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Public engagement in science: New ways of participative science communication and the practical use case of the YES!-project

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PARTICIPATIVE SCIENCE COMMUNICATION AND THE PRACTICAL USE CASE OF THE YES! PROJECT

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Abstract

Informal learning becomes more and more important in a time when media sources are often doubtful and so-called fake news are ubiquitous. Also initiatives like "Fridays for Future" demonstrate the importance of science communication between scientists and lay people, especially the youth. Thereby, science communication should focus on the general public, including all educational backgrounds and social classes. This view is well reflected in the term "science popularization". In our opinion museums, information centers and libraries can have a crucial role within this matter, since they are meeting points for the interested public. However, it is insufficient just providing information on demand for those who are already interested or even engaged in science. Instead, the core question is: *How to create interest and engagement of the broad public?*

Nowadays science communication is characterized by a participative approach, i.e., there is a general shift from public understanding of science to public engagement in science. However, in praxis, linear unidirectional approaches (based on the deficit model) still prevail and real participative initiatives are rather seldom. Based on existing literature and prior empirical research, we outline the new possibilities for science popularization in general and participative approaches in specific. Thereby, we discuss the barriers for participative approaches and how to overcome them.

After these theoretical considerations, we present the YES! project as a practical use case that is coordinated by an information centre (ZBW). It provides school pupils the possibility to work on their own scientific ideas and projects (within the fields of economics and social sciences) in the form of competitive team work, i.e., several teams from different schools all around Germany take part in a competition for the best idea/scientific project. Thereby, the school teams work together with scientists (as scientific mentors) as well as with their teachers (as pedagogical mentors). The YES! project includes several diverse elements of science popularization that would be also useful for other initiatives. We outline these elements and present a list of "take aways" for other similar initiatives. The paper closes with an outlook and discussion of open questions and possible answers.

Keywords: science popularization, informal learning, science communication, participative approach, public engagement in science, scientific dialogue, school competition

1 INTRODUCTION

Science communication becomes more and more important in a time when "fake news" is a buzzword, and the credibility of media sources is often doubtful. Furthermore, recent initiatives like "Fridays 4 Future" (https://www.fridaysforfuture.org/) and "Scientist 4 Future" (https://www.scientists4future.org/) show the importance of public engagement and its alignment with scientific discourse. In this line of reasoning, open science communication is also an important element of the Open Science movement, i.e., science communication for opening up science for everybody. Moreover, in Germany, for example, the fourth Pact for Research and Innovation shows that within the next ten years science interaction with society and the integration of citizens will become even more important (https://www.gwk-bonn.de/fileadmin/Redaktion/Dokumente/Papers/PFI-IV-2021-2030.pdf).

These examples illustrate that science communication should focus on the general public, including all educational backgrounds and social classes. This view is well reflected in the term "science popularization" as defined by Noruzi [1]: "Science Popularization is an attempt to reduce the distance standing between science specialists and the public. Science popularization is interpretation of scientific information (science) intended for a general audience, rather than for other experts or students."

In line with this definition, we use the term "science popularization" throughout this paper, because this view of science popularization is also very well in line with the general shift from purely "public understanding of science" to "public engagement in science". Thereby, in our opinion the already existing meeting points of the interested public like museums, information centers and libraries can have a crucial role. However, we have to go a step further than just providing information on demand for those who are already interested or even engaged in science. Rather, the decisional question is: *How to create interest and engagement of the broad public?*

2 SCIENCE POPULARIZATION: PARTICIPATIVE APPROACH INSTEAD OF LINEAR COMMUNICATION

2.1 Approaches of Science Popularization

Overall, there are three main approaches of science communication [2][3][4][5]: the deficit approach, the dialogue approach and the participatory approach.

The *deficit approach* is based on the assumption that problems of human decision making are due to a lack of knowledge. This view also includes the implicit (and very optimistic) assumption that people are intrinsically motivated to acquire the lacking knowledge. Scientists are viewed as the experts with a repository of knowledge. Accordingly, their role is the reduction of the information deficit of the laypeople by a linear one-way knowledge transfer from experts to laypeople. This view is often based on the belief that people process the scientific information in a rational manner [6]. Also, the assumption that laypeople are intrinsically interested in science and motivated to fill their knowledge gap seems to be problematic. Furthermore, differences in the language between scientists and non-scientists are often neglected.

