PERFORM

Evaluation of training for Early Career Researchers in Year 1

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Contents

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1 Remit and Purpose

This report is produced by UoB within task 3.2 Development of training and guidelines for researchers. It represents the commitment within that task *to provide formative and summative evaluation of the initial training for researchers (which) will inform the development of a second training course to ensure the design and content are appropriate and that the training is effective.*

1.1 Background

The overall aim of the training for researchers is to *provide an appropriate education to Early Career Researchers (ECRs) that will allow them to develop cross disciplinary skills such as communication and engagement skills, team working, a more holistic and interdisciplinary understanding of research including RRI values and social inclusion* (Objectives of WP3, DOW, p. 40). The skills that PERFORM aims to offer to school students are transversal competences, and a further aim of the training is to enable researchers to *effectively transmit the transversal competences*, as is stated in the Description of Work, section 1.2, p.6

> PERFORM will provide the students with the transversal competences they will need for being successful in science careers and related jobs (…) fostering students' 1) sense of initiative and entrepreneurship (i.e., creativity, critical thinking and innovation), 2) social and civic competences (i.e., team work, collaboration, social responsibility) and 3) learning to learn (i.e., self-reflection, scientific method-approach). Such competences are significantly linked to the above mentioned RRI values (…) *To ensure that secondary school teachers and early career researchers effectively transmit such transversal competences, PERFORM (...) will provide them with appropriate education and communication skills*.

It was envisaged that the training provided to ECRs would include:

> training in social aspects of science and reflexivity on the research practice, performance skills, communication skills, working with teenagers, working with schools, gender equality issues, and ethics amongst others (DOW, Task 3.2. Development of Training and Guidelines for Researchers)

PERFORM also undertakes to provide ECRs with opportunities to participate with school students. Interaction between ECRs and students in these contexts are expected to link students with *real science*, and *provide students with the values embedded in RRI*, as follows:

> PERFORM will facilitate direct interaction inside and outside the classroom (i.e., research centres) between secondary school students, their teachers and early career researchers by using performance-based science education methods, as a mean for linking young people with real science. Such interaction (…) will also provide students with the values embedded in RRI (i.e., creative thinking, gender equity, inclusiveness, openness, and mutual learning) since they are key to enhance the current educational process to ensure students' joint engagement in STEM. (DOW, 1.2)

The outcome of the direct interaction is anticipated to provide learning opportunities for the ECRs that will complement the training, as follows:

> The complete participatory process will generate a mutual learning scenario providing young people with basic knowledge about STEM, performing skills and transversal competences while teachers and early career researchers will realise about young people's interests and concerns towards STEM (DOW 2.2 Measures to maximise impact, p.27)

These processes will lead on to a further process during which toolkits will be produced:

> training modules and guidelines for researchers and teachers … to develop cross disciplinary skills associated with the PERSEIAs such as communication and engagement skills, team

working, a more holistic and interdisciplinary understanding of research including RRI values and social inclusion, amongst others. (WP3 objectives, DOW, p.40)

1.2 Process of Development of Training for ECRs

As WP3 leader, University of Bristol (UoB) organised activities to identify key skills, knowledge and methodological approaches that would foster secondary school teachers' and ECRs competences, specifically those that would be appropriate in developing performance-based activities to encourage young people's interest in science. These activities were (1) informal conversations with teachers (2) informal conversations with ECRs and (3) a five-day knowledge-sharing workshop with consortium members described below.

1.3 Knowledge Sharing Workshop

The Knowledge Sharing Workshop took place in Bristol in April 2016 and included discussions and debates about topics from participation to reflexivity. Ninet different partner organisations (UoB, AJA, LAC, SMS, TBVT, UNESCO, UoW, UAB and UOC) were involved. Within the workshop, preparation for the training that would enable ECRs to develop traversal competences took the form of an induction for the partners into RRI and into participatory methods and approaches. Specifically,

- UoB ran sessions on performance-based activities and RRI values
- AJA provided sessions for internal sharing of knowledge and ideas on reflexivity
- UAB and UOC facilitated an information and discussion session, designed to facilitate a common understanding of RRI within the project.

The aim of these activities were to provide a common understanding of the issues related to reflexivity as well as RRI, to improve the capacities of all partners to communicate appropriately on the project and to open perspectives for performers to design PERSEIAs that addressed issues related to RRI and reflexivity with their public.

1.4 Refinement of training plans and proposals

Subsequently, UoB held discussions with ECRs, using the topics discussed during the workshop as a framework. In collaboration with AJA, LAC, UAB and UOC a first version of the topics to be tackled in the training for ECRs was produced. This was further refined during meetings held via Skype in June 2016.

Aims of the training on RRI formulated by AJA were stated as follows: The participants at the end of the training shall be able to answer the following questions :

- *How is my research embedded in social practices, norms and values of the scientific community?*
- *What are my responsibilities towards society?*
- *How my reflexivity on the issues above will be translated in the way I communicate about science?*

Having reached agreement, AJA, UAB/UOC and UoB then developed detailed training programmes to be held in Paris, Barcelona and Bristol, to include the RRI training developed by AJA and also training on communication skills. In accordance with the Description of Work it was agreed that in each case, Early Career Researchers participating in the training would be invited to, and expected to be involved in Participatory Workshops in secondary schools in the cities in which the training took place.

1.5 Training in Year 1

1.5.1 Approach used in each of the three cities

Paris

AJA and LAC outlined a first version of the training program and established contact with graduate schools in Paris to include the training within a catalogue of trainings for their PhD students.

Given the already wide range of engagement training available to researchers in the French system, AJA planned a 3 days' intensive course focused on developing reflexivity on one own research practice, and involving the performers as participants in this training as well as trainers (facilitating the development of ECRs own ideas for performance with school students).

The vision for the training in Paris was that the objectives should be understood by the participants as being within the framework a research project and that to therefore the training was to some extent experimental. The essential core was RRI, and the training enabled those involved to explore the potential to produce performance a style dialogue around science with teenagers, framed by the values and ideas in RRI. A further essential part of the project was collaboration between artists with experience and expertise in performance, and researchers at the beginning of their academic careers. It was emphasised that as well as having expertise in their domain, Early Career Researchers were people who would to be more reflexive about their own practice, and also better able to present and discuss their practice with school students.

Barcelona

UAB and UOC collaborated with UAB's Institute of Education (ICE) to explore local training possibilities and constraints including the needs of students, the most useful topic areas and the logistical arrangements. The Head of Strategic Projects within the Research Executive Administration of the UAB (CEI) is also part of the process to establish synergies with other UAB university trainings and foster its sustainability after the PERFORM project.

ICE and the UAB postgraduate school were enthusiastic about the proposed training since they are interested in fostering RRI and transversal competences trainings and advised that the training should be designed to ensure that all interested researchers could attend, in order to maximise the value of the RRI to other postgraduates at UAB. This facilitated the support from UAB which in turn facilitated an extended distribution list and the creation of a call in the webpage and follow up.

The final arrangement was a 15-hour training programme which consists of four theoretical plenary sessions of 90 minutes, opened to all interested PhD students and postdoctoral researchers, with four practical sessions of 90 minutes; the latter part was open only to those students interested in being actively involved in PERFORM's project activities (15 students maximum).

The first part of training was entitled 'Responsible Research and Innovation: how to maximize the local impact of my research?' four theoretical plenary sessions of 90 minutes, including a range of aspects related to RRI's framework and approach (delivered by UOC/UAB), Participation and Engagement and Philosophy and Ethics of Science (UoB) and Reflexivity and Responsible Communication (AJA). During the first session, researchers were also presented with information about PERFORM's participatory process in schools and the use of stand-up comedy in science education with young people (delivered by the TBVT).

TBVT delivered the second part on performing arts and work with schools; four practical sessions of 90 minutes, open only to those students interested in being actively involved in PERFORM's project activities (15 students maximum).

Bristol

UoB worked with training specialists at the university including the Bristol Doctoral College and the Academic Staff Development Team, discussing ways in which to make the training attractive to and appropriate for early career researchers. The proposal for training in RRI was welcomed because it was perceived by the training specialists that at that time, training available to early career researchers

at UoB did not include sufficient RRI, and that there was an opportunity for the PERFORM project to provide a legacy in terms of training in this area.

These training specialists advised using a cohort approach, devising a 'cool project' and emphasising an opportunity to develop new skills, to participate, to work with teachers and in schools. To give more detail, the advice was for the cohort to meet weekly, for seminars to be held over the lunch period, and to include team work and reflecting, with consideration given to the possibility of a showcase for colleagues and professors, to share and exhibit the learning.

Training was devised to provide a wide and holistic body of knowledge and preparation for engagement work in general, as well as a grounding in the participatory process that this project is exploring. The key areas of interest in the UK training were philosophy and ethics of science, communication skills, working with schools and children, and practical and theoretical approaches to RRI. The model of training involved a talk by an expert in a particular area, utilising expertise from across the university, followed by a practical workshop where researchers were invited to reflect on the day's topic in relation to their own work.

2 Recruitment of ECRs

The process used in each of the three countries was very similar. In each case, emails were distributed through central mailing lists to PhD students at appropriate universities (in Spain, to two universities in Barcelona; in France to the multi-university networks and a multi-disciplinary graduate school, both in Paris; in the UK, solely the University of Bristol). Considerable efforts were made to publicise and recruit ECRs, as described in detail below.

Paris

FRANCE: The training was presented to researchers via an agreement with one graduate school (Frontières du Vivant) and two multi-university networks (Paris Science Lettres and Sorbonne Paris Cité - CFDIP), which between them access fourteen universities.

The researchers were able to officially validate their training hours, which is significant since PhD students in France have to take around 30-50 hours of training every year. Despite the offer of accreditation, recruitment was expected to be difficult, not only because of the relatively unusual nature of the topic and level of involvement required in training, and the challenge of working in schools, but also because of some structural issues such as the timing of the training (November) taking being very early in the researchers' first year of doctoral training and being offered as an option amongst other training that is potentially preferred by students – e.g. training in speaking and writing in English; and because there is no redress on students if they register for a course and then fail to attend.

