



The public-engaged scientists: Motivations, enablers and barriers

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Abstract

Why do scientists volunteer to be involved in public engagement in science? What are the barriers that can prevent them participating in dialogue with society? What can be done to facilitate their participation? In this paper we present a case study of the Children's University programme of the International School for Advanced Studies (SISSA) (Trieste, Italy), discussing the three-year experience, and reporting the outcomes of a series of focus groups conducted with the young scientists who volunteered in the programme. Two kinds of motivations emerged. The first is personal, for example volunteers' desire to improve their own communication abilities, or their curiosity for a new activity. The second is related to the perceived role of scientists in society: many volunteers feel a sense of duty and the need to promote science and its importance in society, to have an impact on the public perception of science and to seed the love for science in young people. After the first year of their involvement, volunteers expressed the need to keep improving their communication skills and participating in professional training courses, and agreed that science communication should become part of all standard training programmes of PhDs. In order for the outreach not to remain a sporadic experience, it is essential that a strong institutional commitment exists to promote, recruit, encourage, professionally train and support those involved.

Keywords: public engagement with science and technology; professional development and training in science communication; public role of young scientists

Key messages

- Young researchers are willing to engage with the public with an attitude of openness to dialogue and participation, unlike the previous generation of researchers who often stick to an old-fashioned top-down model.
- Researchers' motivations for participating in public-engagement programmes are both personal and derive from a sense of duty towards society.
- Scientists' commitment can be fostered by removing barriers such as isolation and lack of communication skills, and creating an encouraging environment supported by all components of the institution.

Introduction

More and more scientists take an active role in communicating their research, being aware of the ever-increasing social, economic and environmental implications of their

work. Also, the need to get funds for research requires scientists to convince non-experts that the work they do is necessary and desirable. Talking about research, interacting with the public, and dialoguing with society have now become an integral part of the job of being a scientist (*Nature*, 2015). This culture shift has been pointed out by Hamlyn *et al.* (2015), who, among other things, also report the considerable investment by the funders of UK research to support public engagement by researchers. Many research findings indicate that the responsibility towards society is particularly strong among researchers working with public funds (Bodmer, 1985; Wolfendale Committee, 1995; Miller, 2001; Pearson, 2001), and more and more scientists are convinced that they have a public role to fulfil (MORI, 2000; Pearson *et al.*, 1997; Martín-Sempere *et al.*, 2008; Andrews *et al.*, 2005). The Responsible Research and Innovation (RRI) model promoted by the European Union – the backbone of all research grants in the Horizon 2020 framework – identifies inclusive, innovative and reflective societies as one of the seven Grand Challenges and puts public engagement as one of the six main themes to consider (RRI Tools, 2018).

But what are the personal motivations of researchers that drive them to take part in public-engagement activities? And what are the perceived benefits from the professional point of view? These questions are addressed here, focusing mainly on the individual perspective. The work does not take into account the institutional perspective, except for the role the institution can have in promoting and supporting the researchers involved. Without going into the analysis of the changes at institutional level, it is important to note that the commitment of the institutions at the highest level of management, providing a structured framework and a clear mission, is an important requirement for large-scale participation (Jensen and Croissant, 2007).

Increasing attention has been given to the role and motivations of scientists involved in public-engagement activities. Even though many are still tied to the idea that public engagement only aims to increase the public's understanding of the basic concepts of science and to provide them with better information (Royal Society, 2006), most researchers have been found to have a positive attitude towards participating in public-engagement activities (Poliakoff and Webb, 2007).

In terms of the personal perspective, the relationship with the public, based on mutual trust, can be very gratifying and an emotionally rich experience (*ibid.*), while from the professional perspective, other studies have shown that scientists who are active in engaging the public in science and technology also benefit from this activity as researchers. Public involvement is indeed a constant source of inspiration, because it urges scientists to face unusual and unexpected questions and points of view, and enlarges the understanding of new issues and their capacity to address wicked questions. Consequently, it helps researchers to design more interesting research projects (Research Councils UK, 2014; Jensen *et al.*, 2008; Jensen and Croissant, 2007). Participatory communication methods, currently in use to reach a wide variety of audiences, can open new areas of investigation and improve the profile of researchers as individuals and as members of their institutions (Rodari, 2010).

