research Fellows.

3.3. Results

The results from the questionnaire and interviews are integrated and outlined here according to the evaluation topic. The qualitative responses, including open responses from the questionnaire, interviews with Research Fellows and interviews with Royal Society staff, have been integrated into one coding frame. In total, four overall themes were noted; the codes and the references made to them are outlined in Appendix C.

3.3.1. Public engagement and outreach experience

The Research Fellows were asked to indicate their prior public engagement experience before taking part in the training course. The main public engagement activities noted were 'Working with teachers' (35%), 'Participating in an institution open day' (35%) and 'Giving a public lecture' (38%), as seen in Figure 3. Most Research Fellows had received very little training in public engagement before attending this course, with the main category of experience being through 'Informal means' (41%) and 'Media training' (24%), as seen in Figure 4.

The most popular reason for undertaking the course before the training, from the perspective of the Research Fellows' professional development, was to improve their understanding of communicating with young people (35%). Prior to the training, most Research Fellows rated themselves as not taking part in much public engagement activity, with nearly half (49%) being 'Rarely active'; however, nearly a quarter of the Research Fellows rated themselves as 'Quite active' (25%). The Research Fellows were asked how many times they had taken part in any public engagement activities aimed at young people in the last 12 months, and the greatest single response was no activities (32%), while another third had taken part in one to three activities (33%). Most Research Fellows stated that they were 'not very well equipped' to engage with young people (41%).

Figure 3: Prior public engagement experience

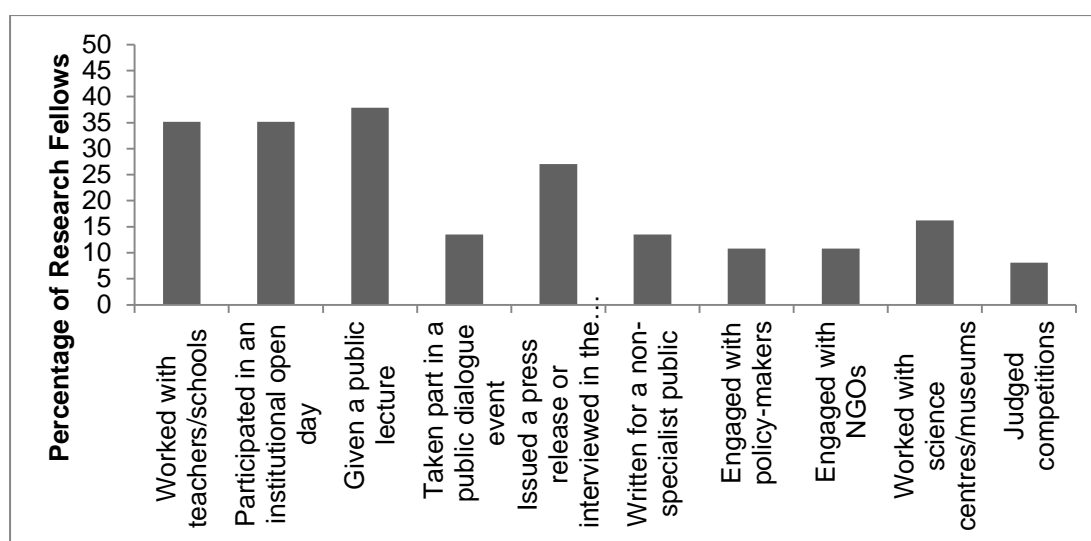
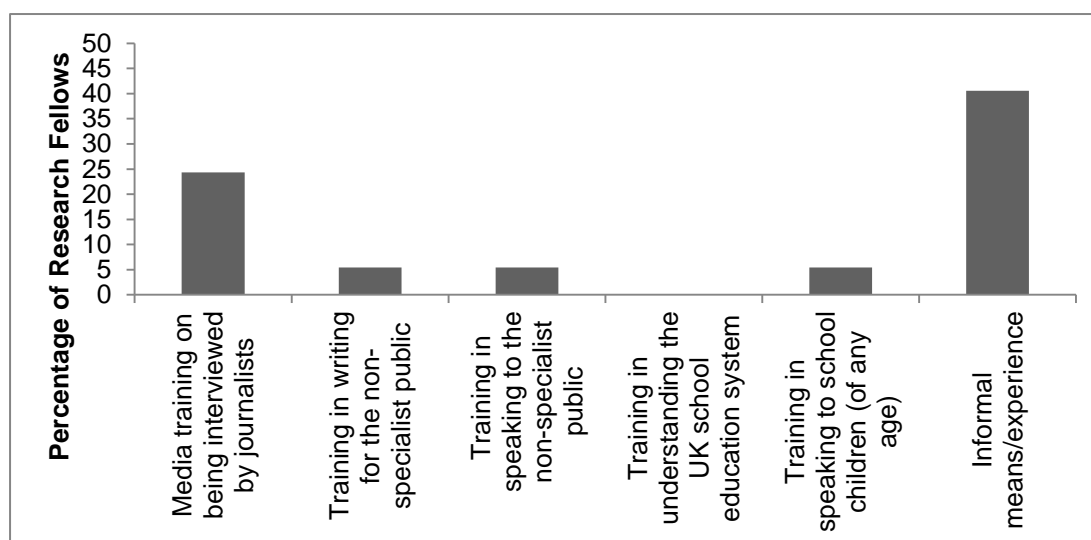
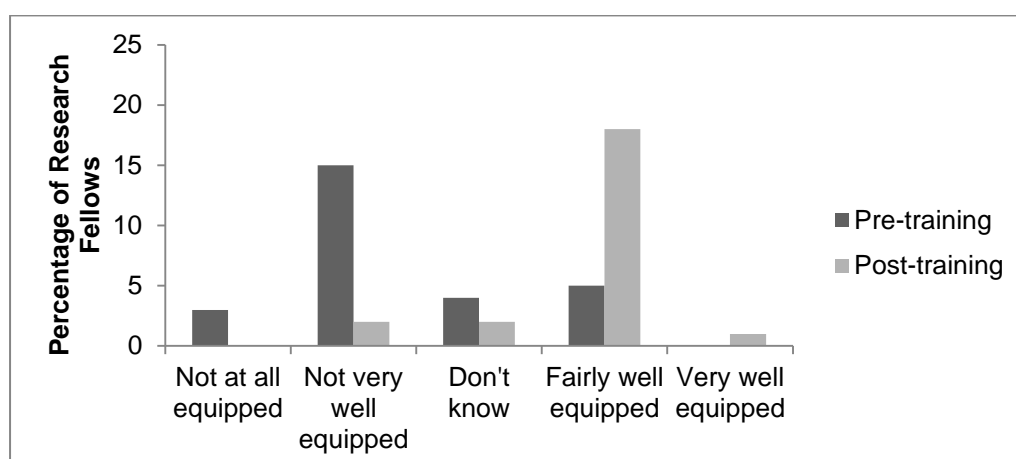