In contrast, the *dialogue approach* focuses on the importance of shared meaning, i.e., the meaning of scientific information is negotiated through the dialogue between scientists and non-scientists. This interactive view assumes that all participants of a communication (scientists and non-scientists) are simultaneously sending and receiving messages. Accordingly, the communication is conceptualized as a two-way negotiation of meaning and thus, appropriate channels for meaningful feedback between scientists and laypeople are of essential importance. This interactive view addresses also social responsibility by highlighting the knowledge co-production (with fluent boundaries to citizen science) and laypeople's participation in the scientific discussion.

The *participatory approach* goes even a step further and includes not only the possibility of knowledge co-production but also involves laypeople's input into scientific research. For example, in medicine, the clinical research should include patients' perspective in all aspects of its research and practice. Another example is given by Simon, Steindl, Larcher, Kulac, and Hotter [7] who showed that writing popular scientific articles about a self-chosen topic can contribute to an increase of high-school students' interest in natural science.

These three approaches are highly interconnected with the general shift from the "public understanding of science" to the "public engagement in science" [8]. Whereas the deficit approach is in line with the public understanding of science, the participatory approach reflects the public engagement in science view. Tatalovic [9] illustrates these different views by the use of science comics. Usually, science comics are made for direct (uni-)linear communication (i.e., public understanding of science). However, if the science comics are made by school children or other laypeople, they can serve as a form of public engagement in science. This implies also a different view of laypeople. A contextual dialogue model acknowledges the influence of the given situation and further context factors. However, the boundaries between the public understanding and the public engagement approaches are fluent, and often, the approaches tend to coexist [8].

2.2 Barriers of Participative Science Popularization

In their introductory essay, Stilgoe, Lock, and Wilson [10] came to the conclusion that "the move from deficit to dialogue is now recognized and repeated by scientists, founders, and policy-makers" (p.5), but they also stated that despite these announcements the practical dialogue with public still "reflect deficit-like assumptions".

This is in line with the results of the meta-analysis by Metcalfe [11] of 5151 activities in Australia that shows that in practice most initiatives follow a mixture of the deficit and the dialogue approach. There are only a few participatory initiatives (which are mainly activities like citizen science), and even these participatory activities are often mixed up and partly depended on deficit activities. In face of this gap between theory and praxis, it is often claimed that science communication needs new approaches that use the full range of possible activities and provides an appropriate frame for public engagement [10][11][12]. Thereby, it is essential to identify the current barriers to public engagement and then subsequently develop approaches on how to overcome these barriers.

In a meta-analysis on climate change communication Wibeck [8] identified three main barriers to public engagement, namely scientific literacy (e.g., limited or no understanding of system dynamics), socio-cultural factors, i.e., social norms, ideologies, values (e.g., lack of cultural narratives which encompass climate change debates) and the lack of sense of agency (e.g., disbelief that individuals can do something and that it is worth doing something in response to climate change). Wibeck [8] claimed that these barriers can be addressed by several empirically-based strategies in relation to content, visualizations, framing and audience segmentation. More detailed, Wibeck [8] stated that the content of science communication should consider the shortcomings of fear-based messages. Instead, awareness-raising messages are more appropriate because such messages still hold the potential to empower people to take action. Furthermore, the content should focus on solutions rather than problems and provide positive feedback on individual action. Visualizations (on climate change) should render global warming visible and focusing concrete, locally relevant impacts and responses to climate change. The framing of climate change should be various, i.e., as a public health issue, security issue, religious or moral issue, and/or economic issue. These different framings will encourage different segments of the public and create personal relevance. The audience segmentation itself should not only relate to demographics and socioeconomic background but also should be connected to their values, lifestyle and different "interpretive communities of risk". Even though the described work of Wibeck [8] is related to the concrete example of climate change, her findings and conclusions can be easily applied to other fields of science popularization. Thus, her work can serve as a helpful use case that might inspire theory and practice for novel approaches on how to overcome the barriers of public engagement in science.

On a more general level, Simis and colleagues [6] provide further empirically-based reasons why the deficit model still persists, including the scientists beliefs about the public and the individual's information processing as well as contextual factors (e.g., lack of institutional training in science popularization). In detail, they listed four main reasons: the scientists' belief that the public can and do process information in a rational matter, the current institutional structures (i.e., many graduate education programs lack training in public communication), the way scientists conceptualize the public (scientists' perceptions of the individuals who comprise the public), and the assumption that the deficit model can influence easily public policy for science issues.