The call for participants is at http://cfdip.uspc.fr/fr/formations/catalogue-des-formations/outils-methodes/ethique-integrite-scientifique/item/321-reflexivity-in-science-for-a-responsible-communication-of-science-strengthen-the-educational-outreach-of-your-academic-activity-contribute-to-theatrical-performances-about-scientific-research-2016-2017. Information circulated is to be found in Appendix 3 and the full schedule of training is in Appendix 1

Barcelona

The training was approved by the UAB postgraduate school and made available to all PhD students at the UAB, as well as to all students and academic staff at ICTA-UAB and at UOC. Information was disseminated by internal channels (email, posters, reminders) at the universities and also through channels beyond the UAB, such as the students' list of ICTA, UOC and TBV. It was made clear that the call was open to students and postdocs from UAB and outside. Registration was initially run by the UAB postgraduate technical team using UAB Campus, part of its own moodle system; later, following some technical problems, an alternative registration channel was introduced to facilitate the enrolment of non UAB postgraduates.

The training at UoC and UAB was entitled 'Responsible Research and Innovation: how to maximize the local impact of my research?' and included a range of aspects related to RRI's framework and

approach (delivered by UOC/UAB), engagement and philosophy of science (UoB) and reflexivity and responsible communication (AJA).

The call for participants is at http://www.uab.cat/doc/doctorat-activitat-transversal-PERFORM-project-uab-es.pdf and http://www.uoc.edu/portal/en/agenda/2016/agenda_561.html and in Appendix 3; the timetable and content for the delivery of training is in Appendix 1

Reminders were sent out before each sessions to: i) UAB's distribution list (around 2.000 PhDs), list of students who had made the online registration for the training; iii) UOC distribution list, iv) ICTA distribution list, v) students participating in PERFORM. The information on the training was also updated in UAB's and ICTA's page.

Bristol

Advertising for early career researchers to join the cohort began in October 2016 using university wide distribution lists (Doctoral Training and the Academic Staff Development network) and distribution lists for groups and individuals considered to be potential interested parties. An informal application process was included, which took the form of a short email to the UoB PERFORM co-ordinator explaining their interest in the training project.

Information circulated is to be found at http://www.bristol.ac.uk/public-engagement/projects/our-projects/perform/ and in Appendix 3), and the full timetable and scheduling is in Appendix 1.

2.1.1 Registration and Attendance

Registration and Attendance				
	Paris	**Barcelona**		**Bristol**
Total Registrations	**15**			**8**
Attendance for session no:		Theoretical sessions	Practical sessions	
1	3	50	26	7
2	3	8	6	7
3	3	?	?	7
4		11	8	7
5				7
6				7
7				8
Are credits given for attendance at session?	yes	yes	no	no
Notes	In Paris, Workshops in Schools took place some weeks after the week during which RRI sessions took place	In Barcelona, Theoretical (RRI) sessions were open to all students. Practical Sessions were attended by the ECRs who took part in the full training, including the Participatory Workshops in schools.		In Bristol, Workshops in Schools took place at intervals between the 7 sessions on RRI and communication skills

Issues that were identified with recruitment and subsequent attendance included:

- Difficulties or perceived difficulties in making sustained time commitments including travel time to schools
- Scheduling of sessions at times that were required by the schools producing requirements for ECRs to attend at unusual or problematic times
- For some Science ECRS, there are that individuals provide their supervisors with justification for time spent away from laboratories. In this case, a supervisor's perceptions of what training is more valuable or appropriate supersedes the ECRs own preferences or interests, which means that potentially interested ECRs do not ultimately register.
- In some situations, there is a preference amongst students for courses that bear accreditation without the investment of substantial time commitment and therefore the opportunity presented by PERFORM is not appreciated.

3 Evaluation

1.1. Aims

The purpose of formative and summative evaluation of the initial training for researchers is to inform the development of a second training course, and its aim is *to ensure the design and content are appropriate and that the training is effective (task 3.2 Development of training and guidelines for researchers).*

The questions for the evaluation, of the RRI training and other elements including communication skills, are:

- Is the content of the training appropriate for the development of a more holistic and interdisciplinary understanding of scientific research including RRI values and social inclusion amongst ECRs?
- Is the content of the training appropriate for the development of communication, engagement and team working skills?
- Which elements of the design were perceived to worked well, by the Early Career Researchers who participated in the course? Which elements did they perceive to work less well?

3.1 Relevance to other Work Packages

The training for researchers includes not only science education and communication capacity, including transversal competences (the domain of WP3) but also innovative science education methods (the domain of WP2). Therefore this report includes material that is relevant both to WP2 and to WP3, and to some extent there is duplication of material in other reports, which is indicated in the text.

3.2 Methodology

The data collection methods in line with an interpretivist paradigm1: researchers seek to gain an understanding and to attain the meaning that others attach to their experiences and situations. It involves the researcher placing themselves close to those being researched to enable the depth of interpretation necessary.

The nature of information that is collected in each country is interdependent with the model used for training in each country, as is made clear in the following table which summarises the model used, the focus of interest and the data collected in each location.

[1] Smith, J. K. (1983). Quantitative versus qualitative research: An attempt to clarify the issue. Educational Researcher 12(3) pp 6-13

	Model	Consequent focus of interest	Data Collection
Paris	Training was held over three consecutive days Trainers: 2 experienced trainers in RRI and reflexivity in science and 3 performance specialists Participatory Workshops in schools took place some weeks later.	*The development of the **process over the three days*** and its effectiveness and value from the point of view of those who planned and presented the session, as well as the ECRs	Evaluators and organisers were present throughout and able to view at first hand Feedback invited from ECRs at regular intervals Discussion session between organisers, trainers and evaluators immediately after course
Barcelona	Variation of locations Variation in the group of ECRs and the numbers of other students and researchers Variation of formats Variation in academic identity of people presenting Participatory Workshops took place during the same period	The experience of individual sessions and their effectiveness and value of from the point of view of those who planned and presented the session, as well as the ECRs	Observation by member of organising or training team using observation sheet supplied by UoB (see Appendix 3) Structured discussion between ECRs, organisers and WP3 team at end of training period
Bristol	Structure was constant week to week same group of ECRs same time specialist academic lecturer discussion amongst ECRs and co-ordinators following presentation Sessions interspersed with Participatory Workshops in school	The experience of ECRs of the process and their perceptions of the ***training as a whole*** and also from the point of view of those who planned and presented the session.	Reflective Diary completed by ECRs over the course of the training period Structured discussion between ECRs and WP3 team at end of training period Observation of sessions by WP3 team members

3.3 Analysis of data

Interview transcripts and supplementary material (observation sheets, notes from meetings and reflective diaries) were analysed in accordance with a method described by Braun and Clarke (2006)[2]. The thematic analysis begins with a researcher becoming familiar with the data: transcripts and other material are read and re-read, searching for meanings and patterns. Through an iterative process of coding and recoding, the specifics of each theme and the overall 'story' of the analysis are refined.

[2] Braun, V. & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3, 77–101.

4 Findings

4.1 The design of the training is important for its success in delivering 'transversal competences'

The use of a design for training that enabled group discussion appeared to underlie some of the success of the training; and the value of this increased when the participants had developed a sense of trust through getting to know one another and particularly through shared experience. During the discussions held after the training with Bristol and Barcelona, the ECRs emphasised the importance of the steps taken to achieve and develop a sense of ease in discussing and reflecting amongst the group. The extracts from interviews given below show the value they had attached to the opportunity to reflect, to consider the barriers and possibilities for facilitating this as a practice in science research, and to identify themselves as potential agents for change. In the words of one participant: *Providing time and space for thinking about different topics was the best part*.

This finding is also true for the ECRs in Paris, where the group was very small and the course involved all present sharing their experiences, including and particularly a session in which each person, beginning with the trainers, related their stories of how elements of their life experience had been significant in shaping their own standpoint, and what congruence and conflicts they had noticed between their own standpoint and the culture of science that they encountered through their education, their working practice as trainee researchers and/or researchers, and in everyday discourse.

The value of an atmosphere that supported discussion and reflection

A frequent comment made by ECRs in all countries was that contact with other researchers and an atmosphere that supported discussion and reflection was unusual for them in their working lives. This was something that they found it particularly valuable.

The extracts given below, which taken from group interviews with ECRs in Barcelona and Bristol, detail the specific aspects of the arrangements that PERFORM had provided combined to enable this context for reflection.

During the final session of the course that took place in Bristol, which was held for the purpose of reflection and feedback, the ECRs continued to discuss the issues that had been raised during the course. An extract is included that illustrates the way in which this group of ECRs explore the culture of science practice and share their insights on the problems of instigating change, and their own role in effecting that change.

Time for thinking away from the lab

The ECRs valued the provision of time and space and the bringing together of different researchers. The following extract is taken from the discussion amongst ECRs in Bristol:

ECR1, Bristol: Providing time and space for thinking about different topics was the best part. Because when I'm in the lab or doing research or so forth I don't have to think about all these things and I don't talk about them. Even if I do the conversation would be with only the people I work with, so there's no diversity of the ideas. It was really nice to come here and see how different sub discipline of science find this stuff, all the gender, ethics and philosophy of science and all those things

ECR2, Bristol: This ability to reflect on a process is totally alien to me, we don't do this in any part of our science. We have meetings where we just sort of bat ideas backward and forwards, there's no actual thinking about the process. So this has been amazing for me as well.

Interviewer: Is that true for all of you?

ECRS: (multiple agreement)

ECR1, Bristol: I'm talking about the meta process.

ECR3, Bristol: Even now, like this session.

ECR1, Bristol: And every time we've spoken about the sessions after the sessions, about what it means in terms of the Perform project, I really enjoyed that aspect of it, like engaging with the social research element of it. That's been incredibly valuable for me (…) Yeah, the reflective diary, those things were amazing, doing those sort of things have been really, really interesting for me.

ECR4, Bristol: I think I have to agree with being able to reflect on things. And also the workshops themselves, they're kind of – I actually felt kind of good that people came just for us and to talk to us and present things. And it was really valuable to hear them talk and also to have the discussions afterwards.

The composition and size of groups

The success was also attributed to the fact that groups consisted of people from different disciplines

ECR, Barcelona: It was good that you took us out of uni and our daily... I mean, we always speak how to lecture geology to geology majors but never to people like what is a plaque tectonique, no sé.... Trying to deconstruct our knowledge. It was very... for us, just to get away from the daily things and see that it has many dimensions, not the only one you are focused on.

It was also considered relevant that the groups were of small size and mixed gender

ECR, Barcelona: …when we were like this, in a small table, and we could discuss, for example, where do your morals come from, your principles... Because you would expect that everyone would say a similar thing and we had completely different ways... Also was there were people from England, people from Spain, we realised that where you had been raised, it changes a lot, and being a woman, being a man... We realised of all those things. And I like those subjects, I discuss them often with people, but being able to discuss it with people I don't know and who work in a quite similar thing like me it was good. And yes, just for gathering other PhD students together, it doesn't happen very much, you only see the people you work with.