Figure 4: Prior public engagement training



Following the training, the Research Fellows indicated that the greatest impact on their professional development had been their knowledge of the school curriculum (22%) followed by understanding of public views on their research area (16%). Most Research Fellows indicated that they would now be 'more active' in public engagement (46%), with the majority indicating they would be taking part in one to three activities in the next year (38%) – this is a 37% increase in people indicating this level of activity. Most Research Fellows stated they were now 'fairly well equipped' to engage with young people (49%). This indicates a 325% decrease in those stating they were 'not very well equipped' (41% prior to the course), and a 260% increase to 'fairly well equipped' (from 14% prior to the course). These changes can be seen in Figure 5.

Figure 5: Change in levels of Research Fellows feeling 'equipped' to perform outreach with young people



Qualitative data reinforced these findings, with Research Fellows indicating their varied levels of experience before the course. Many of the Research Fellows felt that the Royal Society had offered prior courses that were worthwhile, and so they indicated that they wanted to attend to learn from 'experts'. Around half the Research Fellows interviewed had already gained a large degree of experience but were looking for 'official training' for themselves, felt they needed more training, or more information to advise other staff members in their department.

Now that I have got an independent position I need to come up with my own activities. So I really wanted to do the training to get some confidence and some inspiration of how to design activities and how things work well. Rather than just doing stuff that other people have done for me.

(Research Fellow (RF) interview 7 - Female, 6-10 years post PhD, Course 3)

For three years as a part of National Science and Engineering Week, I ran a 'Hands on Science' day for 11 year olds in disadvantaged London schools. This involved getting all the children to do simple experiments to test different hypotheses, and adequately illustrated how badly I need training in communicating with children.

(RF questionnaire - Female, 11-15 years post PhD, Course 1)

I'm now the Director of Outreach of my department. So I'm coordinating outreach actives and also getting more involved in such activities. Therefore, I felt I needed better training to know how to communicate science to young people. (RF questionnaire - Male, 11-15 years post PhD, Course 1)

When I got the invitation to do the training I thought, "Well there is always something more that one can learn". First of all the trainers at the Royal Society are always very good; so in all of the experience I have had, they were very well run. So I always try and attend all of them because they are worthwhile to me. (RF interview 2 - Male, 11-15 years post PhD, Course 1)

Others were seeking advice before starting any outreach.

I think a lot of the problem with people like me, like scientists; we are very much by ourselves. I realise we collaborate but you do work in a lab and you do the data by yourself a lot. So you do need some kind of training in how to get out there and do things. People are quite timid to do that and yes we don't have that here at all. (RF interview 6 - Female, 0-5 years post-PhD, Course 3)

*General cluelessness about engaging young audiences.
(RF questionnaire - Female, 11-15 years post-PhD, Course 2)*

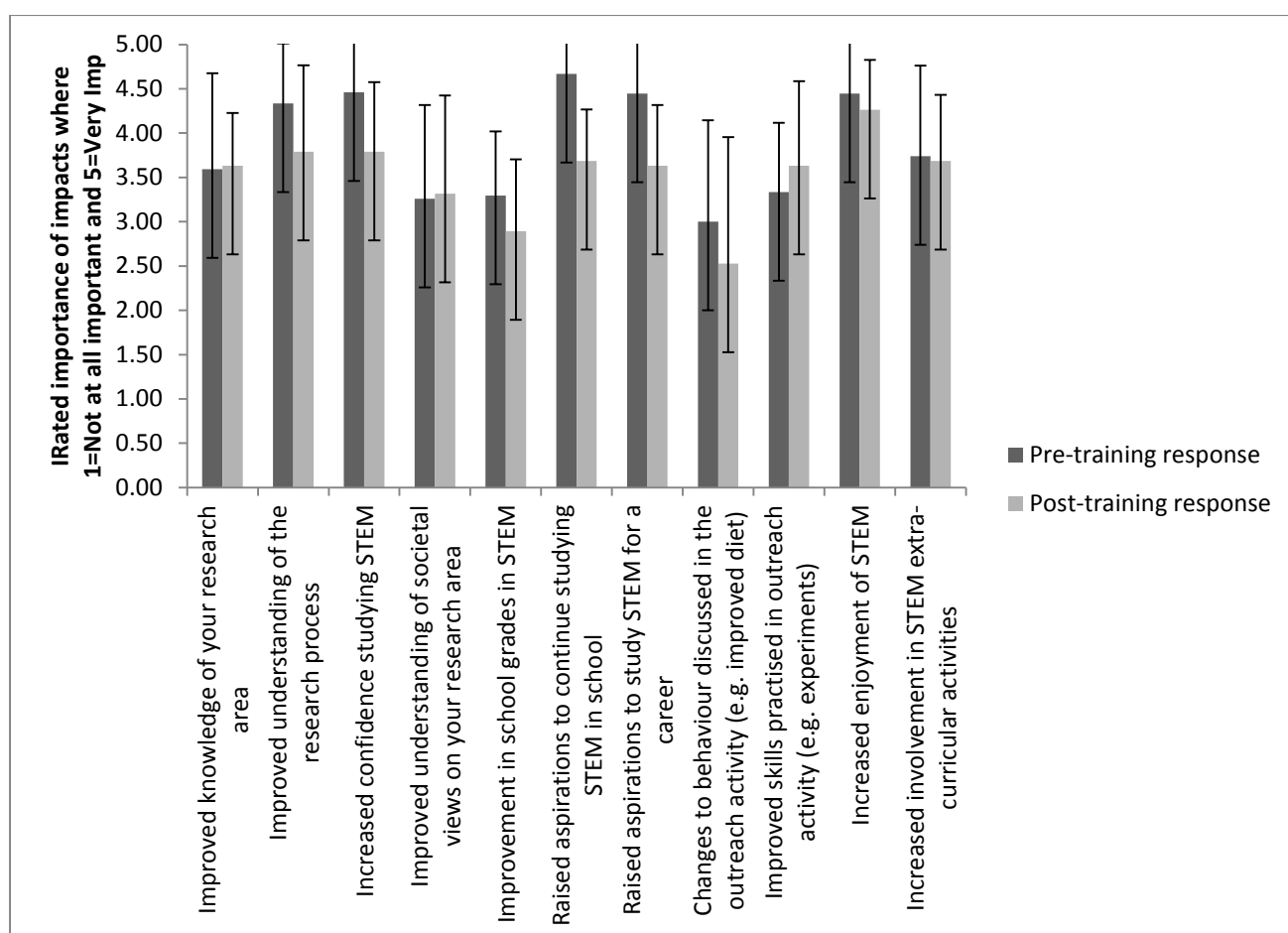
*The wish to become involved in outreach but not knowing what to do!
(RF questionnaire - Male, 16 plus years post PhD, Course 3)*