Overall, in our view, the identified barriers of public engagement can be subdivided into two main aspects of science popularization, a formal one and a personal one:

- The *formal* aspect regards to science popularization itself including the way in which the scientific content is communicated (e.g., provision and framing of the content, the use of visualizations, the media used and the possibilities for feedback, discussion and participation) and the contextual situation (e.g., open access to scientific information, practical frame for public engagement and participation).

- The *personal* aspect relates to the interactive communication between scientists and laypeople including the beliefs about individuals' information processing, the personal interest and involvement as well as the subjectively perceived roles and possibilities of action. In the subsequent subchapters, we will show several possibilities how to address formal and personal barriers of public engagement in science.

2.3 How to Overcome the Barriers of Public Engagement with Science

2.3.1 *How to Overcome the Formal Barriers: New Possibilities of Science Popularization*

Nowadays, the Open Science movement and the participative Web 2.0 enable new and powerful ways of science popularization (general overview is given by Noruzi [1]). A ubiquitous example is the growing number of articles with open access (OA) for the general public. Also Noruzi [1] states in her editorial: "OA is the heart of democratization and popularization of science". The open access is even

more important since scientific articles often include also the possibility to leave a comment. Even though most scientific articles are hard to understand for laypeople, OA makes scientific information available and thus, it can be used for science blogs that address not only experts but also the broad public. Similar, many scientists are present and active on social media (like the microblogging service Twitter) addressing researchers as well as the interested public. Social media enable a public dialogue between scientist and laypeople. However, as Walsh [13] stated such a public discussion is a "double-edged sword of popularization", because scientific research might come under pressure towards generalization and sensationalism (e.g., Popsci.com shut off public comments in 2013; see [13]).

Besides the ubiquitous social media and their interactive possibilities, also public institutions like museums and scientific information centers offer new possibilities of science popularization. For example the Museum für Naturkunde in Berlin (https://www.museumfuernaturkunde.berlin/en) offers a broad spectrum including not only exhibitions and educational activities, but also research activities and the possibility to participate. Similar, the scientific information center ZBW – Leibniz Information Centre for Economics (https://www.zbw.eu/en/) acts no longer as a classic library but rather takes an active part in the Open Science movement and has own research activities and practical initiatives towards knowledge transfer to the broad public. Among other activities, the ZBW is also the coordinator of the YES! project which will be discussed as a practical, innovative use case on how to foster public engagement with science.

For these new interactive and more immediate ways of science popularization, the role of proximity seems to be of special importance. The study of Scotto di Carlo [14] investigated the role of proximity for the case of TED talks in relation to the applied techniques and mechanism. Thereby, TED talks were analyzed on the basis of Hyland's concept of proximity with the five elements when illustrating proximity in popular texts: Organization, argument structure, credibility, stance and reader engagement. The results show that the expert - audience barrier can be overcome by linguistic techniques used to enhance comprehensibility, the use of evaluative and emotive adjectives, and the direct involvement of the audience through the use of inclusive pronouns. Overall the results indicate that TED talks emphasize the proximity of the commitment by concentrating on how the speakers are personally involved in the topic (instead on concentrating on the speakers' identity and reputation or focusing on the proximity of the membership). That means the personal involvement of the speaker breaks the barrier between scientist and audience.

2.3.2   How to Overcome the Personal Barriers: Creating Interest and Engagement

More immediate and personal interaction (including face-to-face discussions) can have several advantages. For example, the self-presentation of scientists can have a positive impact on stereotypes about science and scientists; counteracting stereotypes can, in turn, increase the number of women in STEM domains [15]. Similar, also the study by Ruiz-Mallén, Gallois, and Heras [16] showed the impact of researchers' interaction and self-presentation on students' perception and motivation for science. Thus, breaking negative stereotypes around science and scientists can be essential to foster youth motivation for and interest in becoming a scientist. Ongoing practical initiatives with direct communication between scientists and laypeople are initiatives like "ring a scientist" (http://www.ring-a-scientist.org/modx/en/) or "meet a scientist".

