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The Power of Science Communication

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Abstract

The study will investigate the concepts of science communication and its benefits. Being good communicators in general will help scientists to be better science communicators in order to:

- help the public understand science as part of their real lives,
- see not only the importance of the science and its source of pleasure and wonder, but also to be able to make decisions about it as citizens, policymakers, funders, etc.
- help in educating citizenry, concerned about the threats facing our planet to better shape the direction of political and policy decisions,

because how scientists communicate this information may have measurable conservation impacts on the future of our planet.
More than ever, scientists are called upon to provide assessments, often to non-scientists, on which management policies are built and experts should consider becoming more involved and effective in raising public awareness of these threats.
Traditional scientific training doesn't typically prepare scientists to be effective communicators outside academic circles. For scientists, the most important aspect might be how something fits into the given body of research, whereas, the public wants to know how a new finding might impact their lives. By considering the needs of the public audience versus a scientific one, by crafting an appropriate message, and communicating it clearly, more scientists will be more effective at bringing the world of science to the general public.
The research methodology was the assessment of the information channels from the literature and the authors' studies.
There are many interesting and innovative ways of communicating complicated concepts and the aim of the paper was to present some rules that can be applied to assure that we (scientists and public) are talking the same language, with the purpose to help promote a better understanding of issues facing our lives, thereby stimulating wise and timely action to save what belongs to us all.

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1. Introduction

Not long ago when scientists spoke, citizens listened to them in silence, with respect and confidence. In that period people believed what the doctor, physicist or economist said. At the end of the Sixties, the term "scientific" began to take on negative connotations, evoking more doubts than certainties. The scientist promise to improve life for all began to lose ground in the collective imagination because of the negative impact that some of their findings had. Let's remember the drug called „Talidomide", the „DDT", Chernobyl, and many other problems that science does not know how to solve. Not all of the impacts of science and technology, however, are equally beneficial, nor are they universally seen to be so. Fears have grown in recent years about the capacity of science and technology to intervene adversely in various dimensions of human life. Pollution and physical harm continue to be among the unintended consequences of many beneficial technologies such as electronics, pesticides and vaccines. The increasing dependence on fossil fuel based technologies is changing the planet's climate, with very serious implications for future generations.

At the same time closer relations between science and industry, often actively encouraged by governments, have called into question the presumed impartiality of science and the openness of scientific communication.

Bultitude (2011) found four key cultural factors that have influenced the separation of science from society, resulting in an increased need for scientists to engage with public audiences:

- the loss of expertise and authority of scientists
- a change in the nature of knowledge production
- improved communications and a proliferation of sources of information
- the democratic deficit.

When science authority was questioned, the relationship between science and society underwent a crisis, even if science and technology are among the most positive forces for change at humankind's disposal.

Founded in 1931, the International Council for Science (ICSU) is a non-governmental organization representing a global membership that includes both national scientific bodies (over 100 members) and international scientific unions. In its strategic review (2005) ICSU presented the most important changes that have implications for the international science community:

1. Changes in the mobility and global flows of science and scientists, and associated challenges to universality;
2. Changes in the production of scientific knowledge and the emergence of hybrid (e.g. public-private) contexts of practice, raising concerns about the impartiality of science;
3. Changes in the speed and scale of innovation, producing unavoidable new risks and uncertainties;
4. Changes in the governance of science and technology, especially as a consequence of globalization, creating new demands for expert accountability and ethical conduct;
5. Changes in the nature of expertise on the relations of science and society within civil society, especially among non-governmental organizations (NGOs), and in academia.

And concluded that, in order to strengthen science for the benefit of society, scientists need to be responsive to the changing needs and concerns of society; society, in turn, needs to understand and support the positive role of science.

The relation between science and society is tremendous important: society needs science as a driver for social, economic and political success, while science lives off the resources, talents and freedom that the society makes available. Understanding and fairly communicating risk and uncertainty are increasingly important for science and society. At the same time incorporating science-society insights into scientific practice and public policy has to be developed. The fundamental objective is to establish a deeper and more solid relationship based on trust between them. Only on this basis will the inevitable gap be bridged, even if there will always be a difference between those who hold complex knowledge and all the rest.