*I was quite intimidated by the idea of a large group of kids. I don't mind them one on one but when they get into a whole group, I find them a bit intimidating. So I really was hoping to get some ideas for how to structure it, and what sort of level to pitch it at, if I did it.
(RF interview 1 - Female, 6-10 years post PhD, Course 1)*

3.3.2. Intended impact for young people

The Research Fellows were asked to rate how important they thought various impacts of outreach would be for young people. Prior to the training, the highest rated impact was to raise aspirations for young people to continue studying STEM in school ($M = 4.67$ $SD = 0.62$), closely followed by increased enjoyment of STEM ($M = 4.44$, $SD = 0.70$) and increased confidence studying STEM ($M = 4.46$, $SD = 0.76$). Interestingly, most of the ratings decreased following the training, indicating less confidence in these effects. Following the training the highest rated impact was to increase enjoyment of STEM ($M = 4.26$ $SD = 0.56$), with improved confidence studying STEM ($M = 3.79$, $SD = 0.98$) and improved understanding of the research process also being rated highly ($M = 3.79$, $SD = 0.79$). The full results can be seen in Figure 6.

Figure 6: Perceived intended impacts for young people before and after the training



Qualitative data reinforced these findings, with the Research Fellows overwhelmingly stating how important outreach is for society. This concurred with the aims of the training course, as Royal Society staff member 1 indicated that they wanted to send a “message out that education outreach was important to the Royal Society and that for scientists to get the chance to work with young people and vice versa was an important message for society”. The Research Fellows appeared to be making the case for scientifically literate citizens, who understand the processes of science and can apply it in their daily lives.

I think the most important skill is to be able to think logically and evaluate evidence. This is something science can teach us and is useful and important throughout our lives, not least because it means you can have informed opinions about areas of science that could impact your life (e.g. climate change and health research). Also, many people I've talked to really don't understand what scientific research is, and I think it will always be hard to get people to vote for more funding for something if they don't know what it is. (RF questionnaire – Female, 6-10 years post-PhD, Course 1)

Not everyone can become a scientist, but we need people who have an understanding of what science is, what scientists do, the scientific way of thinking. (RF questionnaire – Female, 11-15 years post-PhD, Course 3)

My main interest is that children learn the advantages in understanding STEM - or the scientific method, and decide that sticking with STEM will help them navigate day-to-day life in the future. I am worried about promoting science careers, as it is a bit rough having a career in science just now. (RF questionnaire – Female, 11-15 years post-PhD, Course 1)

Others indicated that they wished pupils to understand their own research area in order to apply the information both in their school studies and home life.

Outreach is an important way of conveying the conservation message and achieving conservation actions. If this also encourages people to engage more in STEM, then that is a bonus. (RF questionnaire – Male, 11-15 years post-PhD, Course 2)

I think increased understanding of science in general is essential for the future of the UK and underpins our future prosperity, health, well-being etc. I think that increased understanding of my own area is important because it gives students an opportunity to understand behaviour/neuroscience/evolution - areas that I think are very poorly covered by the current A-level curriculum. (RF questionnaire – Male, 11-15 years post-PhD, Course 2)

Overwhelmingly, most Research Fellows stated that they wanted to generally inspire the next generation to enjoy science. They felt that as scientists they could uniquely contribute a personal perspective on the scientific method and the enjoyable process of conducting research. Enjoyment preceded other goals such as improved school grades, continuing to study STEM or undertaking a scientific career.

I think we can have a longer lasting impact on young people if we teach them enjoyment of science, and about the process of research, rather than facts (which is what they are typically getting already in their science lessons at school). In some sense, I do not care about teaching them about my specific scientific discipline (astronomy), I just want them to realize what it is to do science, that there are many different aspects to it, and that it is a very enjoyable process. (RF questionnaire – Female, 6-10 years post-PhD, Course 1)

I would regard outreach as primarily motivational. It's the job of the schools to educate in the details. If motivated, students will apply themselves to their work. Thus, I would not anticipate effects on school grades from any engagement (unless sustained and with this in mind). I think it's important for them [pupils] to see scientists in action and understand that they are enthusiastic about their work and why it matters. (RF questionnaire – Male, 11-15 years post-PhD, Course 1)

I think by increasing enjoyment and confidence all other impacts from STEM will follow, thus they are the most important to me.

