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DivulgaMicro: A Brazilian Initiative To Empower Early-Career Scientists with Science Communication Skills †

Laura Maria Andrade Oliveira[1], Maria Letícia Bonatelli[2], and Tatiana Castro Abreu Pinto[1]*
[1]*Instituto de Microbiologia Paulo de Goes, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil,*
[2]*Escola Superior de Agricultura Luiz de Queiroz, Universidade de São Paulo, Sao Paulo, Brazil*

Communication is fundamental in science. Among scientists, communication skills are required to write a comprehensible scientific manuscript or to prepare an attractive oral presentation. In addition, the ability to communicate successfully with the nonscientific community has been increasingly appreciated, as it represents the most effective way to promote popular scientific literacy. Nevertheless, students majoring in science-related courses are not trained specifically for these purposes, and improving communication skills usually depends on tips and advice given by peers. To this end, we have launched *DivulgaMicro*, an initiative that aims to enhance science communication among early-career scientists in Brazil. *DivulgaMicro* relies on two major cornerstones: providing online resources via a dedicated website (www.divulgamicro.com.br/index.html) and promoting onsite workshops in universities located in different macro regions of the country. On the website, people can access a collection of fun activities designed to teach scientific concepts to a general audience, along with tips and news regarding public outreach events in Brazil. In the month following its launch, our website had 1,026 visitors from 10 different countries besides Brazil. Regarding the workshops, six were offered during 2018, with nearly 600 attendees. In the course, scientists are presented best practices for scientific writing and oral presentations, as well as techniques to improve communication with lay audiences, such as the use of storytelling structure and analogies. There is a high demand for science communication resources in Brazil, attesting to the importance of initiatives such as *DivulgaMicro* in our country.

A comunicação é fundamental para a ciência e a comunidade científica, cuja habilidade em se comunicar é necessária tanto para a escrita de um artigo científico quanto para a preparação de uma apresentação oral atrativa. Além disso, a capacidade de se comunicar de forma bem-sucedida com o público leigo tem sido cada vez mais apreciada, uma vez que representa a maneira mais eficaz em promover a alfabetização científica da população. No entanto, os estudantes que buscam se engajar na carreira científica não recebem treinamento específico nesse sentido, e o desenvolvimento dessa habilidade geralmente é dependente de dicas e conselhos recebidos de seus pares. Nesse contexto, foi criado o projeto *DivulgaMicro*, uma iniciativa que visa promover o desenvolvimento da comunicação científica entre jovens cientistas no Brasil. O projeto *DivulgaMicro* possui dois pilares principais: oferecer recursos *online* através do website http://www.divulgamicro.com.br/index.html e promover workshops de Comunicação e Divulgação Científica em universidades de diferentes macrorregiões do país. No website, as pessoas podem acessar e baixar uma coleção de atividades lúdicas destinadas ao ensino de conceitos científicos para o público em geral, incluindo crianças e adolescentes, além de dicas e novidades sobre divulgação científica no país. Após um mês de lançamento do projeto, o website do *DivulgaMicro* já havia recebido 1.026 acessos de 10 diferentes países além do Brasil. Em relação aos workshops, estão previstas seis edições em 2018 alcançando um público de cerca de 800 pessoas. No workshop, o participante é apresentado às melhores e mais eficazes práticas de escrita científica e apresentação oral, bem como técnicas para desenvolver e aprimorar a comunicação com o público leigo, incluindo como utilizar a estrutura *storytelling* e a aplicação de analogias. Atualmente no Brasil existe uma alta demanda em recursos e fontes de aprendizado em comunicação e divulgação científica, o que corrobora a relevância de iniciativas como o *DivulgaMicro* em nosso país.

*Corresponding author. Mailing address: Av Carlos Chagas Filho 373 bl I room 028, 21941902, Rio de Janeiro, Brazil.
Phone: +5521994205220. E-mail: tcap@micro.ufrj.br
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INTRODUCTION

Communication is one of the most valued skills in the current information age. Correspondingly, the ability to communicate is increasingly appreciated in science and may have a relevant impact on a scientist's career (1). Among

scientists, communication skills are required to write comprehensible scientific manuscripts or to prepare attractive oral presentations for scientific meetings. In addition, there is an increasing awareness that the progress of science does not depend only on having novel and great ideas but also on devoting time to share them widely. Thus, communication in science also needs to reach the lay public effectively. However, training on this subject is not usually offered as part of undergraduate or graduate curricula, and for this reason, scientists usually rely on advice and tips given by their peers. Moreover, scientists can face an even bigger challenge when they have to communicate with a nonspecialized audience: what is the most understandable and engaging way to write or speak about my research (2–5)? Indeed, scientific literacy in the general population is an emerging topic worldwide—and an especially important issue in certain countries like Brazil. In such countries, the population is generally unaware of the importance of science and usually does not support initiatives intended to foster scientific research, leading, ultimately, to a lack of investment in this sector (6–8).