2.3.3   Summary on the Possibilities for Participative Science Popularization

To sum up, nowadays there is a broad range of possibilities for participative science popularization. However, when using these new ways of science popularization it is important to keep in mind how people learn about science. Interest in science predicts knowledge and has also indirect effects on internet use, confidence in the press and the perception of scientists [17]. Again, the core question for public engagement with science remains: *How to create interest in scientific topics and the motivation to engage and take an active part?*

The described prior research indicates that personal involvement is a key factor for creating interest in science. That means the scientific topic should be of high subjective relevance. Partly, it might be necessary to make this subjective relevance more obvious (like it is done by the Fridays 4 Future for the climate change). Additionally, the personal benefit for laypeople should be highlighted to provide an incentive to take part. To some people, scientific competitions can be a motivating way. To others, the benefit for personal development (also in relation to the future career) might be of higher importance. In case of high personal relevance also more idealistic purposes like the benefit for science (analogous to citizen science) or the benefit for society can act as a subjective motivator. Furthermore, it is essential to show the individual possibilities of laypeople to take part in the scientific

discourse and how they, as individuals, can create a change and make a difference. This should go beyond the usual citizen science initiatives when laypeople are just providing data for scientists.

In the following we give a practical example how a participative project with laypeople's active and innovative participation could look like: The YES! project.

3 PRACTICAL USE CASE: DESCRIPTION OF THE YES! PROJECT

3.1 General Overview of the YES! Project

The YES! - Young Economic Summit (https://www.young-economic-summit.org/) project is an annual and nationwide student competition on the economic and social key challenges of our era. It started in 2015 under the patronage of the German Federal Ministry for Economic Affairs and Energy. The YES! project aims to strengthen students' understanding of economics, to promote knowledge transfer between researchers and scholars, and to enable the younger generation to participate in the discourse of possible solutions to current social and economic challenges.

The annual announcement of the YES! project includes some key challenges (proposed by researchers from the partner institutions). School students then start with their own innovative thoughts on these challenges of the future. The teams consist of five to 25 people. Usually, the teams' participation in the YES! project is initiated by a teacher who also accompanies the school teams during the YES! project's competition as their pedagogical mentor. By the help of experts and researchers the scholars work on their own ideas based on research and facts and develop a detailed innovation that can be applied in practice. The supporting experts and researchers are members of the YES! project's cooperation partners who voluntary support the school teams as their scientific mentors. To this end, the YES! project cooperates with a total of seventeen renowned academic institutes and universities throughout Germany, among them eight Leibniz-Institutes (see acknowledgements)

3.2 The YES! Project's Competition

Researchers from the cooperating partner institutes support the school teams with scientific advice, recent research findings, and profound answers on the school students' questions. In their role as scientific mentors, they provide expertise based on their research and relate complex research findings to the reality of young people's lives. Over a period of about six months, the school teams enter into a close exchange with their scientific mentors and develop their own solution proposals. ZBW video-based learning modules on topics such as information literacy or scientific working techniques support the process. The school teams not only get to know relevant literature at a high scientific level, but are also enabled to analyze and answer questions on sometimes complex economic interrelationships with scientific methods.

At five regional finals, the project teams present their proposed solutions and discuss them with the audience. In many other school competitions, young people are evaluated by an expert jury of adults. The YES! project explicitly takes a different approach here and lets the other school students vote on the solution ideas presented, i.e., the different teams evaluate one another. This underlines the fact that the challenges of the future are mainly the challenges of the young students and thus, they can determine which solutions should be considered in the future and are particularly trend-setting. In this way, the YES! project gives the youth a real say in the challenges of the future.

The most convincing school teams qualify for the YES! project's national final, where they not only present their ideas but also enter into an open dialogue with national and international high-ranking experts from science, business, politics and civil society. Thus the young people can experience that they are the voice of the next generation and they are not only plaything of the economic reality, but rather can co-create it. Fig. 1 shows the winning team of the YES! project's national final 2019 in discussion with international experts.

Figure 1. Winning team of the YES! project's national final 2019 in discussion with international experts.