(RF questionnaire – Female, 16 years or more post-PhD, Course 2)

I think confidence is the key to the 'give it a go' attitude that is central to STEM and maybe engagement with young people is 'demystifying' subjects; could give them the push they need.

(RF interview 5 – Female, 11-15 years post-PhD, Course 2)

Inspiring an enjoyment of science was especially cited by female Research Fellows who wanted to encourage non-traditional pupils to continue a career in science. As women and/or people from less affluent backgrounds, they appeared to feel a duty to communicate the message to young people that anyone can do science. This was particularly so if they were from disciplines with fewer women, such as the physical sciences.

My ultimate aim is to get across the idea that science is for everyone, everyone who is interested in it. So to break down the barriers that this is an elite subject, or it's something that girls don't do, or it's something that you have to go to a private school to do, or any of those stereotypes that people might have. (RF interview 4 – Female, 6-10 years post-PhD, Course 1)

Because I'm a female ... there aren't very many of us [Physical scientists]. So when I was at school in the sixth form and they did all the careers type days it always came out that I should be doing something like ... biological things and studying medicine. And depressingly when I have given careers talks to youngsters it seems to be actually the same thing happening.

(RF interview 6 – Female, 0-5 years post-PhD, Course 1)

Working in an area of Liverpool typified by low aspirations in school leavers I would see success as inspiring a pupil to consider that a career in science might be fun and achievable.

(RF questionnaire – Female, 16 or more years post-PhD, Course 2)

[Talking about her motivation for undertaking outreach] My four year old niece told her parents that girls don't do physics.

(RF questionnaire – Female, 6-10 years post-PhD, Course 1)

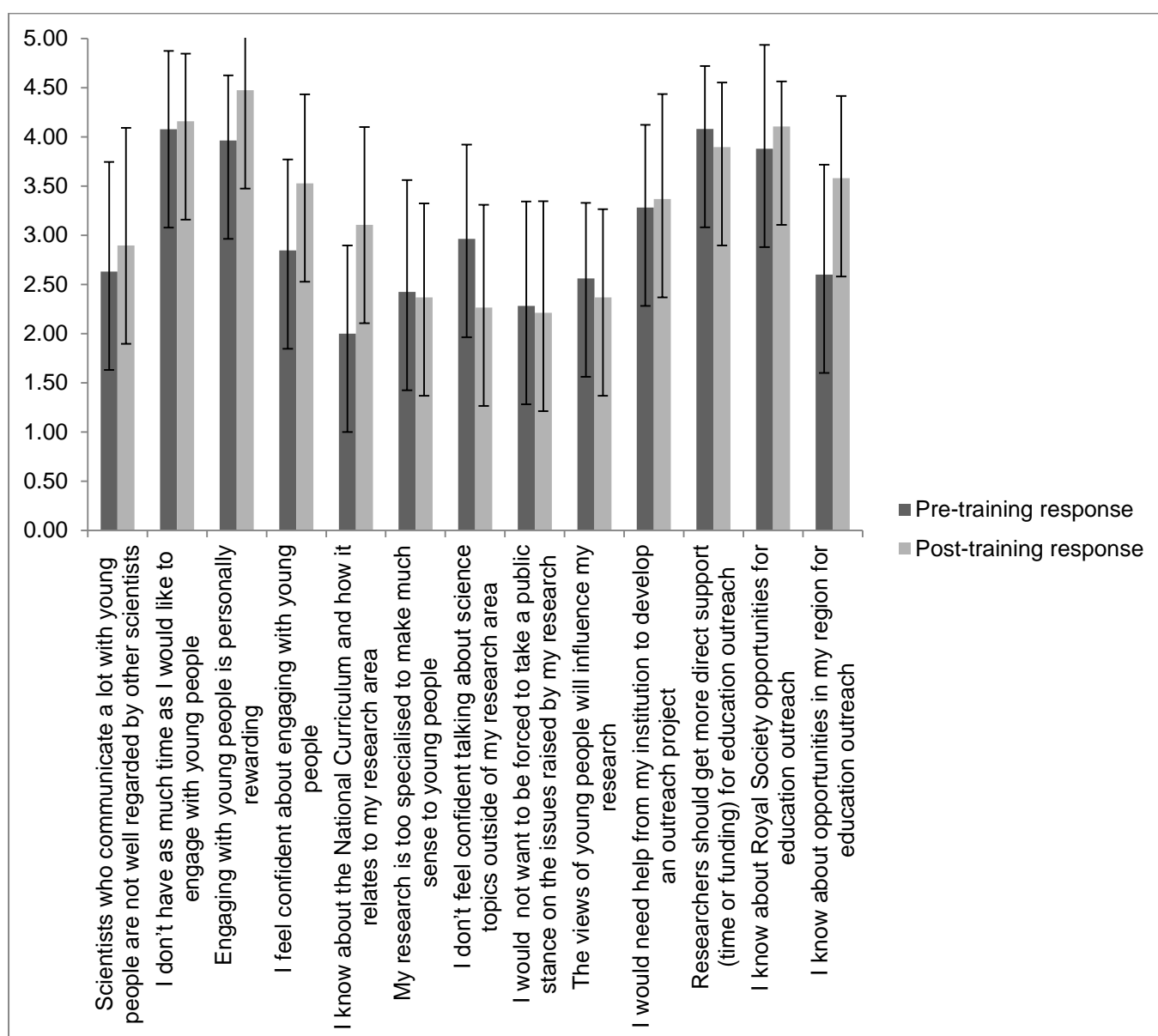
3.3.3. Outreach support

In a series of questions testing agreement with various statements (rated on a scale of 1 to 5, where 5 indicated strongly agree), the Research Fellows were mostly consistent in their responses before and after the course. There was strong agreement that Research Fellows 'don't get as much time as they would like to engage with young people' (post course $M = 4.16$ $SD = 0.69$) and that they should get more 'direct support for engagement' (post course $M = 3.89$ $SD = 0.66$).