A survey conducted in 2013 on a large sample of theoretical physicists from Europe, Asia, Africa and America (Rodari and Daelli, 2014) indicates that these scientists are generally very interested in participating in science outreach activities and many are already involved in science communication.

We present the findings of a three-year research project with several groups of PhD students who volunteer for the public engagement programme, SISSA for Schools, dedicated to school students of all ages. We analyse their personal and professional motivations, their initial expectations and the results obtained after their

participation in the programme. The research was conducted through focus groups, and aimed to better understand the views and experience of SISSA volunteers with regard to science communication and public engagement, and the opportunities and barriers that may facilitate or hinder participation.

The SISSA for Schools programme

SISSA for Schools is the programme of school visits to the International School of Advanced Studies (SISSA) (Trieste, Italy), which is an international, state-supported, doctoral school and research institute specializing in mathematics, physics and neuroscience. SISSA for schools is part of the international network EUCUNET (eucunet), which joins all the Children's Universities of the world with the aim of making higher education more open and accessible to every child. Since 2012, every year SISSA hosts an increasing number of students – from about 800 in 2012, up to more than 2,000 in 2016/17. The students come from tens of different schools, and all ages are represented, from primary school age to teenagers from high schools. The students participate in various scientific activities and learn about SISSA, its activities and researchers.

SISSA PhD students and young researchers are the main participants in the programme, as they work as guides, speakers and facilitators of informal learning activities. Their involvement represents a distinctive and innovative feature of SISSA for Schools in comparison with the usual institutional guided tours. First, SISSA volunteers are very young in comparison to the average scientist, in contrast to the fact that participation in engagement activities tends to increase with the age of the researchers (Jensen and Croissant, 2007). Second, the group of volunteers welcoming the school groups is always large, with a ratio of 1:5 between volunteers and students, which enables informal and direct contact. Third, and most important, the communication between the volunteers and the students does not follow the classic model of transfer of information (deficit model) that is still common among scientists (Braun *et al.*, 2015) — on the contrary, it is based on a more modern model of dialogue, with plenty of room for participation and mutual exchange. Finally, the programme is very flexible and diverse, each time designed according to the composition of the volunteer group, their skills and preferences (see Appendix 3, p. 49 in Cerrato *et al.*, 2017).

In addition to the general goals (to gain the support of society, to gain trust, improve governance, recruit a new generation of researchers, and foster information and education), which it shares with many similar programmes, SISSA for Schools also pursues other objectives, which are just as important. It aims at increasing the sense that the volunteers have that they belong to the SISSA community, which becomes not only a place to learn and research but also a place to have social encounters. Moreover, participation in the SISSA for Schools programme has the ambition of helping to create a new generation of researchers who have experienced a positive, constructive dialogue with society.

Methods: Focus groups with volunteers

In 2014, 2015 and 2016, we conducted an evaluation with the volunteers to better understand the views of the PhD students and researchers who took part, and to obtain their ideas and suggestions for improvement.

Who the volunteers are

Although the volunteers for SISSA for Schools come from all parts of SISSA, including PhD students, professors and senior researchers, and administrative and technical staff, in this report we focus on PhD students, who make up the majority and are the founding core of activities.

SISSA PhD students are part of a rather small community (about 250 students), and work in three areas (physics, mathematics and neuroscience). Two-thirds are Italian and, SISSA being an international school, one-third come from other countries (countries in the Middle East, South Asia, North, Central and South Americas, and from China, Russia and many European countries). They are at the beginning of their scientific careers, and their ages range from 23 to 29. There is a strong interpersonal relationship between the students, and relationships with the professors are quite informal. About one-third of the 250 students take part in the programme (between 70 and 80 people each year).