The co-ordinators in Bristol had invited all the ECRs to meet one another and the WP3 team over a social event beforehand. Asked whether they felt that this had been useful, they commented that getting to know one another had facilitated discussion

> **ECR2, Bristol:** I think it's nice. It kind of took away from just being training to something a bit more social. I don't know, yeah.
>
> **ECR3, Bristol:** I was just thinking when you mentioned started with the philosophy of science stuff (…) but in terms of the discussion that maybe that's actually a thing that's better to happen once people have got to know each other a little bit and are comfortable.

In the course of the discussion itself, the ECRs began to reflect on the culture of science research

ECR1, Bristol: It's going to sound really weird but one of the things that I've also really enjoyed is working in a group like this, like being the only guy here. In terms of that gender equality, I actually miss that session. (Laughter) In the sense that it's been like – our lab is fairly heavily male dominated and the male environment in science in terms of that attitude, what I'm talking about is the masculine methods and how we discuss ideas and how work is done, this is a totally different process, and it's a thing that's been incredibly valuable.

ECR2, Bristol: In our thing, we're all in our lab but we're all working on different things. So you've got PhD students and postdocs and research technicians and then the Principle Investigator, the professors. But we're all working on different projects coming under the same sort of subject area. When we get together for a lab meeting everyone discusses their work and we go round the table and other people get to make suggestions about it. It's all particulars of those different projects that are going on.

But to actually be reflecting on, I don't know what you'd reflect on, I think it's a culture thing.

This led to discussion of what the impediments to a change in practice, and how cultural change might happen:

Member of WP3 team: Learning to teach is itself a reflective practice model. When training science teachers, we ask our students to read a chapter on reflective practice amongst science teachers[3] which explains that the discipline of science lends itself to not being reflective; scientists are normally what we call dualists. In other words, if something doesn't work you reject it, because that's the positivist scientific method, to reject it. That's not helpful for teaching, that approach. So, scientists do struggle with the nuanced reflection that's needed. It works or doesn't, and just reject things.

ECR4, Bristol: It's like we lack – at least I lack like expressive feelings, expressing how you feel about the career, like everything. We don't normally speak about these things with our supervisors or even in the group. Everyone feels the same, everyone has imposter syndrome, everyone feels like – like all of us. But people do not tend to share.

ECR6, Bristol: I ran a discussion group in my last department which started as a lean-in circle. It was a discussion group on gender issues initially but we also had imposter syndrome and unconscious bias and things like that. My point is that you only really had women at it and you also only really had the articulate women. So it's really, really hard to get people to talk about these things

ECR4, Bristol: I guess it's a self perpetuating thing, like if you don't see more senior people or people who are just slightly ahead of you talking about this stuff then you're not going to do it, because it's showing vulnerability, and if no one ahead of you does that

ECR5, Bristol: that's why I think this is important. Because it's these discussions that bleed out and hopefully change the culture, because it's got to come from the roots up. It can't come from the top down because anytime you talk to our Principle Investigator about these things, he's like, "Just go do some more writing."

The ECRs were quite explicit about the nature of the impediments to change

> One of the major problems is that research groups tend to be quite isolated from each other, it's almost like they're autonomous within the university. And even if you had some kind of departmental thing, say we want to work on getting people together to discuss these common issues, there will be PIs who will say, "No, we don't have time for this, we have more important things to do, to get that Nature paper published." I've seen that a lot of friends who've been doing PhDs in groups and have been deeply unhappy because – this is just an example, where one of my female friends was in a mainly male dominated group and the PI was male, and they were very – well, sexist basically towards her. And the PI didn't do anything and she didn't feel like she could talk to anyone because he was like the big PI. And she complained and they said, "Well, sure, we'll look into it," but then ultimately they gave the PI a secretary or something to keep him here. There's these kind of things, and I think – and it's not just for gender issues, I think it's all kinds of issues, I think that's a real big roadblock to actually having this kind of open environment where people feel like they can share.

4.2 Institutional factors supported ECRs' interest in the training on RRIs

For some ECRs there were institutional reasons for wanting to learn about RRIs: the stated benefits for them included grant proposals, accreditation for attendance at course (as discussed in Registration and Attendance on page 4); and also wanting to develop other skills in order to have the option of a career outside science.

> **ECR, Bristol:** I really enjoyed the philosophy of science, ethics and the RRI talks and discussions. Just because it was great to be given time and space to think about that, because you're never given that as a scientist, but it's all so useful for your career and for your grant applications and for things like that. It's really pertinent to our research but so often gets ignored.

[3] Malthouse, R. & Roffey-Barentsen, J. (2014) A*re science teachers immune to reflective practice?* in Watts, M. (Ed). Debates in Science Education. Routledge

ECR, Bristol: I would also say the RRI, because that's useful for grant applications, so I don't know how you could put in that, but something like that. Learn about writing impact statements and about communicating your research to a lay audience. Because if you phrase it like that, those little things that people need to do.

ECR, Bristol: I also think everything around RRI and philosophy for a lot of people it's just something you tick off. You have to include it, you just say, I'm going to meet with patients, I'm doing this, and it was just – because you don't really have the time or necessarily the understanding of what it's actually for – I mean, obviously you understand why you should engage with people, but really the crux of why that would be beneficial to you as a researcher isn't really clear.

ECR, Bristol: I think having that session to talk about it, and I understand – even if it's very vague and some of it is maybe a bit they're just trying to, you know, put some kind of governance, just so they can have it written down rather than it being actual guidelines, I think it's still really important to have the opportunity to talk about it and get a bit of an understanding why that might be beneficial.

4.3 The RRI training elements were broadly successful

The data collected from participants and from the organisers of the training suggest that the RRI elements were successful and well received. In Bristol, this was especially clear to see in the extensive discussion amongst ECRs (given earlier) and in the comments provided in their diaries:

(Reflective Diary comment from one Bristol ECR) I had not been aware before this talk that RRI is a well-defined framework developed by the ERC. Some of the details of that were of course a bit dry, but overall it was interesting to see what is considered "responsible" in research. The idea of thinking about and engaging with this topic is of course good, though the framework does seem flawed in various ways, e.g. the focus on marketability and on properties that can be easily measured, as well as the binary perspective on gender.

Nevertheless, I did find it useful and interesting. I had not encountered the term "ethics dumping" before, though the concept is sadly not terribly surprising. The concept of STEAM was also new to me and I would like to learn more about it. Again, it would have been nice to have more time to discuss (which is also a part of RRI :))

(Reflective Diary comment from another Bristol ECR) I had come across RRI before, at a workshop at Science Museum London with other science museums from across Europe. It was great to get a really thorough description of it and to dive deeper into what that definition means for us as researchers. I'm still not sure I understand it though, the definition is so broad and the terminology is not "plain English"! The reflective tool on the RRI website has helped to get to grips with the different parts, and going over the slides again will help. I particularly enjoyed the discussion parts of this workshop - hearing everyone else's experiences of the different aspects around RRI was very interesting.

As has already been described, the trusting relationships enabled the ECRs to participate in discussion of the area defined as RRI, resulting in deeper understanding of the implications and dilemmas involved. The training was therefore successful in stimulating thinking about the issues as well as delivering content, and the ECRs therefore gained far more from this process than simply the ability to state on a grant application that they had undergone RRI training.

ECR, Bristol: But there was a real moment when we were talking about stats that I thought was really interesting actually. There was this real shared sense of there are things wrong with how we treat stats and how we use stats and that then relationship to what we're saying about scientific fact outside of the academy. And it felt like that was one of those conversations that just actually there was a real value to having it here, because this is a safe space to do that in, but if all departments were a bit more – but it kind of comes outside of just these issues of gender or just these issues of individual insecurities that everybody has. Actually this is directly impacting on how we're doing the job we're supposed to be doing.

In Barcelona, the organisers' impression was that:

> very few ECRs had had some prior training in philosophy, and that they had been engaged and stimulated during the session. Examples were thorough engagement during an exercise in the form of an ethical dilemma, discussion of the hierarchy of factors in deciding what is right and wrong and an exercise considering their own ethical views.
>
> introducing the ECRs to different ethical positions is of value as a grounding for understanding RRI, because it gives deeper understanding of what might be meant by 'right' and 'wrong' actions and 'responsible' and 'ethical' research, and enables ECRs to think about ethical considerations in relation to their own positions as science researchers.

In Barcelona as in Bristol, a small group size was perceived to facilitate this discussion and quality of thinking. However, the organisers also recorded that the design of the sessions also impeded the quality of the discussion. They stated:

> the division of the session into a lecture and discussion (the lecture was attended by more students, the discussion by fewer) effectively reduced the time available for discussion

4.4 For the ECRs, the workshops in schools and communication skills were more salient parts of the training than the 'RRI' elements

As was discussed in section 1.5 and shown in Appendix 2 the training made available to ECRs was made up of two parts, one of which was more directly concerned with RRI and communication skills, and the other was direct experience in the schools (termed Participatory Workshops).

In collecting information from the ECRs in Barcelona and in Bristol about their experience, one immediately striking finding was the salience, for them, of the Participatory Workshops in relation to other aspects of the training.

This pattern was seen in the contributions made by ECRs during group interviews, both in Barcelona and Bristol, during which contributions were primarily about their experience in schools. In both locations, interviewers found that they needed to ask additional questions and probe carefully to encourage discussion about the more theoretically based sessions.

The pattern can also be illustrated in the case of ECRs in Bristol. The members of the cohort of ECRs were asked to complete a reflective diary. The following table shows the numbers of diary entries from Bristol ECRs for each session that took place:

Training session or Participatory workshop (in date order). Sessions held at schools are in **bold**	**Reflective Diary entries (total)**	Diary entries about **Participatory Workshops at Schools**	Diary entries about Sessions on **RRIs**	Diary entries about Sessions on **Communication Skills**
Working in schools	5			5
First visit to school	6	6		
Science busking training	7			7
Second visit to school	4	4		
Communicating your research	3			3
Responsible research and innovation	3		3	
Science and society	3		3	
Third visit to school	3	3		
Ethics in science	3		3	
Final visit to school and performances	2	2		
		15 diary entries (of 28 possible)	9 diary entries (of 28 possible)	15 diary entries (of 28 possible)
		53%	32%	53%

The table shows that there was a higher proportion of diary entries for the workshops in schools and communication skill sessions; it also shows that the writing of diary entries was higher at the earlier stages of the training than later on. Reflective comments on the sessions on aspects of RRI (reflexivity, ethics, society) were provided by a relatively small proportion of the cohort. However, these provide detailed information on the ECRs experience and illustrate the high levels of interest of the ECRs in the content, and are found in Appendix 5.