Agreement with 'I would need help to develop an outreach project from my institution' decreased following the course, indicating positive change (post course $M = 3.37$ $SD = 0.07$). Agreement with the following statements increased following the course, also indicating positive change. These were 'engaging with young people is personally rewarding', 'I feel confident engaging with young people', 'I know about the National Curriculum and how it relates to my research area' and 'I know about opportunities in my region to engage with young people'. These results can be seen in Figure 7.

Engagement with the Royal Society was fairly high, with 59% of the Research Fellows indicating that they attend one to three Royal Society events each year. When asked to rate agreement with the question 'I know about Royal Society opportunities for education outreach', agreement was high and slightly increased following the course to $M = 4.11$ ($SD = 0.46$).

Figure 7: Levels of agreement with statements about education outreach before and after the training course



The qualitative data provided further depth to these statements about outreach support. Whilst the Research Fellows were keen to undertake outreach and recognised its importance to the Royal Society, they indicated that the external environment created several barriers. These included time pressures, university perceptions and recognition of outreach, and external funding bodies and drivers such as the Research Excellence Framework (REF).

I think if we really want academics to do outreach properly they need at least a three month break for the academic to do it. To be honest, life for me is so

*busy; it's even difficult for me to find time to have a conversation with you.
(RF interview 2 – Male, 11-15 years post-PhD, Course 1)*

*I think it depends on your institution. I've never experienced any serious resistance to it, but I have frequently had people suggest that I should just concentrate more on my research and less on outreach. Because at the minute I feel like it's seen as a kind of a nice bonus if you want to do it, but actually you could do your whole fellowship without doing any of it and then you get more research done.
(RF interview 4 – Female, 6-10 years post-PhD, Course 1)*

These pressures were especially felt by those looking to progress in their research careers.

*I am a little bit worried that women who do public engagement have a higher likelihood of being pigeon-holed as 'not committed to research', but I don't have much data to support this. I think the problem tends to be that it's not really regarded as something that counts towards your CV by the University. It's very clear that the money you bring in and the papers you get out are going to be more important until the Government decides to base something on outreach, and how it funds [research].
(RF interview 1 – Female, 6-10 years post-PhD, Course 1)*

The priorities when you look a promotion aren't really outreach activities they are always going to be income and publication. But I think it will kind of depend on REF as to whether impact can be tied in with some of the things that we do with outreach. And if we can measure the impact our outreach activities have and tie that in with research then I think we will always be supported. (RF interview 7 – Female, 6-10 years post-PhD, Course 3)

Many Research Fellows agreed with these views, and wanted to influence how outreach was perceived by others. They indicated that lobbying from the Royal Society for increased recognition and value of outreach may help more researchers undertake these activities.

*Education outreach should be supported more openly and concretely by universities (time should be allowed and support funds provided).
(RF questionnaire – Female, 16 or more years post-PhD, Course 3)*

*I would hope longer term to influence research policy with our Research Council and further afield [about the value of outreach]. This will require concerted and sustained action.
(RF questionnaire – Male, 11-15 years post-PhD, Course 1)*

Raise the profile of outreach and public engagement so that Universities value it more and encourage it rather than seeing it as an optional extra. Make resources (time and funding) explicitly available within Research Fellowships to support outreach and engagement activities so that they don't have to be squeezed into researchers' spare time. Possibly make it compulsory to include an element of outreach/engagement activity in Fellowship applications

(not necessarily face to face engagement, as not everyone wants to do this, but could include e.g. educational website to app).

(RF questionnaire - Female, 6-10 years post-PhD, Course 1)

I think the most important thing for the Royal Society is that they can influence the policy makers. I know in America every researcher has to do outreach, but the UK has an optional one [system].

(RF interview 2 – Male, 11-15 years post-PhD, Course 1)

Some Research Fellows argued that the Royal Society could also reduce time pressures by providing practical support to teachers and Research Fellows. This included branded resources and schemes, but also an expanded range of funding grants available for bidding. Funding from the Royal Society was viewed as helping gain support in terms of esteem and recognition, but also through legitimately buying out time for outreach work.

I think that [funding] helps in the sense of people really respecting the Royal Society, it has an impression on university management. I think the things so far that I have experienced have been really good that the Royal Society is doing. I think their new plan is having a good impact.

(RF interview 5 – Female, 11-15 years post-PhD, Course 2)

I think the Royal Society is involved in the right areas, e.g. training, brokering (getting researchers into schools) and book prizes. However, other aspects might be worth considering, e.g. sponsoring prizes in games or app development for scientific communication.

(RF questionnaire – Male, 11-15 years post-PhD, Course 1)

I don't know if somehow the Royal Society could support the teachers in maybe getting them to have some extra hours. I think if the teachers could have some more time to dedicate then they could probably be more active and run more sessions; sessions for the different year groups and so on. And maybe broadening the kind of grants that they have? So not just having people to visit the school, but actually in a broader sense supporting outreach in general like developing a new website, or writing a magazine, or writing a book, you know?

(RF interview 4 – Male, 11-15 years post-PhD, Course 1)

I have had some cool ideas of things but you just think, oh wow £3,000 is a lot I'm not sure I could spend that. Whereas if it was a small amount you could think, "oh yeah, I could buy that and then we could see how it goes and then maybe I will apply for something bigger".

(RF interview 6 – Female, 0-5 years post-PhD, Course 3)

4. Summary and Recommendations

This report evaluated the perceptions of Royal Society Research Fellows towards education outreach. This section presents the summary of the evaluation and provides recommendations for future training courses.

4.1. Education Outreach Training Course

The Royal Society Education Outreach Training Course appears to be a valuable addition to the public engagement training landscape. Attendees had a wide variety of experience levels, mostly gained through informal means or Media Training Courses. However, all of the Research Fellows indicated that they were seeking to improve their understanding of communicating with young people, either for their own career development or to pass on to other staff members.