Some of the volunteers had had previous experience in science communication, while for others it was their first occasion to face lay audiences. The activities performed were also quite different: from more traditional lectures to discussions with teenagers or interactive games with children.

Focus group and research questions

At the end of the school year 2013/14, we organized focus groups for 14 volunteers, who were divided into two groups of seven people each. The technique of focus groups was preferred to other approaches – such as individual interviews – in order to have a better insight into volunteers' understanding of, and feelings about, the experience they shared. We thought that this technique would elicit a variety of views and emotional processes within the groups.

The discussions were held in May 2014 at the end of the school visit programme. The meetings were audiotaped with the permission of the participants. A moderator led the discussion, and an observer helped to keep track of the interactions.

The research questions explored were in two main areas:

- the motivations behind participation
- the volunteers' perception of their work.

Understanding the reasons that motivated volunteers to participate is important for finding ways to promote the involvement of new students in future programmes of public engagement in science. If, on the other hand, the experience did not meet expectations, we can get insight into which aspects could be improved, in order to avoid disappointment and to respond to volunteers' needs and ambitions. The first group of questions addressed these points:

- Why do SISSA researchers decide to participate in outreach activities?
- What were the motivations that led volunteers to participate in the SISSA for Schools programme?
- Were these expectations betrayed?
- Did the motivations survive the actual experience?
- Were other reasons to participate discovered?

The second group of questions aimed to understand how volunteers perceived their work with school students, that is, how they defined their role but also which emotions accompanied the experience:

- Was it mainly a matter of transmitting information to the students?
- Was it a way to practise their ability to give lectures and present their own research?
- Was it seen as a possibility to relax and have fun?

For the years 2014/15 and 2015/16, only the volunteers who were more active in the SISSA for Schools programme (about 30) were invited to the focus groups, and all were available to take part in the meetings, which were held at the end of June 2015 and June 2016. We decided to explore five key issues and propose them in the form of questions to the focus group participants:

- What did you expect from SISSA for Schools?
- What did you get from SISSA for Schools?
- In your opinion, was this edition of SISSA for Schools successful?
- What are the elements that would encourage you to take part in next year's edition of SISSA for Schools?
- Do you have any comments or suggestions for next year?

Volunteers had to write their answers individually on sticky notes, and then all the answers were read and discussed within the group. In this way we aimed to collect meaningful data.

Barriers and enablers

The motivations for the engagement of scientists in outreach activities resulting from the focus group discussions in 2014, 2015 and 2016 were:

- to improve personal communication skills
- curiosity, fun, need of a break from the daily routine
- commitment towards society
- to promote science in society at large
- to promote a better image of scientists
- to seed the love of science in children
- to foster social inclusion
- to help critical thinking
- to encourage children to consider a career in science.

The focus group discussions revealed the following benefits that volunteers got from the experience. These were in general much higher than their initial expectations. Moreover, they got benefits they did not expect at all:

- improved personal communication skills
- had a positive emotional experience
- opened up one's mind to different perspectives
- become a better scientist: understand topics much better, improve research competence, get new ideas
- become a better person.

In all three years, we wanted to identify the factors that can facilitate or discourage participation. If we can identify the potential obstacles that limit scientists' participation, we will be able to offer solutions, in order to support those who would like to be more active but for some reason are prevented from taking part. The focus groups revealed the following enablers of participation:

- past behaviour (positive experiences)
- networking ('the more, the better')
- encouraging environment (sharing passion and interests)
- professional training in communication of science
- direct participation in planning and evaluating activities
- strong commitment of the institutions
- some official recognition.

The focus groups revealed the following barriers to participation:

- lack of volunteers (feeling alone)
- lack of communication skills
- professional instability
- financial instability
- sceptical environment (mild hostility of the supervisors)
- the negative political situation in the country.