A third source of data shows the interest and enthusiasm in discussing what had taken place in schools; this is the way that ECRs responded to the interest of the organisers in hearing about their experience, summarised in Remit and Purpose. During this final reflection session a member of the WP£ team wrote, on a board at the side of the room, the points that emerged from the discussion. It can be seen from the list that of 55 identifiable comments/topics, fewer than 10 focused on the subjects of RRI and other transferable skills. This is particularly noteworthy given that the ECRs had been asked to prepare for this reflective session by summarising the learning that they might present

to their colleagues in their academic department. To the surprise of the WP3 team, the information that each of them prepared and brought to the reflection session focused almost entirely on the Participatory Workshops (i.e. their experiences with working with young people in the schools), with little time given to discussing reflexivity, ethical, philosophical and societal aspects of the training.

Despite the foregrounding of their interest and experience in schools, the Bristol ECRs were clear that they found the reflexive, ethical, philosophical and societal aspects valuable, as the following extract from the group discussion shows:

> **Interviewer:** If we had advertised that we were going to run a short course on ethics, governance, gender and so on, would you have come? If it hadn't got the school stuff.
>
> **ECRs:** (Multiple people agree)
>
> **Interviewer:** Really? So to what extent was the opportunity to go into schools and do exciting stuff around performance an incentive to come? Was it part of it? Or—
>
> **ECR2:** I think that caught my attention but then understanding a bit more what it was about when I emailed (the organiser) to get a bit more about it, that was what made me apply.
>
> **ECR7:**I think for me, definitely the performance thing was the main.

4.4.1 ECRs expected that there would be opportunities to communicate science experience, science content and science practice with young people

It was clear from discussions in all three countries that the ECRs perception of the course was that it would include opportunities to communicate with school students about scientific practice, specifically their own research and the experience of becoming a science researcher.

In Bristol, the training began with a first session in which the nature of schools in England was discussed, and this included a discussion of the interests and orientation of teenage learners in schools, and the nature of the curriculum. Later in the series, there were sessions on communicating research to the public and on busking and performance skills. In this context, it was unsurprising that the ECRs had expected to gain some experience in communicating about their research and about science to school students. In common with ECRs from Barcelona and Paris, some considerable regret was expressed about the disjunction between the training and the role that they found themselves given in the participatory workshops:

ECR, Bristol: When I first applied for this programme, I thought our job was to go there and mostly do our research – like teach them about our research or more outreach sort of thing. I felt that was a bit lacking. We were there talking science but most of the time as I said I was also just there and kind of guiding them through the process, but not really talking about science/science. So I guess it'd be nice, as you said, like five minutes on each of our research to give that presentation

I found this quite frustrating, and I wondered if more engagement from us as researchers on our science would have helped us add actual science into the sessions. It felt a bit like we were all there but actually we were never really used as scientists. And I felt like we all have interesting research and we could all have done a five minute thing, getting them a bit more engaged about stuff that we do.

4.4.2 Reflections on the difficulties of communicating science in the classroom

ECRs in Barcelona attributed the lack of richness of the interaction between them and the school students to the dynamic that had been set up for the school students, or in other words, the way that they were introduced and the role that they were given when in the classroom, which was more like a 'special guest' than a researcher with something interesting that they were ready to communicate:

ECR1, Barcelona: In my group, Oriol tried to link a couple of times in the workshops that I was a early career researcher, 'Oh look at (name), she is an example...', but I think at the end the students didn't realise that I was a researcher. And I was not doing special comments or improvements, I didn't have a special role as researcher. And maybe is also my mistake in not having a more active role in the dynamic, but since you receive dynamics that are more or less done, and sometimes with few time before, it's something that you don't really participate in how the dynamic is worked.

ECR2, Barcelona: Well, we had a moment just to comment about our topic and that we are early career researchers and maybe we had the opportunity to say that, but I didn't say it, I didn't realise that... That's what I was saying, that I didn't prepare my intervention or my dynamic thinking what I should say also to engage them. It was more like "I'm doing research and that...", but not very empathetic with them.

ECR1, Barcelona: Well, we had three minutes to introduce ourselves so... [laughs]. Its not.

WP2 team member: ...much chance.

ECR1, Barcelona: No, I just focused in explaining what geology is mainly.

4.4.3 Reflections on aspects of training that could facilitate roles and communication

These ECRs considered whether this might have been different if some preparation work had taken place, specifically on working how to talk about their subjects to students, what kind of conversations might be useful, and what kind of questions to anticipate:

ECR3, Barcelona: for example, they asked me about some technique in the lab and my three minutes was talking about it, so... ok maybe if we know that, we could change a bit our speech trying to make it more personal. Also maybe just preparing the speech and maybe send it to the facilitator and say "ok, maybe this is not so personal or this is not motivating because you are just presenting your research, why don't you say things about when you were a child?". That could be interesting, just to have their feedback.

ECR2, Barcelona: One day one student asked me: but do you have your own life? And I was like yeah [laughs]. But I think we were not really prepared for that because after this question I realise that I say something that maybe if I knew before the dynamic and the possible questions, I would prepare better. So, for me, it was a very interesting process but my problem was that I was more curious, than thinking that I was really participating or contributing in something as special guest. The idea for example of having more information about the dynamics but with more than a week, like about the whole process, I think is a problem to think about your role.

> **ECR4, Bristol:** It would have been useful to have had more of the training before we first went into the schools, I certainly felt very out of my depth in the first school workshop and wasn't really sure what I was doing. There was this critical thinking thing we did with the students with the papers, and I just didn't think I did a very good job of guiding them into thinking about that. Because I hadn't spent much time thinking about it myself, I hadn't been able to look at the paper itself beforehand. So there was really no time to prepare anything much less think on a more meta level of how to teach about that.

4.4.4 ECR perceptions of the value of their contributions during the Participatory Workshops

> **ECR2, Barcelona:** I think that what was relevant about our role is that we were young people, so they didn't regard us as teachers and what was also good is that we spoke them quite plainly but also I think we watched quite a lot the language we used, tried to be critical, 'ok you don't have to say this like that...'. Because in the critical thinking session or in the stereotypic, in the gender stereotypes, for example, well I have my ideology in feminism and I could apply that. Not because I'm a scientist but because I'm a person that has been reading and has opinions about things. So, I think if I were not a scientist I could have helped anyway, in the same ways I did.

ECR6, Barcelona: I think that our contribution was like empathy with the students, like 'we are here, ask whatever don't be shy, we are not gonna mark you or anything...'. And then critical thinking, like 'why are you saying this? Are you saying this because you really believe it or because you have read here that they say that this is true...?'. Like to give a counterpart to what they are saying kind of.

When asked whether the training had helped them to engage with the students, the ECRs in Barcelona felt that this was something that could be improved:

WP2 team member: So I guess the question here is if in your interaction with students in the workshops, for instance in the critical thinking session or the gender session, the training or the reflections that you had during the training did help you engaging with the students, or, as you say, you didn't make the connection until now.

ECR2, Barcelona: No.

ECR4, Barcelona: It's difficult... Maybe it would be a good idea, to explain it a little bit during the training. "This could be good for the schools, because blablaba..." Sometimes it's true that maybe we should have this thinking, but if you make it more easy and more directly, for us is easier to make the click.

ECR1, Barcelona: I just went to two workshops and there were like a bit... Well, the first, the introduction one and then the other one, like critical... so it was a lot more abstract, not related to the day to day, I guess. It was useful, because I made myself some questions and then I could ask the students, but in the dynamics, no. I don't think it was addressed.

ECR4, Barcelona: I totally agree with (ECR1). I went to 4 or 5 and yes, for my own training and my own research it was really good, but not to interact with teenagers. Maybe I would add a training about how to motivate students, how to treat with teenagers, something more practical.

ECR2, Barcelona: Yeah, I agree. I didn't realise that this training was really related to the practical part.

4.5 ECRs were not successfully enabled to 'effectively transmit the transversal competences'

Barcelona and Bristol

As described earlier, one of the purposes of the training was to enable researchers to *effectively transmit* the transversal competences: "PERFORM will provide the students with the transversal competences they will need for being successful in science careers and related jobs (…) fostering students' 1) sense of initiative and entrepreneurship (i.e., creativity, critical thinking and innovation), 2) social and civic competences (i.e., team work, collaboration, social responsibility) and 3) learning to learn (i.e., self-reflection, scientific method-approach). Such competences are significantly linked to the above mentioned RRI values (…) To ensure that secondary school teachers and early career researchers effectively transmit such transversal competences, PERFORM (…) will provide them with appropriate education and communication skills." (Description of Work, section 1.2, p.6).

In Bristol and Barcelona, the ECRs commented that the Participatory Workshops had not been designed to make use of the other parts of the course (training on communication and creativity, critical thinking and innovation, team work, collaboration, social responsibility, self-reflection, scientific method-approach, as described in Appendix 1).

ECR1, Barcelona: I didn't realise that this training was really related to the practical part, like it was. Like the theoretical and practical part I remember it was more like to reflect on our research, but our research is nothing similar to what we are doing, no? Because if I don't remember bad, the training was about the three R's, this, like... ¿cómo se dice esto?

WP2 team member: RRI

ECR2, Barcelona: That's it. For me that is one thing, but to develop a monologue with students... It's true that it could be related, no? But...

ECR1, Barcelona: There are a lot of steps in the middle that we missed, somehow.

In expressing their ideas, ECRs in Barcelona made it clear that the two parts of the training could have been connected, but that the focus on creating a performance (monologues) in schools had closed down, rather than opened up, the opportunities for RRI-related discussions amongst ECRs and young people in the schools:

ECR2, Barcelona: And it's practical, this kind of training about how to motivate students or how to facilitate a conversation, if you have it is OK, but if we didn't have it before this workshop in the school... Yeah, I was thinking related to that... because I was doing the evaluation workshop there, that one of the objectives is to improve their skills, is not just to create the monologue. (…) I think another important thing is just to improve the abilities they have, like in a way try to communicate things, not just to do the monologue. And in this sense I think it could be interesting maybe to reflect in the social issues of the monologues, with time, and maybe not before the monologue, maybe after doing the monologue. Just to talk about these things, sexism, gender... I don't know, many things that were... Because when writing the monologue you can have examples to discuss with them and to improve later. Because its true that we were talking about gender and we didn't have more time to talk about other social issues or even gender, when they were developing the monologues.

