

Change – The transformative power of citizen science

The role of citizen science in public engagement with socio-scientific debates

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Abstract

Human societies face many challenges for which scientific knowledge is essential to gain a broader and in-depth understanding of the problems and possible solutions and alternatives. However, fake news, anti-science claims and misinformation unbalance much-needed public debates on socio-scientific issues. Conversely, failure to convey a clear and transparent message about science can also contribute to the emergence or growth of controversies. There is no simple solution to such a complex problem, but the introduction of collaborative and participatory approaches to research, as a way of involving the public in the production of scientific knowledge, can be a powerful strategy for promoting trust in science, while integrating a critical view on research work. We recently proposed a new concept, engaged citizen social science, which aims to provide a theoretical framework for deeper engagement of citizens with science. This concept is being tested in a HE-funded project that integrates social sciences and humanities in the development of a new biosensor technology. Biotechnology is a hot topic in socio-scientific debates, involving issues such as control, risks, access to data, democratisation of science or governance. By engaging in structured conversations with different publics, we are mapping these and other cultural and social perceptions, exploring dimensions of representation (ideas and cultural meanings about the technology) and identity (who the public is considering knowledge, proximity to the technology, and scientific information consumption). The results of these social dialogues influence the project's research agenda and the production of the communication outputs, thus also having the potential to influence scientific policies in this area. Here we present the preliminary results of this mapping and discuss our findings in relation to our dialogical strategy.

Keywords: engaged citizen social science, biosensors, public engagement with science, cultural and social perceptions.

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Introduction

Living in societies increasingly dependent on science and technology, science and society dialogues are essential to the functioning of contemporary democracies (Davies et al. 2019). But a current scenario marked by fake news, anti-science claims and misinformation unbalances much-needed public debates on socio-scientific issues (Jonsson and Grafström 2021). Conversely, failure to convey a clear and transparent message about science can also contribute to the lack of public engagement on socio-scientific debates.

The introduction of collaborative and participatory approaches to research, as a way of involving the public in the production of scientific knowledge, can be a powerful strategy for promoting trust in science, while integrating a critical view of research work. This action mode is at the heart of citizen science, a growing field that aims to bring scientists and citizens together in the production of scientific knowledge (Irwin 1995; Vohland et al. 2021). These dynamics have important impacts on the scientific and the social communities, contributing to alternative models of knowledge production, promoting dialogues among the different members of both communities, and fostering a commitment to respond to or address socio-scientific questions (Trench 2008; Bonney et al. 2009; Kullenberg and Kasperowski 2016; Bonhoure et al. 2019; Campos et al. 2021).

We sought to incorporate citizen-science approaches in the research and communication of the Horizon Europe project BioAssembler (<https://bioassembler.eu/>). The project has an interdisciplinary approach and two major goals: 1) to develop a new generation of biosensors, and 2) to promote societal engagement about the impact of the technology. Despite being very present in people's daily lives, biosensing technologies are not widely discussed, and their development is linked to important debates in biotechnology, such as control, data privacy, democratisation and governance. Our interest, therefore, was to create a social dialogue that can feed both the project research and communication. In this paper, we present the preliminary results of the second goal—the creation of the project's communication outputs—which began by identifying the proximity of youth to science and their social perceptions and knowledge about biosensors.

Theoretical framework

The analytical and practical work described here is based on the concept of engaged citizen social science (Campos et al. 2021). As an advance in the understanding of citizen science, the concept addresses the inclusion of participatory and collaborative practices embedded in social challenges to favour the integration of non-scientific knowledge and other types of community-based knowledge. It is thus rooted in an idea of citizen science that is flexible, to accommodate other knowledge production systems, and dialogical, to create a two-way engagement with science: citizen engagement with science and scientists' engagement with society (Campos et al. 2021).