It is essential to make a scientifically based voice heard loud and clear, especially in time of crisis (epidemics, financial crisis, earthquake, new medications, etc.) and this can be done through professional communication. The price for not communicating or communicating poorly is becoming higher every day because today those who are not well represented in the public arena risk losing their say, resources or trust.

Communicating is considered a strategic function by the majority of organizations which interact in our social system because it identifies and justifies them, it „allows them to gain consensus and to work to achieve the objectives that all systems have: to survive, to protect themselves, to obtain resources, and to grow" (Carrada, 2006).

The scientific community should commit to communication as an integral part of a researcher's professional role and training in communications has to be a key component of science education.

And, to be effective, communication has to be a two-way process: scientists should not only present their findings, but also be prepared to take into consideration the public's needs and views.

According to ICSU statute 5 (2011) it requires also responsibility at all levels to carry out and communicate scientific work with integrity, respect, fairness, trustworthiness, and transparency, recognizing its benefits and possible harms.

2. Science communication concept

The 2000 report of the Office of Science and Technology and Welcome Trust, "Science and the public: A review of science communication and public attitudes to science in Britain" defines science communication as a term that "encompasses communication between:

- groups within the scientific community, including those in academia and industry
- the scientific community and the media
- the scientific community and the public
- the scientific community and government, or others in positions of power and/or authority
- the scientific community and government, or others who influence policy
- industry and the public
- the media (including museums and science centres) and the public
- the government and the public."

Burns et al (2003) defined science communication as the use of appropriate skills, media, activities, and dialogue to produce one or more of the following personal responses to science:

- Awareness, including familiarity with new aspects of science
- Enjoyment or other affective responses, e.g. appreciating science as entertainment or art
- Interest, as evidenced by voluntary involvement with science or its communication
- Opinions, the forming, reforming, or confirming of science-related attitudes
- Understanding of science, its content, processes, and social factors.

According to Fischhoff and Scheufele (2012) science communication must perform four interrelated tasks:

- identify the science most relevant to the decisions that people face
- determine what people already know
- design communication to fill the critical gaps (between what people know and need to know)
- evaluate the adequacy of those communication.

The purpose of science communication was described by Burns et al (2003) with a wowel analogy (AEIOU), a concise label that personalizes the impersonal aims of scientific awareness, understanding, literacy and culture:

- Public awareness of science aims to stimulate awareness of, and positive attitudes (or opinions) towards science.
- Public understanding of science (its content, processes, and social factors).
- Scientific literacy, when people are aware of, interested and involved in, form opinions about, and seek to understand science.
- Scientific culture is a society-wide environment that appreciates and supports science and scientific literacy.

Another term, frequently used in relation with communication science is Public Engagement with Science (PES). As outlined by McCallie et al (2009), Public Engagement with Science involves scientists and publics working together, and allows people with varied backgrounds and scientific expertise to articulate and contribute their perspectives, ideas, knowledge, and values in response to scientific questions or science-related controversies. It is framed as a multi-directional dialogue among people that allows all the participants to learn.

Science communication may involve science practitioners, mediators, and other members of the general public, either peer-to-peer or between groups.

The main types of science communication methods were described by Rowe and Frewer (2005) as a three-pronged approach consisting of:

- Communication (information flowing from the „sponsor"- scientific organization- to public representatives);
- Consultation (direction of travel of information from public representatives to the sponsor
- Participation (two way communication between sponsor and public representatives)

Bucchi (2008) presented a similar multi-model framework that involves: Transfer, Consultation and Knowledge-Co-Production.

Science for All (2010) presented a three key communication approaches: Transmit (inspire, inform, change, educate, build capacity and involvement or influence the others decision), Receive (use the experience, views, skills, knowledge of others to inform, inspire, educate or build your own capacity or decision), Collaborate (collaborate, consider, create or decide something together). Any science communication activity involves a mix of this approaches according to the needs of the audience and the scientist involved.

McCallie et al (2009) presented a three dimension model focused on the role of the public, of the experts and the content focus of the discussion.