WP2 team member: Did you share any of your personal knowledge or experience about your own career or the subject matter you work with?

ECR3, Barcelona: I would say half and half, not always. As Laura commented, at the beginning is true that you can explain your own experience and talk about your own work but when the teenagers took a topic is their topic, so you cannot change their ideas, so... Maybe in the first part yes, in the second part I think our role is more related to the methods, to be critics about the information, how to explain the topic within a monologue, this type of things.

Similarly the ECRs in Bristol experienced a disconnect between the two parts of the project. They had struggled to make a connection between the two parts of the project and to work out what the overall purpose was, and their role within it:

ECR2, Bristol: Perform in my opinion is a bit of experimental work to learn from kids and to feedback into them basically. Because, I mean, I think all of us had some opinions about it but we didn't really know what the angle was, I think it was really experimental in that respect.

ECR3, Bristol: I tried to summarise in a sentence what it was about and I found it really hard. I think one of the issues was maybe what we said about the kind of disconnect, there are so many different aspects to it that it's not really quite clear a little bit what the actual aim was.

ECR1, Bristol: I felt you guys had learning objectives for me to go out and learn about RRI and learn about ethics and philosophy and then to take those back to my lab and do as exactly you said. But then there were times where I felt like I was working with you guys to go into schools and do stuff with them. And I felt like maybe if our role was a little bit more defined in the sense that you are constantly learning, so when you're going to work with the kids you're also trying to learn about that and it's us being reflective learners. Or whether you wanted us to be more co-researchers with you in the sense that we want you to think about how you would communicate these ideas back to your team. That's just the overarching feeling I got about my role, I was unsure whether I was meant to be – in what way I was meant to be engaging with these things.

ECR4, Bristol: I think that's really how it felt to me, because that's – before asking you, I thought maybe this is on purpose, they wanted to experiment this, because it's so open, so undefined and learning and applying back in a constructive way. I guess this is kind of it, but there wasn't any statement really.

Paris

In contrast, the training in Paris, in which performance specialists (TRACES) had participated, had specifically worked to prepare researchers to communicate their research. In these sessions, TRACES led discussions about producing performances in schools and the ECRs began to discuss how they could use the materials from their specific PhDs for their performances, and were curious about seeing that happen in the school. As explained, the design of the training had helped to build a bond between the ECRs and the performers, enabling a sense of relationship and trust between them. In particular, the presence of members of the performance experts in sessions on standpoint theory, in which each person in the room shared their personal history, and the relationship between their identities and their education.

The researchers put forward their early thoughts about ways to represent their research that integrated them with the transversal competences that they had been learning. An example was given by the trainer: "*for example, (learners and researchers) could play with a representation of the system and debate, discuss, rebuilt in own cultural setting, some of the metaphors that are used, and to take a distance, using a metaphor that might be different from their own standpoint and their own cultural background*" in response to which the ECRs contributions were:

> **ECR chemist:** I would present myself and maybe my standpoint, why I am here, why I am doing science, and then to make them question about recycling, and what is the composition of electronic waste and how many they have in their house; and maybe showing some ideas about the composition of our waste and maybe visual support . Then we would like to translate the subject of my research; perhaps one pupil will be a phone and will be composed of a per cent of water, and we can explore who is who and what is his role; we would introduce the political aspects of my research and how EU legislation will change the science and how funding will have an impact on our work – it's like a cycle – a loop.
>
> **ECR sociology:** I would like to talk about what is sociology and why we why many things in our life which is sociological but we don't realise it and we apply with the relationship with school, but the relationship with school is sociologic. We could address our own social status, ask questions like why am I am social being – why am I different to you. What makes me a social being, and in order to understand the two main theories in sociology – you act in a way that you don't control it and there are things in your environment that do it – there is also an individual part, the personal histories that can change all the determinisms. so by questioning the social status and social relationship with school they are going to understand how and why are we acting like this, and acting in life, it is because of this and this. And I would like to describe how if look for surveys and big data, show examples; and if a sociologists want to go into personal stories you use interview – how to create an interview, to experience it, ask friends and partner about relationships with school or with knowledge.

However, as reported by WP2, the ECRs in Paris also faced the same problem as their counterparts in Bristol and Barcelona during the Participatory Workshops:

> In relation to the kind of knowledge they could share about their own research topic, one was straight, answering they could not share anything. They explained it by deploring they only had between 5 and 20 minutes to present their research and that this little amount of time was not adapted to really have the chance to share with students. Despite of this issue, they reported they might have contributed bringing a different approach to specific students' points, clarifying some scientific or technical concepts during the debate or sharing with students. However, they deplored that it was not directly related to their research topic.
>
> Through the interviews, and coherent with what the PW3 reported in April, the overall feeling was quite negative. They deplored they had neither time to share with the students nor enough space to discuss with them. Moreover, they were skeptical about the interest of their presence during the workshops, as ECR 1 reported:

« I could certainly bring another different method to formulate (students') answers when we put in common what had been learned during the exercise about the articles. I doubt that it was more pertinent than what the facilitators could have been able to say themselves during this given time » (ECR 1)

This overall feeling of disappointment might have contributed to their opinion related to their participation within the project. They said they would have been more involved if the conditions would have allowed them to. They justified their motivation by the fact that they had invested the time in transportation to reach the school. Indeed, this school was located almost one hour a half far from the center of Paris. However, for them to get more involved, one ECR specifically reported that the activities developed during the workshops should be related to the topic of the ECR.

4.6 It is relevant to ask whether 'transmitting transversal competences' is a skill in Science Communication or whether it requires teaching skills

One of the statements in the Description of Work refers to 'transmission'. While the training course has an underlying principle in skills in 'Science Communication' , the ECRs experience in schools was one in which they found that they were lacking in teaching skills (rather than skills in communication of their subjects and experience).

ECR4, Barcelona: one thing is the critical thinking you need for your scientific career and another thing is the critical thinking that needs a 15 year old when he reads something on Facebook and he has to believe or not or in the news... Or for example, one thing is the gender gap we are experiencing in university everyday and another thing is what it happens in high-schools and how girls are treated differently than boys. I mean is a different scale of things and not necessarily similar. So if we spoke directly from our present experience, the teenagers wouldn't understand what we are talking about so we have to translate it, to teenagers.

ECR2, Barcelona: for example to create these spaces for critical thinking, to discuss about gender... Maybe they are not applying this thinking or these processes in the moment of the monologues or maybe this year, but maybe in 5 years they have this "ok, yes... I did that and I can apply that" or something that is there in their brain. And I think that is positive

As has already been described, there was a marked disjunction between the preparation in the communication training and RRI sessions and the role they were given in the Participatory Workshops. The following extracts from the discussion amongst ECRs in Barcelona illustrates an awareness of the demands of integrating with the school students' interests and understanding; it also illustrates their awareness of the difference between presenting their research (communicating science) and the interactive, interpersonal nature of teacher-student relationships:

ECR2, Barcelona: Well, we had a moment just to comment about our topic and that we are early career researchers and maybe we had the opportunity to say that, but I didn't say it, I didn't realise that... That's what I was saying, that I didn't prepare my intervention or my dynamic thinking what I should say also to engage them. It was more like "I'm doing research and that...", but not very empathetic with them.

ECR1, Barcelona: Well, we had three minutes to introduce ourselves so... [laughs]. Its not...

WP2 team member: ...much chance.

ECR1, Barcelona: No, I just focused in explaining what geology is mainly.

ECR4, Barcelona: But maybe it is also our fault. I mean, for example, they asked me about some technique in the lab and my three minutes was talking about it, so... ok maybe if we know that, we could change a bit our speech trying to make it more personal.

'Making it more personal' was possible when discussing gender with school students:

ECR4, Bristol: I really liked the gender bit that we had with them, and I feel like that's a very good starting point to go and have those discussions again, gender and unconscious bias and things like that. The stuff we did there was good and the discussion points we had. So that for me is very pickupable to another situation. I'm not sure how comfortable I'd feel about teaching people to busk though, I don't feel like I can do that again.

The perception that teaching was different to discussions and needed further training was picked up by other ECRs in the same conversation:

ECR2, Bristol: Having not done any outreach before, I would probably be wary of doing it all myself again, but I've already started going to more training stuff with my department.

ECR7, Bristol: Probably science in society would be also easier to take it and just do it yourself, reading the article and asking them what they thought about it, and critically thinking of – of course you need the training beforehand, but I think that could also be something that you could individually carry out.

ECR8, Bristol: I guess there's a bit of tension in those. Like somebody mentioned earlier whether we made a positive or negative impact on the kids, we showed them quite contradictory video and then we said you have to question – we told good things, but maybe we didn't emphasise enough that scientists are doing also good things. It's not just like they have to be questioned because they may produce some nonsense on the news, but they are doing valuable things as well.

ECR4, Bristol: We didn't get to reflect with them either, what they thought about what we did.

ECR2, Bristol: If it would be possible to somehow bring those two things together, sort of reduce the stereotypes, show the stats, the people who are fallible, but then at the same time kind of – yeah, talk about how they are normal people so you can be one.

A member of the WP3 team who has considerable experience in training teacher commented:

WP3 team member: there is a difference between science communicating and science teaching. If you want to teach it you're an expert who's got to become a novice.

In response to the observation that ECRs had enjoyed being able to work repeatedly with small groups in developing busks and monologues, and that some of the discussions had been helpful and significant, this team member said:

WP3 team member: another adult in these kids' lives that drifts in and drifts out. And some of these kids come from very dysfunctional homes where adults drift in and drift out. They need stabilities, it's relationships. Teaching is all about relationships, and that's why it's worked with you guys, you got to know them.

In the comments from ECRs in Barcelona, an underlying sense that teaching skills would have meant that they could more easily facilitate the sessions in which they were involved. One of them explained that the skills she used had been developed through experience with the scouts and in theatre, but even this had not enabled her to be well prepared for the situation she encountered.

ECR1, Barcelona: I mean, it reminds me of the role I had when I was a scout leader, for example. I watched teenagers all day and prepared activities for them, so that they would give a second thought to many things they take as granted.

WP3 team member: So you were using a lot of your experience and skills when you were working with teenagers...

ECR1, Barcelona: Yeah, from the scouts and from the theatre, when I was doing theatre, but I think that was a lot more relevant than the scientific side, definitely. But also it was quite different from the teenagers I used to have in the scout groups, so it was a bit challenging.

ECR2, Barcelona:: Yeah [laughs].

WP3 team member A different kind of demographic?