This vision is aligned with a growing body of research that demonstrate the importance to observe science communication as a process of (co)construction of meanings, which considers the experiences and identities of the public in creating connections with scientific topics (Davies et al. 2019). In the scope of

BioAssembler, this perspective is being used to co-create a visual dictionary of biosensor-related knowledge integrating contributions from scientists and citizens. However, given the complexity of the science behind biosensor's development, the first step was to comprehend who the public is considering their knowledge of biosensing technologies and consumption of scientific information, as well as their social perceptions around this technology.

Methods

This paper describes part of the citizen science approach to the social dialogue within BioAssembler, with students from two professional school classes in the city of Coimbra, Portugal. Two visits to their school were organized to 1) characterize students' interest in science and technology and their perception of biosensors and biotechnology and 2) discuss the concepts and questions related to biosensor's development and applications that should be integrated in the visual dictionary. Different methodologies were used, including a 13-question questionnaire that covered personal details, consumption of science information and knowledge of biosensors and biotechnology and two round-table debates. Students responded to the questionnaire and debated more general aspects of biosensors in the first visit. In the second visit, students discussed and revised the overall concept of the dictionary, contributing to its development with suggestions for new entries and for the writing style.

Preliminary results from the questionnaires

Sixteen students completed the surveys. 37,5% were 17 years old and 62,5%, 18 or older. Regarding gender, 56,25% identified as male, 31,25% as female, and 12,5% chose "another option". Concerning their consumption of scientific information, we were able to identify some results:

- the majority (75%) answered that they rarely search for information about science;
- most of the students revealed that they have some interest (43,75%) or almost no interest (43,75%) in science and technology, and only 12,50% said they had a lot of interest;
- as for the preferred medium to get information about science¹, the most popular choices were online (100% of participants), movies and documentaries (56,2%) and social media (50%);
- as for the most interesting formats for content about science¹, the most popular choices were video (100% of participants), audio (56,2%) and art and illustrations (31,2%);
- as for the motivations for consuming information about science¹, the most popular choice was curiosity and personal interest (56,2% of participants), followed by learning (43,8%);
- as for the barriers to engage in content about science¹, the most expressive reasons were the lack of examples and situations applicable to my reality (31,2% of participants) and the lack of interest in the topics (31,2%).

¹ These questions allowed multiple choices

The group was also asked about the terms biotechnology and biosensors.

- 68,75% considered that the term “biotechnology” was “not very familiar”, while for 18,75% it was “very familiar” and for 12,50% it was “not at all familiar”.
- as for the term “biosensor”, 50% considered it “not very familiar”, 43,75% considered it “not at all familiar”, and 6,25% said it was “very familiar”.
- concerning their perception of the impact of biotechnologies on society, most respondents said they could not form an opinion (62,5%), while 37,5% had a predominantly positive perception; none of the respondents said they had a negative perception.

Discussion

Engaged citizen social science (Campos et al. 2021) involves people actively participating in scientific research and data collection, focusing on social issues. This approach democratizes research by integrating local knowledge and experiences, enhancing the relevance and impact of studies on societal challenges, and empowering communities as key stakeholders in the research process. It also defies the boundaries between researchers and citizens, allowing the latter to interfere with the research process. But low familiarity to a given scientific subject can hinder citizen interest and/or engagement with the science (Frensley et al. 2017).

This preliminary data helped to understand the group’s acquaintance and general feeling towards the technology. Responses hinted at which themes and examples might or not produce identification, providing a starting point and narrative strategies to address socio-scientific debates or complex messages. Data provided more substance to reflect on the potential of creative forms of public engagement with science and contributed to our understanding of the reasons behind difficulties in recruiting and keeping citizens involved in the research and communication processes, and confirmed the unfamiliarity with the topic of biosensors and biotechnology (Ikegwuonu et al. 2018). Being a citizen science-based co-creation process, the results obtained are being incorporated into the development of the visual dictionary. The citizen contribution for the development of the dictionary is expected to continue with other citizen groups.

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