3.3 The Participative Approach of Science Popularization of the YES! Project

While there is a large number of school competitions in Germany on the subject of business start-ups (e.g., Deutsche Gründerpreis für Schüler, Junior, Startup-Teens, business@school), the direct professional exchange between economic researchers and young people is rare. The YES! project fills this gap and enables young people a close exchange with scientific experts on economic topics on a scientific basis. Thus, the young people at the YES! project not only develop their own solution proposals to current topics from business, politics, society and the environment but also learn and use scientific methods to develop solutions and relate their innovative approaches to recent research. At the same time, the YES! project offers young people a platform on which they can carry their own solution proposals into politics, business and civil society.

Thereby, the YES! project relies strongly on a participative approach of science popularization by encouraging young people to work on (and to learn about) their own ideas with the scientific support of experts.

School students gain insight into different scientific methods and can apply them independently. This creates a connection between theory and practice and the students learn scientific working

techniques. The self-efficacy of the students is strengthened by this activity-oriented method, the creation of research results, and the implementation of their own ideas. Through the selection of the topic, the coordination of the procedure, the creation of solutions for a more general application and the evaluation of their own statistical surveys and ideas, the students show a high degree of personal responsibility. Step-by-step they learn the necessary skills in time and make practical experiences with project management. Their ability to cooperate is also encouraged. Only through good, committed cooperation and appropriate communication with their own team, the scientific and pedagogical mentors as well as with the YES! project's organization team, the students can come up with a solution idea that is suitable for presentation. They also learn how to deal with successes and failures and thus learn to cope with frustration and fears. Furthermore, at the national final, they present their results in English, so that also practical language skills are fostered.

3.4 Steady Development of the YES! Project

The YES! project is characterized by a steady development, which is based on a continuous dialogue with the user groups during and after the YES! competition, i.e., the participating students can give informal feedback about their experiences. Also, the organizers engage in regular discussions with teachers and researchers to further develop the project. For example, most of the provided learning modules were originally (in 2015) taught face-to-face by a member of the YES! project's organization team at the schools. But since 2017, the YES! project has started to develop a cloud-based working and learning platform for the young participants. Since 2019, this has been underpinned by learning videos, which is in keeping with the way young people learn today. This has the advantage of being able to train a larger number of young people in the project. The high quality of the solution proposals shows that the transfer of knowledge is still successful in this more digital manner.

Furthermore, the YES! project took place exclusively in English in the years 2015-2017 (the regional finals as well as the national final). In the discussions with the teachers, however, it became apparent that a certain number of young people were intimidated by presenting and discussing in English. In order to make the entrance in the competition easier for school students who perceive English as a language barrier, there is now the option of discussing and presenting in German at the regional finals. However, at the national final when they also get in dialogue with international experts, it is an obligation to present and discuss their ideas in English. This allows the young people to train not only their language skills but also lets them experience a discussion on an international level.

3.5 Outlook

The interest in the YES! project is high, even across the borders of Germany. For example, it is currently being examined whether the concept can be implemented in Brazil and the USA. First initiatives have already taken place in several European countries (e.g., the Netherlands, UK, Austria). Additionally, it is planned to integrate also a multimedia competition in the YES! project in order to reach 9th grades and offer an easy entry into the YES! project.

Finally, there are also first attempts to tackle the challenge of how to reach the school students even after finishing school. Science clubs could be worthwhile for this, as they could represent an exchange of content within an alumni network and offer the opportunity to continue working on solution proposals and their implementation during their university studies. Such science clubs could use the former contact with their scientific mentors as a starting point. The discourse could take place in the rooms of the cooperating institutes. However, since school students often moved in different directions after finishing school, it could be advantageously to provide online-space for future work.

4 TAKEAWAYS FOR OTHER INITIATIVES

The YES! project is first and foremost a kind of blended approach that combines elements from different approaches of science popularization. However, linear information search and direct input from pedagogical and scientific mentors are more or less side activities of the YES! project. More important is the dialogue with the experts and scientists. Yet, the core and glue that puts all together is the participative engagement of the school students who propagate their own ideas with the help of scientists.

Overall, the primary successful ingredients of the YES! project that might be also helpful for other initiatives of science popularization are the following:

- Focusing on the students' own ideas about scientific solutions supports personal involvement, engagement and continuous motivation.

- The developed solution proposals are presented to the public, experts and policymakers. Thus, the school students experience that they can make a real difference. This enhances their self-efficacy and boosts their motivation to continue their scientific participation.

- Competitive teamwork provides not only an incentive, but also fosters social skills and experiences in project management.

- Development of the students' own ideas based on scientific methods and facts gives a realistic insight into the practices of science.