ECR1, Barcelona: Yeah, yeah definitely. And also what it shocked me the most is that "no, I don't want to do anything, there is nothing you can say that will make me do something". Is like, "ok, if we get to this point, what can you say?".

But yeah, I think that the training with young people is not a matter of two sessions, is something you have to be doing for a lot of time to understand how to do it.

4. Summary

1. **For the ECRs, the workshops in schools and communication skills were more salient parts of the training than the 'RRI' elements**

   The training course was of interest to ECRs because of the opportunity to participate with young people in educational settings. The expectation of ECRs was that they would gain experience in communicating their own research.

2. **Institutional factors supported ECRs' interest in the training on RRIs**

   RRIs were of interest to ECRs but of less significance than the opportunity to spend time in schools. Where small group sizes and familiarity between participants was facilitated, attendance was high, and rich discussions of the content of RRI took place.

3. **The design of the training is important for its success**

   The inclusion of performance experts in Paris in the training was considered to be particularly valuable, along with the facilitation of an atmosphere in which personal experience and theoretical and philosophical points could be shared and discussed.

4. **ECRs were not successfully enabled to 'effectively transmit the transversal competences'**

   There was a disjunction between the training designed by the partners in the universities (UoB, AJA, UoC and UAB) and the training designed by TVBT and delivered by the performance experts SMS, TRACES and TBVT in schools, such that ECRs experience was that they could neither communicate their own research nor effectively interact with young people in the way that they would have valued.

   This is also demonstrated in the Participatory Workshops by the manner in which RRIs are approached in the planning of activities. They were nominally attended to in the sense that subject headings had been set for the PWs, but they had been translated into activities by performance experts and did not retain the depth and complexity that characterises these subjects.

5. **It is relevant to ask whether 'transmitting transversal competences' is a skill in Science Communication or whether it requires teaching skills**

   The difficulties experienced in the Performance Workshops can be ascribed to the contrasting expectations of all parties involved. In particular there is an implicit expectation for ECRs to combine communication skills and reflective practice that they have just been introduced to, in a demanding situation, and alongside performance specialists who do not fully understand the complexity of the researchers' position.

The reflections of the WP3 team on this issue were:

- that the roles taken by teachers in the classroom had been one of standing back and allowing the PERFORM team to carry out their work. This passive role had effectively been given to the teachers by the project, since the preparation of Participatory Workshops had not involved any planning and integration of the workshops into curriculum requirements or the teaching activities of school staff.
- *that school students expected to take a role of pupils and for adults to take a role of teachers.* Even in a PERFORM workshop in which ECRs have a special status as real-life scientists, is that students expected to interact with them as if they were teachers – in line with cultural norms of the classroom.. Similarly, during the Participatory Workshops, the ECRs, who are also familiar with the classroom as a certain kind of educational setting, also perceived themselves as in the role of teachers, but without the necessary skills. With thought and planning, it would be possible for the ECRs to communicate with young people in a way that does not involve them taking teacher-pupil roles.
- *school students have existing skills and interests in* performance and in some schools, are the basis on which individual students have been selected to participate in the workshops. The use of a 'one size fits all' approach to performance workshops means that the workshop activities are introduced to schools without being able to draw on or contribute to existing skill development and teaching in these and in science areas.

5 Conclusion

The following table shows the expectations of the training, taken from the DOW and discussed in the Introduction to this report, alongside the summary of data obtained and analysed in this report.

Expectation	Met/not met
training in social aspects of science and reflexivity on the research practice, performance skills, communication skills, working with teenagers, working with schools, gender equality issues, and ethics amongst others (DOW, Task 3.2. Development of Training and Guidelines for Researchers)	**Met: in general, ECRs reported that they had gained from the RRI aspects (**social aspects of science and reflexivity on the research practice, gender equality issues, and ethics). There was also evidence that they had gained from the training on performance skills, communication skills, working with teenagers, and working with schools.
PERFORM will facilitate direct interaction inside and outside the classroom (i.e., research centres) between secondary school students, their teachers and early career researchers by using performance-based science education methods, as a mean for linking young people with real science. Such interaction (…) will also provide students with the values embedded in RRI (i.e., creative thinking, gender equity, inclusiveness, openness, and mutual learning) since they are key to enhance the current educational process to ensure students' joint engagement in STEM. (DOW, 1.2)	**Not met:** Although ECRs participated in communication skills training and RRI, there was no evidence that the direct interaction enabled them to further develop such skill; and therefore there was no evidence that ECRs were better able to link school students with real science or provide school students with the values embedded in RRI
The complete participatory process will generate a mutual learning scenario providing young people with basic knowledge about STEM, performing skills and transversal competences while teachers and early career researchers will realise about young people's interests and concerns towards STEM (DOW 2.2 Measures to maximise impact, p.27)	**Partially met:** ECRs gained some understanding of young people's interests and concerns in relation to STEM in schools

5.1.1 Successful aspects of the training in Year 1

- The interest generated amongst ECRs by a training course that offered an opportunity to present science in schools as well as learning about RRI
- Training on RRI was highly valued when a form of organisation of the training was used enabled the ECRs to get to know one another and to feel comfortable about discussing the course content and sharing their experiences.
- The inclusion of performance experts in the RRI training provided opportunities to discuss how ECRs could use performance skills to communicate RRI aspects as well as their own research

5.1.2 Unsuccessful aspects of the training in Year 1

- Communication skills offered in the training could not be used effectively by the ECRs, for the following reasons:
  - Absence of explicit framing of the role and involvement of ECRs when in schools together with lack of a role and engagement of the teacher
  - Absence of a consideration of the performance skills, interest, and experience already developed amongst the pupils in schools
- The absence of an integration between the two aspects of the training meant that ECRs were unable to use the time they spent in schools to develop skills in communicating RRIs

6 Recommendations

1. The successful elements of the training in Year 1 should be continued in Year 2 (in particular the aspects that facilitated small group discussions and trust: and the inclusion of the performance experts in the RRI training).
2. ECRs should be considered to be science researchers who have undertaken to take part in a training course to increase their skills in science communication; there should be a clear distinction made between the skills involved in this, and the skills involved in teaching.
3. The role of the ECRs, of teacher, and of performance experts in the classroom should be distinguished from one another in order for the ECRs to be understood as 'real scientists' and not teachers.
4. The quality of experience of young people and school staff should be prioritised; in order for this to happen, each school should participate in planning and executing the activities of PERFORM on its premises

   There should be a thorough consideration, for each school involved, of

   - the expectations and needs of
     - school students,
     - the school itself and
     - the school staff
   - the existing expertise of
     - the school students,
     - the teachers, and
     - the ECRs

   These expectations and expertise must be taken into account in the planning and implementation of workshops involving ECRs.

7 Appendix 1

Model for delivery of training in each country

As explained in section 1.5.1, the training in the different countries was

- adapted to take in to account local needs and the existing training and institutional infrastructures
- aimed to have potential for sustainability beyond the scope of the project activities.

Paris
DAY 1 **Reflexivity in science for a responsible communication of science - Strengthen the educational outreach of your academic activity** RRI, your interpretation: From scratch, how do you interpret the RRI expression? In what sense is your research practice responsible? Being transparent on your research, tell us: What are the epistemic challenges you face? Who is your academic community? Where is your research situated in terms of history of your discipline? What are the institutional/organizational obstacles you face? What are the funding schemes for your research? What are the sources of reliability in the specific research methods you employ? Monday 21st November 2016 13:15 – 16:30
DAY 2 **Normative aspects of RRI**: Read European + French codes of conduct. What are the deviation to the norms? **Values in research**: Read Merton 1942 paper and comment. Read the slow science manifesto. Write your own manifesto! **Feminist epistemology: situated knowledge, standpoint theory and strong objectivity**: Based on this approach of STS, declare you own standpoint. **Get to know your public**: Science communicators present the schools' social and economic backgrounds. Literature is cited, which explores (often failed) attempts of more inclusive science education and science communication. Tuesday 22nd November 2016 08:30 – 15:00
DAY 3 **Imagine a collaboration artists and researchers***:* Researchers and artists imagine how to frame into performances some key aspect of the (reflexive) human dimension of research experienced by the early career researcher. Tuesday 23rd November 2016 08:30 – 15:00

Barcelona
TOPIC 1: Science with and for society (UAB, UOC & TBV) Theoretical session: Wednesday 14th December, 16:00 – 18:00 Practical session: Wednesday 14th December, 18:00 – 19:00 The Responsible Research and Innovation (RRI) approach and values: what, why and how? The PERFORM project: stand-up comedy in science communication and education. Information on the project and the apprenticeship.
TOPIC 2: Key competences for engaging with society (UoB) Theoretical session: Wednesday 11th January, 16:00 – 17:30 Practical session: Wednesday 11th January, 17:30-19:00 Engagement and participation: collaborative approaches to science communication and education, inclusiveness and constructive dialogue.
TOPIC 3: Philosophy and ethics of science (UoB) Theoretical session: Thursday 19th January, 16:00 – 17:30 Practical session: Thursday 19th January, 17:30-19:00 Philosophy of Science: can we define the scientific method? What makes good science? The problem of public trust in science. Ethics in scientific research and communication: What is responsibility? Who are we responsible to? Funding, methods, outputs and risks.
TOPIC 4: Towards practice (AJA) Theoretical session: Thursday 26th January, 16:00 – 19:00 Practical session: Friday 27th January, 16:00 – 19:00 Communication skills for researchers: What is responsible communication? How to make my PhD understandable? Practising responsible science communication: How to plan, initiate and scale up activities that communicate about the social dimension, norms and values of our local / disciplinary scientific community. Reflections on the PERFORM project and next steps.
Apprenticeship: six selected dates between January 16th and March 20th

Bristol
TOPIC 1: Working in schools Jon James (UoB Graduate School of Education) & Ellie Cripps (Schools University Partnership Initiative) Exploring science education curriculum in British schools & pertinent issues to bear in mind when working in them as researchers. Wednesday 18th January 2017 13:00 – 15:00
TOPIC 2: Science busking training David Price (Science Made Simple) Wednesday 1st February 2017 13:00 – 15:00 Understanding and practising the science busking approach that Science Made Simple (SMS) use to communicate science to children.
TOPIC 3: Communicating your topic Ed Drewitt (UoB) Exploring the skills and knowledge needed to communicate complex research topics to non-expert audiences. Wednesday 1st March 2017 13:00 – 15:00
TOPIC 4: Responsible research and innovation Vivienne Kuh (UoB) & Ellie Hart (Centre for Science and Philosophy, UoB) Exploring RRI, what it is, where it came from, and what it means for the practice of science and its relationship to society. Wednesday 8th March 2017 13:00 – 15:00
TOPIC 5: Science and society James Ladyman (Centre for Science and Philosophy, UoB) Exploring scientific realism, reliability and the post-fact society, examining scientific literacy in the general population and the impact this has on the way the public respond to and understand scientific progress. Wednesday 15th March 13:00 – 15:00
TOPIC 6: Ethics in science Megan Blomfield (Department of Philosophy, UoB) Using geoengineering as a lens to examine ethics in science and our moral obligations as scientists within it. Wednesday 22nd March 2017 13:00 – 15:00
TOPIC 7: Reflection Vivienne Kuh (UoB), Ellie Hart (Centre for Science and Philosophy, UoB), Sarah Eagle (Graduate School of Education, UoB) Reflecting on the experience of being involved with the PERFORM project – how we might evolve the project from the researcher perspective in year 2, and how the project might impact on the researchers own work in the future. Wednesday 5th April 201713:00 – 15:00

8 Appendix 2

Information for observers of ECR training

Please assemble three types of information,

1. Information gathered through observation and informal discussion with the participants
2. Information gained from talking to the organisers, and
3. Information in the form of course material and planning documents.