Science communication involves expertise from multiple disciplines (Fishhoff & Scheufele, 2012): subject matter scientist, to get the facts right; decision scientists, to identify the right facts, so that they are not missed or buried; social and behavioral scientists, to formulate and evaluate communications, and communication practitioners, to create trusted channels among the parties. For the most part, though, individual scientists are on their own, forced to make guesses about how to meet their audiences' information needs. That's why colleges and universities need to do a better job of training scientists to explain their work.

3. Modalities to communicate science. Benefits from online presence

There is a breadth of possibilities to communicate science through:

- traditional journalism (both print and broadcast)
- live or face to face events: public lectures, debates, dialogue, science centers, science museums, etc.
- online interactions: online journalism, internet sites, blogs, wikis, podcasting, Facebook, Twitter, other social media activities, etc.

In the age of the internet, social media tools offer a powerful way for scientists to boost their professional profile and act as a public voice for science. As the benefits become more apparent and dedicated metrics are developed to supplement scientists' portfolios, social media may soon become an integral part of the researcher's toolkit. Researchers and students in the field of science need to be taught about social media in order to understand how it works, how it affects science and life, to become aware of social networks and use them efficiently.

According to Bik and Goldstein (2013) public visibility and constructive conversation on social media networks can be beneficial for scientists, impacting research in a number of key ways:

- online tools improve research efficiency
- online visibility helps track and improve scientific metrics
- social media enhances professional networking
- broadening „broader impacts", etc.

Scientists can maximize their reach by considering the following points:

- establish a professional website
- locate pertinent online conversations
- navigate the deluge of online information
- interact with diverse participants
- reach your audience.

Whatever channel of communication is chosen, effective communication suppose two important things: rationality, that in the planning stage helps to identify the opportunities, but above all the limitations of

communication; and the ability to construct, as in any literary text, a dialogue with the public, imagining for a moment what the reaction may be to what is said and consequently adapting it to the answer.

At the same time there are some rules that must be followed:

- to respect the factual truth
- to not disregard the possible negative consequences of the research (Carrada, 2006)
- to not emphasize the results more than is rightful because a public that has been disappointed once, will be skeptical forever
- to not omit other options
- to declare possible conflicts of interest
- to be ethical, accountable and transparent (Science for all, 2010).

Scientists have to declare the values of their work, but also to divulge the social implications of their work as well the work of others, and their own opinion, positive or negative. Nowadays there are enormous ways for scientists to make themselves heard so as, on one hand, their work to matter and on the other hand, the public to be well informed.

4. Conclusions and discussions

The current multiple revolutions in science and technology have an immense impact on society today and affect the future of humanity and of the Earth. Science and society look for and need each other. Scientists have an ethical obligation to the public to produce factual, intelligible, timely information and to account for their stewardship of the public funds used to support their work. As much of the ongoing research is funded with public money, it is evident the need to inform the public about the main research results, so as to allow interested people to follow the ongoing developments and to form their own opinion on the basis of sound, science-based facts and data. Communications are adequate if they reach people with the information that they need in a form that they can use.

To realize this we consider that colleges and universities need to do a better job of training scientists to explain their work. Students who are majoring in science should be required to take courses in how to communicate scientific research to the public. As we have noted, most of the science faculties in Romania don't offer courses in communication nor in science communication. This may lead to the problem of not being able to get grants and funds for the research, a widely spread problem in Romania. Romanian scientists lack in presence in the world scientific elite also because of inefficient communication skills, this being also one of the reasons of choosing this research topic.

More than this, as Fischhoff & Scheufele (2012) pointed, the nature of emerging technologies, the ongoing transformation of our communication infrastructures, and - most importantly - the insights from social science about nonexpert audiences and their interfaces with other societal stakeholders make also students from social sciences important in this demarche. In addition, universities should offer more workshops to train scientists who have already begun their research careers to communicate with the media more effectively.

Scientists, policy makers, and academics have to think creatively about new directions for rebuilding science–society interfaces and for participating in the ongoing debates surrounding emerging technologies. It is necessary to build a collaborative infrastructure between science and society, as issues like global warming, nanotechnology, all kinds of biotechnologies, etc., increasingly blurs the boundaries between science, society and politics.

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