Isolation, insufficient commitment from the institution and lack of support for professional training are among the causes that can hinder participation. These obstacles have also been found in other similar research (Shugart and Racaniello, 2015; summarized in the infographics *Factors affecting public engagement by researchers*, Hamlyn et al., 2015). Others are more specific to the Italian political and economic context.

Professional and economic instability emerged as a very problematic aspect, especially for students who were about to complete their PhD and were facing a major life change. The fact that they might be able to plan their own lives only for a short time ahead could limit their capacity to plan their involvement in outreach activities. The continual pursuit of 'the next postdoc' might reduce the energy and time that some scientists could spend on projects related to communication. Younger students and senior researchers feel less pressure of this sort.

Some volunteers indicated that their own motivation and ability were the only barriers between them and their dreams: according to them, if they remain focused on their objectives, they will manage to achieve them. A lack of money and funds was also mentioned as an obstacle, as were personal life issues, such as family, children and change of job.

Some barriers can be independent of the scientists' life and work: the political environment of the country in which they live, for example, could be more or less favourable for science and science communication. Volunteers stated that the environment in Trieste was very favourable for their commitment to science communication activities. Especially in SISSA, this type of project was always encouraged and, furthermore, volunteers could find a fertile environment where other students, professors and professionals shared their passions and interests. These factors were reported as being very important in stimulating students and researchers to become engaged in public outreach.

Even if volunteers generally judged SISSA as an encouraging place for communication activities, some volunteers reported that not all supervisors shared the idea that public outreach is something in which scientists should be involved. The mild hostility of some supervisors discouraged PhD students from taking part in activities organized by SISSA for different publics, and even transmitted this attitude to some students. This is another reason why a strong institutional commitment is needed to support these activities and the volunteers, especially the young researchers.

The improvement of science communication skills was still not seen as part of the training that a PhD programme should provide in order to shape better scientists.

On the contrary, some senior scientists still viewed these activities as being a waste of time or as representing an attitude that was not scientific enough. Eradicating this attitude would benefit both the students and the institution itself, which could count on more resources for public engagement.

Volunteers also highlighted networking and good contacts as factors that could facilitate scientists' participation: 'the more, the better' was the case here. One volunteer said:

Be connected with people who have the same interests, for example here it's easy, because there are many. But if you are in a place where everyone is just thinking about research, that could be a problem.

An important factor that was identified that could help scientists' involvement and success in science communication activities was some kind of formal education in the field. According to the volunteers, a course in communication could be very helpful for students and researchers: it would help their professional life as scientists and their participation in public-engagement activities. PhD students reported that during their PhD training they had no opportunities to learn and test how to communicate the value and the results of their research to the lay public, and that only their participation in SISSA for Schools gave them this opportunity. Some volunteers stressed that studying a topic to explain it to the general public, especially to children, forced them to understand it much better, improving their competence in doing research as well.

According to the volunteers, the focus of such courses should not be too specific, and should cover, for example, topics such as how to make good presentations and how to write good papers or abstracts, and should combine both theoretical and practical aspects. The best experiences are those that challenge students and researchers, putting them in a real situation: in front of a class, or writing a real paper.

Issues, tools, methods and know-how for effective communication of research should become part of the training of the scientist of today and in the future, and, indeed, the lack of communication skills can be a barrier for many scientists. This result confirms conclusions reached by other studies (MORI, 2000; Trench and Miller, 2012; *Nature*, 2015).

Discussion

Our experience of SISSA for Schools shows that scientists willing to participate in outreach activities and engaging the public in science are moved by personal motivations, but also by motivations of social relevance. Already strong at the start, these motivations are further strengthened by direct participation: the more scientists feel that they are directly involved and that their contributions are valued, the more their commitment grows. Personal commitment and dedication are very important (Poliakoff and Webb, 2007). Yet the goodwill of single individuals is not enough (Hamlyn *et al.*, 2015; Royal Society, 2006), and scientists feel that outreach and public engagement in science should be promoted, fostered and supported by the institutions at the level of management. The possibility of sharing one's passion, interests and ideas, not only with the public but also with colleagues at the same institution, is an important factor in transforming public engagement in science from an occasional activity to a widely acknowledged programme.