1. Observation

Observation sheets

The observers will prepare a sheet for each session with the headings A, B and C below. The information in A and B will go forward to the final sheet. Under heading C, the observer will record notes what takes place, in a form that will assist them in holding a discussion with another observer. See section C below.

Final information to be returned to UoB

The final information returned to UoB as a result of the observation will consist of the information collected under headings A and B and a summary of the discussion between the observers.

For each session, the information returned will begin with the titles for the session as the organisers have arranged it (in Bristol we have: working with schools - 'Performing' Science to Children - Communicating your Topic – RRI - Scientific method - Science and society - Ethics in Science. In BCN and Paris the sessions are organised to fit the needs of the ECRs and the institution)

A General information

- *The title of the session*
- *Number of ECRs*
- *Gender breakdown*
- *Notes on who is delivering the content and their background or experience*
- *How long the session lasts*
- *Where it takes place*

B For each stage of the session, write down a short description of what the organisers did

- A brief description of what information was presented
- How they presented the information
- How discussions were organised
- Other relevant information that helps the reader understand what took place

C Subjective impressions

Ideally there is more than one observer present and the subjective impressions recorded are a result of discussion between two or more observers. Whether just one observer or more than one, the purpose

of the observation is to *focus on the nature of the session from the point of view of the participation and learning by the ECRs* and to record:

- **What is significant and potentially of value for discussion in relation to planning for next year**
- **And also what is significant and potentially of value for the project as a whole**

As each stage of the session takes place, each observer should make notes on ***what they think went well* and *what could be improved***, and then use these notes as a basis for discussion with the other observer(s). The discussion should take place very soon after the end of the session, and the final notes should always give some reasons for their impressions. There should be some information on who the observers were, giving brief information on their academic background, explaining the knowledge and experience that they have that is relevant to the subject matter that is being delivered, and any other information they feel is helpful and relevant.

If it is possible for the observers to talk to ECRs about what they thought could be improved when planning for next year, this could be a useful way of enriching the notes produced. If if time and organisation make it possible to talk to ECRs, then the observers are welcomed to include this method of gathering information.

2. Background information about the setting up of the sessions

The observer(s) should also speak the organisers and find out

- What were the efforts that were taken to advertise the sessions to ECRs?
- What was easy?
- What was difficult?
- What reasons do people give for it being easy or difficult? Please add any thoughts and comments that could be useful or helpful to planning for next year.

3. Course material and planning documents

Please collect copies of all course material and planning documents

7. Appendix 3: EARLY CAREER RESEARCHER TRAINING: information to potential participants

Information provided to potential participants in France

The following document was collaboratively produced by AJA, UoB, UOC and UAB and was finalised on 8 June 2016. It presents the offer for training to ECRs in France, and provided an agreed basis for the content of ECR training in Spain and the UK.

The link to the online version is

http://cfdip.uspc.fr/fr/formations/catalogue-des-formations/outils-methodes/ethique-integrite-scientifique/item/321-reflexivity-in-science-for-a-responsible-communication-of-science-strengthen-the-educational-outreach-of-your-academic-activity-contribute-to-theatrical-performances-about-scientific-research-2016-2017

REFLEXIVITY IN SCIENCE FOR A RESPONSIBLE COMMUNICATION OF SCIENCE – STRENGTHEN THE EDUCATIONAL OUTREACH OF YOUR ACADEMIC ACTIVITY

This training is provided free of charge as part of the PERFORM European project. It is a Science With And For Society program funded by European Union under Horizon 2020.

Duration: 8 days (3 days of training, 3 days of mentored involvement in activities)

Number of participants: 8 – 12 ; number of trainers: 2

The need for responsible behaviours to be adopted by a larger share of the academic community has received growing concerns. The European Union uses the concept of « Responsible Research and Innovation » (RRI) for its funding schemes. It is meant to align research and innovation with societal needs and concerns.

All those aiming at a career in research shall be given the tools to enrich their academic scholarship with a responsible behaviour towards society. This requires to acknowledge possible ways to bridge one's own commitment as citizen with scientific endeavour.

A socially responsible conduct of research, where scientists are aware of the societal outreach of their work, is not intuitive. Such behaviour goes beyond sharing knowledge. Scientists also need to reflect upon and share with citizens the social dimension, the norms and values that govern the scientific community.

Training future scientists to social responsibility broadens their skills for working as researchers as well as working in knowledge based careers. Research institutions, industry and public administrations are recruiting people trained in science who are also able to nurture a dialogue about scientific innovation and new technologies, aware of their potential impact for society, and able to handle related responsibility issues.

The training will have a special focus on sharing “the human dimension of research”. This refers to the possibility for scientists to engage with citizens sharing practices and values that characterise scientific activity: collaborative work, creative and critical thinking, constructive dialogue, questioning of established theories.

While science activities towards the public most of the time focus on sharing knowledge, sharing norms, values and social practices of science further allows to empower citizens, and thereby to have a significant local, social and economical impact.

This training consist in 3 days of interactive courses and 3 days of activities in primary schools. The role in the schools will consist in interacting with a group of students and an artist who are conceiving together a theatrical performance about science.

Contents addressed and skills to be developed, based on case studies

practising responsible science communication :

- What is responsible science communication? What is RRI?
- how to plan, initiate and scale up activities that communicate in a responsible way about the social dimension, norms and values of your local / disciplinary scientific community
- how to make my PhD understandable?
- how to communicate the value of my involvement in such activities for my career
- setting the current call for responsible science communication within the history of science communication : how it evolved through time & political changes

In addition to the above contents, in order to implement responsible science communication in primary schools in Paris, we will provide information about the educational challenges for the primary schools in Paris and region you'll be working with :

- territorial, social and economic inequities
- the question of motivation for disadvantaged pupils

The participants at the end of the training shall be able to answer the following questions :

- How is my research embedded in social practices, norms and values of the scientific community ? − What are my responsibilities towards society ?
- How my reflexivity on the issues above will be translated in the way I communicate about science?

Course method

- Participants will receive an online questionnaire to be filled at least 2 weeks before the training. This will allow to adapt the training to their profile and expectations.
- A 3 days workshop will consist of interactive sessions allowing participants to reflect upon and adopt their own attitudes at an individual and a collective level, with respect to their own research environment, activities and projects.
- Half a day will be dedicated to meet the artists before coming to the school, the meeting will be facilitated by the trainers.
- participant will then take part to 5 workshops organised by partner ESPGG / TRACES, related to the development of theatrical performances about science : (5 half-days, including transportation to / from schools)
- these 5 workshops will be intercalated with 2 sessions of 2 hours of follow-up and mentoring (evenings). In addition to discussing the implementation of the skills mentioned above, we will discuss how to implement partnerships with institutions outside of the university, and in particular with schools.

Individual Performance and Assessment : Participation and quality of skills to critically analyse the issues addressed during the training will be evaluated. Participants will also be evaluated based on proposals of activities they will be encouraged to invent. Evaluation will be qualitative and will assess how the participants developed the target skills and will have reached the outcome of the

. Validation based on attendance, participation and evaluation will be decided by the graduate school directly.

Participants profile

Attendance to this workshop is for young scientists (graduate students, post-docs, research assistants) eager to enrich their academic role with a strong social commitment, or just willing to explore unusual interactions in between science and society.

Language of the training & activities : English, with trainers who also speak French to ensure good understanding.

Information produced for potential participants in UK

http://www.bristol.ac.uk/public-engagement/projects/our-projects/perform/

PERFORM: Participatory Engagement with Scientific and Technological Research through Performance

PERFORM is a groundbreaking European Union Horizon 2020 research project investigating the use of innovative science education methods based on performing arts, in fostering young people's motivations and engagement with STEM in selected secondary schools in France, Spain and the United Kingdom.

Call for PhD students and Early Career Researchers

Philosophy of Science, Science Communication and Performance Training Programme

As part of PERFORM, the Public Engagement Team is offering University of Bristol PhD students and Early Career Researchers in science a unique opportunity to participate in a bespoke training programme covering philosophy of science, science communication and performance. We have invited an exciting range of experts from across the University and city, from philosophers of science to stand-up comedians, to contribute to this unique training. You will be encouraged to critically

consider scientific practice and develop skills to communicate this thinking to secondary school students.

Alongside training, you will have the opportunity to put your skills into practice by participating in workshops in secondary schools in Bristol as 'scientific experts'. Workshops are led by science performers Science Made Simple, who for this project are sharing their expertise in 'science busking'. Workshops will culminate in school students developing their own science performances to perform to the public.

PhD students and Early Career Researchers involved must be: able to attend training programme sessions and school workshops; enthusiastic about communicating science to school students; and willing to have to a DBS (formerly CRB) check.

Start date:TBC

Training

Duration: 8 lunchtime sessions of 2 hours, Wednesdays 1-3pm (TBC)

Format: Lunch talk followed by workshop

Location: University of Bristol

School Workshops

Duration: 4 workshops of (2 x 2 hours, 2 x 4 hours) (TBC)

Format: Participatory science performance workshop

Location: TBC

Travel expenses to and from the schools will be provided.

To apply please send a short covering letter explaining a little about your work and why you would like to take part to Vivienne Kuh (vivienne.kuh@bristol.ac.uk).