Following the course, the number of Research Fellows who stated they were now 'fairly well equipped' ($M = 49\%$) to engage in education outreach had more than doubled, and the most frequent response ($M = 46\%$) for engagement activity was that they would be 'more active' in public engagement in general.

Recommendations:

- **Continue to provide an Education Outreach Training Course in a residential format.**
- **Consider including a more general Public Engagement course to cater for different forms of outreach other than schools.**

4.2. Impacts for Young People

The Research Fellows universally described education outreach as a worthwhile activity for themselves, their research, young people, and society in general. Prior to the course, the Research Fellows thought the most important impact for young people would be to raise aspirations to continue studying in STEM. Following the course, quantitative and qualitative data indicated that the Research Fellows thought the most important impact would be increased enjoyment of STEM. This is very interesting in the context of literature on education outreach, as it shows that the Research Fellows now feel that enjoyment of an activity contributes to all other potential impacts (see Table 2) (Dierking, Falk, Rennie, Anderson, & Ellenbogen, 2003; Museums Libraries and Archives Council, 2014). Improved confidence studying STEM and an improved understanding of the research process were also rated highly, indicating that the Research Fellows support the idea of scientifically literate citizens, whether or not pupils continue into STEM careers (OECD, 2006).

While the Research Fellows perceived the importance of education outreach, quantitative and qualitative data indicated that they felt the external research environment did not always share this view. External pressures for funding and

publications meant that they felt little time could be meaningfully devoted to education outreach. This was evidenced in the fact that very few of the Research Fellows gained further experience in education outreach either between the training days or following the course. However, most indicated that they would put the training into action in the near future.

Recommendations:

- **Continue to show support for education outreach through courses, funding grants and advocacy.**
- **Continue developing the Associate Schools and Colleges programme as a worthwhile venture for schools and pupils.**

4.3. Royal Society Support for Education Outreach

The Research Fellows respected the Royal Society, the freedom of their Fellowship, and the breadth and excellence of the Royal Society training programmes. Nearly two-thirds ($M = 59\%$) attended one to three Royal Society events each year and there was high agreement that the Research Fellows knew about Royal Society opportunities for education outreach. Qualitative data indicated that the Research Fellows felt that working with the Royal Society improved their standing in their universities and also with the schools or young people with which they conducted outreach.

The reputation of the Royal Society meant that many Research Fellows believed the Society could have significant influence, and so in particular they wanted to see further advocacy for the importance of education outreach with governments, funding bodies and universities. Influencing these dominant organisations was felt to be a powerful route to developing a higher perceived value for education outreach, which in turn would mean researchers could devote more time to it. Suggestions included greater emphasis placed on 'Impact' from education outreach in the REF, more funding to buy out time, and options to include outreach efforts within academic career paths.

Recommendations:

- **Continue to advocate and lobby for the greater perceived value of education outreach for academic and research career paths.**
- **Continue to work with governments, funding bodies and Higher Education organisations to develop recognition for education outreach efforts.**
- **Continue to provide funding grants for education outreach, but consider a wider range of options including smaller grants, or grants for outreach work taking place outside schools.**

- **Continue to support female researchers to conduct education outreach to influence the gender balance in science.**
- **Consider a follow-up course or networking event to continue to support and develop the Research Fellows interested in undertaking education outreach.**

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6. Appendices

6.1. Appendix A: Questionnaires

6.1.1. Pre Questionnaire

Please complete all the questions so that we know a little about you, as well as your prior experience.

Demographics

- 1) As a unique identifier in case you want to withdraw your questionnaire from the study, please enter your date of birth:

Day _____ Month _____ Year _____

- 2) Are you?

Male ☐ Female ☐

- 3) Which of these categories represents your ethnic group? (Note: These are based on the Office for National Statistics national standards)

White British)	White Irish)	White Other)	White and Black Caribbean)
White and Black African)	White and Asian)	Caribbean African)	Indian)
Any other Black Background)	Any other mixed background)		Bangladeshi)
Pakistani)	Any other Asian Background)	Chinese)	Any other Ethnic Group)

- 4) How many years post PhD are you?

0-5 ☐ 6-10 ☐ 11-15 ☐ 16 plus ☐

- 5) From the list below, which discipline most closely describes your current area of research interest?

Non-clinical bioscience (including medical, psychology, veterinary, agricultural)	<input type="radio"/>
Engineering/Engineering sciences	<input type="radio"/>
Computer Science	<input type="radio"/>
Environmental sciences (including earth and marine sciences)	<input type="radio"/>
Chemical / chemical engineering	<input type="radio"/>
Physics (including materials sciences) and astronomy	<input type="radio"/>

- Mathematics ☐
- Environmental Sciences ☐
- Other (please specify) _____ ☐

6) How many years have you held a Royal Society fellowship?

Please state _____

7) On average, how many activities organised by the Royal Society do you take part in each year (such as conferences, lectures, outreach, writing etc)?

None ☐ 1-3 ☐ 4-6 ☐ 7-10 ☐ 11 plus ☐

Education Outreach Experience

8) Please indicate the types of public engagement activities you have undertaken in the past 12 months (tick as many as apply).

- Worked with teachers / schools (including writing educational materials) ☐
- Participated in an institutional open day ☐
- Given a public lecture, including being part of a panel ☐
- Taken part in a public dialogue event / debate ☐
- Issued a press release and/or been interviewed in the media ☐
- Written for a non-specialist public (including media, the web, social media and books) ☐
- Engaged with policy-makers ☐
- Engaged with non-Governmental organisations (NGOs) ☐
- Worked with science centres / museums ☐
- Judged competitions ☐

9) Thinking about your past experience, please rate how active you have been in public engagement.