- The two different kinds of mentors, scientific experts and pedagogical mentors (teachers), give students orientation and a secure background for their scientific engagement.

- The possibility for repeated talks with scientists during the development of their own ideas allows a detailed insight in science and scientific practices. Students learn not only about the scientific content but also about scientific methods and practical obstacles in science.

- Students are the "leaders" of their ideas whereas scientific experts and pedagogical mentors are only "supporters". This enhances self-efficacy and motivates young students for future work in science.

Besides the listed ingredients of the YES! project that mainly aim at the interest and participation of young people, the YES! project also provides a general societal and economic impact by enabling the practical application of the solution developed during the YES! project's competition. In this sense, students not only directly participate in the scientific progress, but also work on their future.

5 OPEN QUESTIONS AND OUTLOOK

The YES! project is a successful example of participative science popularization with societal and economic relevance. However, the YES! project focuses on school students with a relatively high educational background. Thus, several important open questions remain, especially:

- How to reach people from educationally disadvantaged backgrounds?
- How to reach illiterate people?
- How to reach people without any initial intrinsic interest in science?
- How to perpetuate long-term interest in science after students have finished school?

To address these open questions, the first necessary step is to contact these groups of people and "open the door" for them, i.e., to captivate them with science and show up their individual possibilities to participate. Thereby, it is essential to take the people where they are, that means, the interest in science should be created during their everyday activities. Thus, the initial contact with science should be made during their daily routines including their favorite media and places. This can be done in the form of announcements (e.g., flyers, graffiti) or science activities (e.g., "science slam") in everyday-places like a railway-station, a supermarket, a mall, or a gym and fitness center. Also social media contributions (in popular media like You Tube, Facebook or Instagram) in form of videos, photos, live-chats during an experiment, or multi-player science games could be a way to attract people from educationally disadvantaged background and even illiterate people. Thereby, former approaches on edutainment might provide helpful inspiration. Especially for illiterate people, picture-based material seems to be advantageously. This relates not only to videos, pictures and other language-free materials. Rather, media with fluent boundaries between words and pictures like comics and cartoons can be a good way to create not only interest in science but also foster the learning motivation. Accordingly, it is also important to investigate how such comics with science-related content can be created in a way that also attracts people without initial intrinsic interest in science [18].

However, in this context it is also important to consider the reasons for non-participation in the scientific communication. Dawson [19] illustrated three main reasons why people are apart from science communication: Cultural imperialism (i.e., misrepresentation), feeling of powerlessness, and imagined publics. For example, the results of Dawson's [20] focus group interviews showed that centers for informal science education (like museums) have special expectations about the visitors' scientific knowledge, language skills and finances. Accordingly, museums practices (related to these

expectations about their visitor) reinforce the preexisting sense of people from educational disadvantaged backgrounds that museums and science centers were "not for us".

As mentioned above, a further open question relates to the long-term engagement of non-scientists, especially young people. Even though science popularization for school students is very important and necessary, it is not sufficient. Instead, the students' engagement in science should be preserved during their later lifetime (even though they might have a job far away from science). One answer to the question of long-term engagement can be the possibility to remain together as a kind of long-term science club. Like Garcia-Guerrero and colleagues [21] pointed out there is a need for permanent science communication programs like the long-term permanence in science clubs. In order to assure the participants' full interaction on the physical, intellectual, and emotional level, it is necessary to turn the participants' role from observers to protagonists. Empirical results [21] showed the value of children science clubs in three aspects: They are enjoyable (motivate to stay involved), useful (provide elements that serve children in school or other aspects of life), and stable (offer a permanent place for anybody interested to attend and participants to keep going as long as they want to).

To sum up, the described YES! project is an example of a successful blended approach of science popularization that is partly at the crossroad to Citizen Science. The heart of success is the engagement of the students by working on their own ideas. In this sense, the YES! project is a reversed mirror to the usual projects of Citizen Science (where citizens support the scientist in their work), because in the YES! project, the students are the originators and leaders of their own ideas and the scientists support them when developing a science-based practical solution. Thus, the YES! project goes far beyond learning-by-doing. The underlying mechanisms could be described as "understanding and experiencing science by developing own ideas and solutions with the support of scientist". We hope that this novel approach will be a fruitful inspiration for other initiatives of science popularization.

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