Information produced for potential participants in Barcelona

http://www.uoc.edu/portal/en/agenda/2016/agenda_561.html

RESPONSIBLE RESEARCH AND INNOVATION: HOW TO MAXIMISE THE LOCAL IMPACT OF MY RESEARCH?

This training is **provided free of charge to PhD students and/or junior postdocs** as part of the **PERFORM project**. It is a Science With and For Society program funded by the European Union under Horizon 2020 that **explores a participatory educational process on STEM** (Science, Technology, Engineering, Mathematics) **through the use of scenic arts** with secondary school students, their teachers and early career researchers, who will get actively involved in experiencing science. *www.performresearch.eu*

The need for responsible behaviours of a larger share of the academic community has received growing concerns in the last years. Accordingly, the European Union uses the concept of « **Responsible Research and Innovation** » (RRI) for its funding schemes, as an attempt to align research and innovation with societal needs and concerns. This means that all those aiming at a career in research shall be given the tools to enrich their academic scholarship with a responsible behaviour towards society. It requires to acknowledge possible ways to bridge one's own commitment as citizen with scientific endeavour. The training will have a special focus on sharing "**the human dimension of research**". This refers to the possibility for scientists to engage with citizens, sharing practices and

values that characterise scientific activity: collaborative work, creative and critical thinking, constructive dialogue, questioning of established theories. Sharing norms, values and social practices of science further allows to empower citizens, and thereby to have a significant local impact. Training future scientists to social responsibility broadens their skills for working as researchers as well as other knowledge based jobs.

Course structure and description: The course is facilitated by an **international team of trainers** and consists of a *theoretical training*, open to all students, and a *practical training* including fieldwork through the PERFORM project for interested and selected students.

The *theoretical training* will be opened **to all interested PhD students and junior postdocs** and will take place at the UAB. It will consist of **four plenary sessions** that will take place at UAB Campus, in selected Wednesdays and Thursdays from December 2016 to January 2017.

The *practical training* will be open to students interested in being actively involved in the PERFORM project activities. **Participation in this training will be restricted to 20 PhD students.** It will consist of **four workshop sessions, most of them after the theoretical plenary sessions**, that will take place at the UAB Campus from December 2016 to January 2017. From January to March 2017 students will also **engage in an apprenticeship through their involvement in PERFORM's participatory workshops** in schools, guided by the science communicators of Big Van. Through these participatory workshops, students will share their research with secondary school girls and boys, and support them in the creation of a science based performances following the principles of the RRI approach. The workshops will take place in a secondary school located in Terrassa or Castellbisbal and travel costs will be covered by the project.

8. Appendix 4: Bristol discussion

Transcription of notes taken during discussion between ECRs about their experience, showing the number of "+1" indicating agreement by individual ECRs (Notes were written on the whiteboard as the discussion took place and ECRs added their "+1" mark to the notes on the board at the very end of the session). In the transcript, items have been re-ordered in accordance with the rating by ECRs.

Benefits of RRI	+ve aspect: to understand RRI as more than tick box	8
	+ve aspect: RRI for grant applications	7
	+ve aspect: engagement on CV	6
	+ve aspect: impact on how I write lay summaries	2
Training	sessions came too late for use in school	6
	+ve aspect: specialists for talks	5
	+ve aspect: RRI, philosophy, ethics, useful for career and interesting discussion witih range of different scientists	4
	school session useful	4
	more understanding of school curriculum	4
	+ve aspect: feedback on sessions (using digital shared space, blackboard)	2
	people who gave talk should have stayed for discussion	2
	+ve aspect: communicating topic	2
	articles to read in advance	1
	first few sessions didn't teach anything new	
Recruitment	project aim is unclear/ v complex	8
	Time commitment seemed a lot but wasn't overwhelming	6
	would have applied if RRI only	2
	Performance main motivation for application	1
Toolkit	+ve aspect: could use busking ideas again	5
	+ve aspect: communicating ideas	2
	develop our performance	2
Workshops	sessions were too long	8
	session on different types of science would have been helpful – careers	7
	Sessions weren't child led and were very rigid	6

	disconnect between performance & RRI	5
	big gaps between workshops	5
	+ve aspect: Sticking with one group throughout	4
	more time for rehearsal, less learning stuff	4
	+ve aspect: gender stereotypes workshop	3
	not enough experience of busking before developing their own task	3
	pupils weren't confident in first workshop	2
	+ve aspect: Student choosing topic and working in groups	1
	didn't acknowledge /make use of pupils' experience of drama	1
	doing sessions multiple times different schools	1
	+ve aspect: discovered what the pupils didn't know (e.g. science in the media)	
	+ve aspect: they got excited about performance and using props and that was fun: props should be included earlier on	
	space for discussion (like in training)	7
Our Role	It would be good to have more chance to talk to students about research and science	5
	When (male researcher) presented, women should have done so too	5
	Time in workshops when we weren't used – passive role	4
	Not planning session	4
	more part of it because busk related to research	3
	Becoming Reflective Researchers? how should we engage with RRI? in our research? to communicate with schools? both? this role could have been clearer	3
Performance	lacked science content	4
	too focussed on sticking to script, took away from enjoyment of doing	1
	nervous about 'nerdiness"	1
	scripts went 'out of the window' in performance	1
	+ve aspect: they busked	
	wasn't made clear the script was only a structure	

9 Appendix 5

Extracts from Reflective Diaries written by ECRs in Bristol

Ethics in Science

(Reflective Diary comment from one ECR) I did have some Ethics classes in school and was lucky enough to have a very good teacher for those, but have not spent much time talking about ethical issues since. I'm really motivated now to do that more: as a scientist, as a citizen, and of course as a human being. The session was really interesting. The concept of the veil of uncertainty/ignorance was applied to a real-world situation, which gives an interesting insight into a case where more knowledge may not necessarily lead to better decision-making overall. As with many of the topics we're covering in these sessions, there aren't any easy answers, but it was good to go over a range of different questions and some suggested answers. I would have liked to spend a lot more time on those topics. The question of when purely theoretical research should be stopped was a particularly interesting one, because as scientist we are often tempted to think of knowledge as something universally good. It was therefore useful to come up with instances of where the situation is not quite so clear-cut. The reminder that ethics is culturally varied also stuck out to me. It was fascinating to note that Science Fiction was mentioned several times in the course of the discussion; I guess this relates to using arts to make complicated issues more intuitively knowable.

(Reflective Diary comment from another ECR) I read the paper (ADD REFERENCE) just before the class and really wished I read it earlier as I wanted to read around the research more to better understand the ethical implications before the session! The talk was interesting, and covered different arguments. I didn't realise this was something philosophers were so engaged in, but I did wonder how much their research and thinking feeds into the scientific process and policy decisions? it would have been nice to discuss this further, or even had a few more concrete examples of ethics research topics. (..)The session included some pair work (...) *I find whole group discussions more rewarding and interesting, though they take a while to get going so I would have used that time for the whole group instead*. Perhaps would have been beneficial if the speaker could have stayed to contribute to our discussion as well. As with previous sessions this raised so many interesting points and I really loved having the time to think about this aspect of science and research with others.

(Reflective Diary comment from another ECR) Trying to relate the workshop to the PERFORM work has shown the need for further consideration of the kids in this process. The issue was raised that school students can be seen as a resource or a media to perform research within or on, really made me think about the ethics of this project. I really hope that the kids take the best from this work and aren't put off from future work in the sciences by this work, I guess they could be frightened by performing, or be bored by our questions, or feel patronized to, and I don't want any of this for them.

Science in Society

(Reflective Diary comment from one ECR) Science and Society talk was really useful. It was good to get a quick overview over important issues in Philosophy of Science as pertaining to the relationship between science and society. Some of these topics I had come across before, but was not necessarily up to date as to the latest ideas, like no longer using falsifiability to demarcate science. The example about energy conversation was particularly striking, as I'd never thought about this question before, despite my undergraduate degree being in Physics. I also found the collection of common misunderstandings between scientists and non-scientists very interesting: e.g. the nature of scientific truth and the distinction between singular and population-level causation. The discussion was also very good. I wish we had had more time to talk about the notion of objectivity, how it relates to science, and also whether there are cultural differences there -- it does seem like this notion is often being used to devalue non-Western approaches to the world. It would have been interesting to discuss the role of mathematical sciences (maths, large parts of computer science, theoretical aspects of other sciences). For one thing, mathematics does provide absolute truth, though of course that is still dependent on the assumptions being made, which may or may not hold for the real world (and errors are of course also possible).

(Reflective Diary comment from another ECR) This talk touched on lots of aspects we'd discussed already in the group and things I hadn't thought about before. It opened up some ways to approach talking about the scientific process with people that will be interesting to explore - particularly with students. The time spent afterwards as a group was good as well - it is so unusual to have the time to think about these bigger questions, and be able to discuss with people from a wide range of areas and experiences. I love having this time to talk and feel like it should be something all scientists get.

(Reflective Diary comment from another ECR) We discussed the differences between science, pseudoscience, bad science and science fraud, and went on to prepare a toolkit with questions which could be used at schools (or in general with the public) to discern if the information that we find in the media can be considered scientifically reliable. I enjoyed the session a lot, it is very good to go back to the fundamentals of science and revisit all these philosophy concepts. And what I have enjoyed most has been the discussion with the rest of the team, I think it has been very enriching. It has also made me feel that I am not "alone" when I feel lost thinking about the significance of science, etc.

RRI

(Reflective Diary comment from one ECR) Ihad not been aware before this talk that RRI is a well-defined framework developed by the ERC. Some of the details of that were of course a bit dry, but overall it was interesting to see what is considered "responsible" in research. The idea of thinking about and engaging with this topic is of course good, though the framework does seem flawed in various ways, e.g. the focus on marketability and on properties that can be easily measured, as well as the binary perspective on gender.

Nevertheless, I did find it useful and interesting. I had not encountered the term "ethics dumping" before, though the concept is sadly not terribly surprising. The concept of STEAM was also new to me and I would like to learn more about it. Again, it would have been nice to have more time to discuss (which is also a part of RRI :))

(Reflective Diary comment from another ECR) I had come across RRI before, at a workshop at Science Museum London with other science museums from across Europe. It was great to get a really thorough description of it and to dive deeper into what that definition means for us as researchers. I'm still not sure I understand it though, the definition is so broad and the terminology is not "plain english"! The reflective tool on the RRI website has helped to get to grips with the different parts, and going over the slides again will help. I particularly enjoyed the discussion parts of this workshop - hearing everyone else's experiences of the different aspects around RRI was very interesting.