Not active at all ☐ Rarely active ☐ Quite active ☐ Very active ☐

10) **What training, if any, have you had in communicating science to the non-specialist public? Do not include any teaching training you may have had. (Please tick as many as apply).**

- Media training on being interviewed by journalists ☐
- Training in writing for the non-specialist public ☐
- Training in speaking to the non-specialist public ☐
- Training in understanding the UK school education system ☐
- Training in speaking to school children (of any age) ☐
- Informal means / experience ☐

11) **How many public engagement activities aimed at young people (aged 18 and under) have you taken part in over the past 12 months?**

- None ☐ One ☐ 2-3 ☐ 4-5 ☐ More than 5 ☐

12) **How well equipped do you personally feel you are to engage with young people (aged 18 and under) about your research?**

- Not at all ☐ Not very well ☐ Don't ☐ Fairly well ☐ Very well ☐
equipped equipped know equipped equipped

13) **Thinking about our research aims, do you have any comments about your prior experience or involvement with public engagement or education outreach?**

Education Outreach Aims

14) What motivated you to take part in this training?

15) From the list below, please rank the most important things you would like to achieve for your professional development from taking part in training on education outreach (where number 1 is the most important thing).

For your professional development:

Improve knowledge of school curriculum	_____
Improve understanding of communicating with young people	_____
Improve understanding of public views on your research area	_____
Increase confidence engaging with young people	_____
Raise awareness of your research area	_____
Increase support for science and engineering	_____
Improve your communication skills	_____
Gain experience of public engagement	_____
Enjoyment of communicating your research	_____

16) Outreach activities can result in a number of impacts on young people and their communities.

For you personally, please rate the importance of the impacts you would like to encourage in young people, on a scale of 1 to 5, where 1 is not important and 5 is very important. Please be as honest as you can, so we can understand which impacts are most important to you.

In this question STEM refers to the general concept of 'Science, Technology, Engineering and Mathematics'.

For the young person:	1 Not important	2	3	4	5 Very important
Improved knowledge of your research area	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Improved understanding of the research process (working scientifically)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increased confidence studying STEM	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Improved understanding of societal views on your research area	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Improvement in school grades in STEM	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Raised aspirations to continue studying STEM in school	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Raised aspirations to study STEM for a career	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Changes to behaviour discussed in the outreach activity (e.g. improved diet)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Improved skills practised in outreach activity (e.g. experiments)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increased enjoyment of STEM	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increased involvement in STEM extra-curricular activities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

17) Why did you rate the impacts like this?

18) Please rate your agreement with the following statements, on a scale of 1 to 5, where 1 is strongly disagree and 5 is strongly agree.

	1 Strongly disagree	2 Disagree	3 Neither	4 Agree	5 Strongly agree
Scientists who communicate a lot with young people are not well regarded by other scientists	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I don't have as much time as I would like to engage with young people	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Engaging with young people is personally rewarding	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel confident about engaging with young people	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I know about the National Curriculum and how it relates to my research area	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My research is too specialised to make much sense to young people	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I don't feel confident talking about science topics outside of my research area	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would not want to be forced to take a public stance on the issues raised by my research	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The views of young people will influence my research	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would need help from my institution to develop an outreach project	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Researchers should get more direct support (time or funding) for education outreach	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I know about Royal Society opportunities for education outreach	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I know about opportunities in my region for education outreach	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

19) Do you have any other comments on education outreach and working with young people?

Thank you for your time and enjoy the education outreach training.

6.1.2. Post Questionnaire

Training Course

20) As a unique identifier in case you want to withdraw your questionnaire from the study, please enter your date of birth:

Day _____ Month _____ Year _____

21) Please rate your experience on the training course on a scale of 1 to 5, where 1 is Not at all and 5 is Completely.

	1 Not at all	2	3 Moderately	4	5 Completely
How well did this training course meet your needs and expectations?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How much did you enjoy the training?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How suitable was the classroom style of the course for this type of training?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How useful was the break in training days to allow time for experience?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How much would you recommend this course to other researchers?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

22) **Thinking about your experience of the training course, please indicate below if you would have liked..?**

	Less	About the same	More
Time to learn theory about education outreach	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Time to practice outreach hands-on activities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Time to brainstorm your ideas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Time to plan and rehearse your own outreach activity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Time to experience outreach with young people	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Time to meet and discuss outreach with other researchers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Time to learn about education outreach support networks to connect with after the course	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

23) **How well equipped do you personally feel you are now to engage with young people about your research?**

Not at all ☐ equipped Not very well ☐ equipped Don't ☐ know Fairly well ☐ equipped Very well ☐ equipped

24) **Do you have any other comments about the training course?**

Experience

25) **Do you have any comments on how organisations like the Royal Society can help researchers undertake education outreach or public engagement?**

26) **Have you visited an Associate or other school during or after the course?**

Yes ☐ No ☐

27) Have you signed up to visit an Associate School or other school in your region?

Yes ☐ No ☐

28) Do you plan to visit that school, or another one soon?

No ☐ In the next month ☐ In the next three months ☐
In the next six months ☐ In the next year ☐

29) If you have not or do not plan to visit a school, please let us know why. Have you, or will you, gain experience in any other way?

30) Please rate the potential of your paired school experience on a scale of 1 to 5: (where 1 is Not at all and 5 is Very)

	1 Not at all	2	3 Moderately	4	5 Very
How useful overall was it to work with an Associate School?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How much has this practical experience met your needs and expectations?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

31) If you visited your paired school, please rate your experience on a scale of 1 to 5: (where 1 is Not at all and 5 is Very)

	1 Not at all	2	3 Moderately	4	5 Very
How easy it was to organise your activity with the school?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How helpful was the teacher when undertaking your activity?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How easy was it for you to engage with the pupils?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How useful overall was it to work with an Associate School?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How much has this practical experience met your needs and expectations?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Activity Outcomes

- 32) During the course you designed an activity for young people. Please briefly describe your activity.

- 33) Outreach activities can result in a number of impacts on young people and their communities.