The benefits gained by the scientists participating in outreach activities are much greater than they expected, and some are totally unforeseen. In fact, beyond improving communication skills, and having an enjoyable and emotionally rewarding

experiences, most of the scientists declared that they had become better scientists and better people. The scientists' approach towards the audiences has been shaped by the desire to share their passion for science and to establish a real dialogue, where both parties can give and take. Motivations related to the attitudes of scientists who want to educate the public, based on a deficit model, were not registered during the focus groups. As a result, a real transformation, almost existential in nature, occurred in the way that scientists who were active in communication approached their research work, thought about their role in society and set the agenda for their personal career achievements.

Conclusions

In this study of three groups of PhD students volunteering for the SISSA for Schools public-engagement programme, we have found many elements already highlighted by other studies regarding motivation for participation. As found by Poliakoff and Webb (2007), Valentina and Rodari (2014), Ecklund *et al.* (2012) and others (MORI, 2000; *Nature*, 2015), there is a trend towards a greater participation of scientists in dialogue with society, whether for personal reasons or from a sense of duty towards society. Also, scientists' commitment can be fostered by an institutional policy that encourages and rewards participation, and a structured programme shared by all components of the institution (Jensen and Croissant, 2007). The need for proper training has been highlighted, and this also agrees with the international trend (Besley *et al.*, 2015; Shugart and Racaniello, 2015; Hamlyn *et al.*, 2015; Holliman and Warren, 2017).

However, we found some important distinctive aspects. First, the age of the participants (23–29) is far below the average age of scientists who deal with public activities, who are generally senior scientists in later stages of their careers (Jensen and Croissant, 2007). Second, the attitude of SISSA volunteers is one of great openness to dialogue and participation: most of the volunteers consider the public as a partner with whom to establish a relationship, rather than as a passive recipient to whom information is merely transmitted. Finally, there is a general awareness that science can be a vehicle of social inclusion and an opportunity for an honest life, especially for those who come from regions where criminality is high. It is not within the scope of this paper to investigate the impact on social inclusion that our PhD students have in their respective countries of origin (in particular, we refer to three cases of Colombia, Mexico and South Italy included in the group of volunteers). However, there are many studies and cases that demonstrate the positive role of science and technology. We refer in particular to Archer *et al.* (2015), Dawson (2014) and Merzagora *et al.* (2015).

These considerations lead us to conclude that shared objectives, appropriate recognition and reward of excellence, ongoing support through organizational management, and mentoring, can be powerful and effective tools to encourage the participation of younger researchers, and thus create a new generation of scientists more aware of their public role.

Notes on the contributors

Simona Cerrato has dealt with science communication since 1989, and has established a relationship with an extended network of scientists, institutions, universities and communicators. She has participated in many international projects: websites, magazines, schoolbooks, exhibitions, training courses, expeditions, films, European

projects and outreach activities. She specializes in the communication of science to children and teenagers, with a special focus on gender issues and social inclusion.

Valentina Daelli has a PhD in cognitive neuroscience from SISSA, Trieste, and a master's degree in science communication. She collaborated with SISSA Medialab on projects including research about the needs and experiences in science communication training for scientists and researchers. She is interested in education and science communication, and she collaborates with magazines and publishing houses.

Helena Pertot has a master's degree in Italian literature from the University of Udine and a master's in science communication from SISSA. In 2014, she collaborated with SISSA Medialab on the outreach initiative, SISSA for Schools.

Olga Puccioni has an MD in experimental psychology and PhD in cognitive neuroscience. Her research focused on factors modulating the impact of ageing on cognitive functions. From March 2014 she has collaborated with SISSA Medialab coordinating outreach initiatives with the general public, training young scientists in science communication activities, and designing and organizing science-related events and projects for diverse audiences.

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