Please rate from 1-5, as honestly as possible, the impacts you think the activity you have designed has achieved or will soon achieve. If your activity didn't have an impact listed, please rate it as not important.

In this question STEM refers to the general concept of 'Science, Technology, Engineering and Mathematics'.

For the young person:	1 Not achieved	2	3	4	5 Completely achieved
Improved knowledge of your research area	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Improved understanding of the research process (working scientifically)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increased confidence studying STEM	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Improved understanding of societal views on your research area	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Improvement in school grades in STEM	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Raised aspirations to continue studying STEM in school	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Raised aspirations to study STEM for a career	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Changes to behaviour discussed in the outreach activity (e.g. improved diet)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Improved skills practised in outreach activity (e.g. experiments)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increased enjoyment of STEM	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increased involvement in STEM extra-curricular activities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

34) What feedback did you get from the pupils or teachers on your activity and experience?

35) Do you have any other comments on your outreach experiences?

Your future

36) From the list below, please rank the most important things you think you have achieved for your professional development from taking part in training on education outreach (where number 1 is the most important thing).

For your professional development:

Improved your knowledge of the school curriculum	_____
Improved your understanding of communicating with young people	_____
Improved your understanding of public views on your research area	_____
Increased your confidence in engaging with young people	_____
Raised awareness of your research area	_____
Increased support for science and engineering	_____
Improved your communication skills	_____
Gained experience of public engagement	_____
Enjoyed communicating your research	_____

37) Please rate your agreement with the following statements, on a scale of 1 to 5, where 1 is strongly disagree and 5 is strongly agree.

	1 Strongly disagree	2 Disagree	3 Neither	4 Agree	5 Strongly agree
Scientists who communicate a lot with young people are not well regarded by other scientists	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I don't have as much time as I would like to engage with young people	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Engaging with young people is personally rewarding	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel confident about engaging with young people	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I know about the National Curriculum and how it relates to my research area	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My research is too specialised to make much sense to young people	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I don't feel confident talking about science topics outside of my research area	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would not want to be forced to take a public stance on the issues raised by my research	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The views of young people will influence my research	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would need help from my institution to develop an outreach project	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Researchers should get more direct support (time or funding) for education outreach	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I know about Royal Society opportunities for education outreach	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I know about opportunities in my region for education outreach	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

38) Have you learnt any other transferrable skills through taking part in this training?

39) **Following this training programme, please rate how active you think you will be in public engagement over the next 12 months.**

Less active ☐ About the same ☐ More active ☐

40) **How many public engagement activities aimed at young people (aged 18 and under) do you think you will take part in over the next 12 months?**

None ☐ One ☐ 2-3 ☐ 4-5 ☐ More than 5 ☐

41) **Do you have any other comments on education outreach and working with young people?**

Thank you for your time.

6.2. Appendix B: Interview Schedule

	Core question	Prompts if needed
Icebreaker	First of all, please would you tell me about your research area?	Which area of science do you work in? <i>Engineering and Physical Sciences Biotechnology and Biological Sciences Science and Technology Facilities Medical Research Natural Environment</i>
		What do you specifically research?
	Prior to the training, what was your experience of education outreach?	What education outreach have you done before the course?
		What experience did you have of working with schools?
Outreach Attitudes	Let's start thinking about the goals of education outreach. These questions are about your thoughts and experiences prior to the training.	
	What were your aims for doing education outreach?	What impact did you think it would have on you and your research?
		What impact did you think it can have on young people?
	How confident were you about doing outreach?	How did you feel about engaging with young people?
		How much did you know about education outreach?
	In your view, how well supported are researchers who want to take part in education outreach?	How does your department support outreach?
		What about Royal Society schemes? What about other drivers like REF, Impact and funders? Do you think it's valued?
Training	Now let's think about the training itself.	
	Why did you want to do the education outreach training?	What did you want to learn from the training?
		Which skills or knowledge did you feel you could improve on?
	Tell me your thoughts on the training course in terms of its strengths and weaknesses.	What were the good areas?
		How could it be improved?
	How much do you think the course has met your needs?	How has it met your goals?
		How much did it cover all the areas you wanted to know? What do you think you learned? What skills do you think you have developed?
Schools	Now let's think about the education outreach experience.	

	Tell me about your experience with the Associate School you were paired with.	What has the organisation process been like?
		If you have not been in yet, why not?
		When are you planning to visit or get more experience?
		What was it like working with the school?
	Describe your outreach activity and how the young people responded to it.	What did you aim to communicate through your activity?
		How did you feel doing the activity?
		How much did you enjoy working with the young people?
	How much did you get to apply the knowledge you gained from the training?	What knowledge, understanding or skills did you put into practice?
	What difference do you think your activity has made to the school community?	Changes in confidence, knowledge, attitude, skills, behaviour, enjoyment?
		Do you think you will work with the school again?
	What are your thoughts on the Royal Society Associate Schools system?	How worthwhile is the scheme?
		How well communicated do you think the scheme is?
		Do you think it could be improved?
Future	Let's think about the impacts and future directions for education outreach.	
	What impacts do you think the training has had on you?	What knowledge, understanding or skills have you gained?
	Being a Royal Society representative, how did you feel about being viewed as a general scientific expert?	Are you confident extrapolating knowledge to wider scientific issues?
		How did you feel about tackling questions outside your research area?
	Will you stay involved in education outreach?	In your view, would your university be supportive of this?
	What suggestions would you have as to ways that the Royal Society might help you?	
	What resources will you access to help you?	
	Any other comments	

6.3. Appendix C: Qualitative Themes and Codes

Theme	Code	References
Importance of outreach	Influence the influencers	26
	Inspire next generation	47
	Societal need to engage	22
	Women in science	10
Outreach support	Associate Schools	30
	Conflicts with research work	38
	Future plans	25
	Royal Society	50
Personal development	Advice for starting out	27
	Developing other staff	10
	Improvement on experience	36
Training course	Feedback on own activities	16
	Knowledge and skills	34
	Overall scope	30
	Participant discussion	21