Focusing on filling these gaps, we have created an initiative called *DivulgaMicro*, a project dedicated to encouraging Brazilian scientists to promote their research in a broader and clearer way, ensuring engagement of the population and increasing popular awareness of the importance of Brazilian science. *DivulgaMicro* relies on two major cornerstones: providing online resources via a dedicated website (www.divulgamicro.com.br/index.html) and promoting onsite workshops in universities located in different macro regions of the country. Tools and resources offered by *DivulgaMicro* are all in Portuguese, the official language of Brazil, with the ultimate goal of inspiring, mobilizing, and involving a great number of scientists in communication and making the public aware of the importance of our scientific research.

PROCEDURE

DivulgaMicro website

On the website (www.divulgamicro.com.br/index.html), *DivulgaMicro* offers several tools and resources, all free of charge, focused on science communication and public outreach, including promoting related events in Brazil, tips for improved science communication, a collection of fun science-related activities, and the Up-Goer 5 challenge in Portuguese. The website was originally built in Portuguese, the official language of Brazil, but it also has an English version (www.divulgamicro.com.br/en/index.html).

The collection of ludic science-related activities represent Portuguese-translated versions of K–12 lessons originally designed and provided by the American Society for Microbiology (available at https://www.asm.org/index.php/educators/k-12-classroom-activities). We discovered that translating the activities into Portuguese was crucial to gaining wide acceptance among K–12 students and teachers in Brazil, since English is not a mandatory subject in Brazilian schools. Moreover, none of the activities involve biological safety issues, so they can be performed anywhere, regardless of the existence of a laboratory infrastructure, and by anyone, scientist or not. Currently we offer six science education activities, all available for free download from the website. They are described in detail in the supplemental material.

The Up-Goer 5 challenge (http://splasho.com/upgoer5/) is a text editor created by geneticist Theo Sanderson, who challenged people to explain complex ideas using only the 1,000 most common words in the English language. The Up-Goer 5 challenge, in turn, was inspired by a brilliant comic (https://xkcd.com/1133/), which described in an unprecedented and incredibly simple way how a space rocket would go to the moon (Saturn V). In collaboration with Theo Sanderson, *DivulgaMicro* released the Portuguese version of this text editor. The Up-Goer 5 challenge in Portuguese aims to inspire scientists to practice their communication skills by describing scientific projects and ideas using only the 1,000 most common words in Portuguese. All participants who successfully meet this challenge can send their texts to *DivulgaMicro* to have the text published on our website. All published texts will be submitted to popular vote and run for a prize.

DivulgaMicro workshop

The science communication workshop offered by *DivulgaMicro* is a one-day session (nearly 8 hours) and comprises different aspects of science communication skills, including the following:

- Best practices for writing scientific papers: In this section, we explain the importance of writing well and outline the critical points and basic structure of a scientific manuscript.
- Best practices for poster design and presentation at scientific meetings: In this section, we show the students how to design a high-quality poster to be presented at scientific conferences and meetings and explain the importance of face-to-face communication for professional purposes.
- Tips for preparing oral presentations: In this section, we explain the importance of knowing the target audience, we show how to design visual art for your presentation, and we offer tips for controlling anxiety before oral presentations.
- Strategies to communicate effectively with the lay population: In this section, we show and explain some techniques that can be applied to public outreach situations, including the storytelling model and the use of analogies. In addition, we highlight differences between a scientific and a journalistic article and show some examples of scientific blogs that are active in science outreach in Brazil.

The workshop is highly interactive. Throughout the day, we provide correct and wrong examples for each of the sections above, and we frequently request the participation of the audience to perform exercises related to the workshop scope.

In 2018, six workshops were offered throughout Brazil, ensuring that *DivulgaMicro* reaches all five macro regions of the country (Fig. 1). This approach is particularly important in Brazil, a continent-sized country with a very uneven distribution of both population and socioeconomic resources. In general, the South and Southeast regions of the country are the most populated, where financial resources are more abundant. The North and Northeast are the largest regions in terms of territory but harbor fewer people and have poorer socioeconomic conditions.

The authors listed in this paper are responsible for the development of the workshop and are its instructors. Workshops were organized in collaboration with local universities. Registrations for these workshops were fully completed in a few days and nearly 600 attendees were computed, showing the high demand for this type of activity in Brazil.

Safety issues:

None

CONCLUSION

DivulgaMicro has had very positive feedback. Only one month after its official launch on March 19, 2018, our website had recorded a total of 1,026 visits. Most of the website accesses were from Brazil (92%), but we also registered visits from the United States, Peru, the United Kingdom, Germany, Canada, Chile, the Philippines, Pakistan, Portugal, and Uruguay. On August 10, 2018, we therefore made an English version of the website available. The most frequently accessed content in our website was the page about the science communication workshops (seen by nearly half of all visitors). In terms of the workshops, nearly 600 early-career scientists were trained by *DivulgaMicro* during the six workshops offered in 2018. Such positive feedback from the scientific community may be related to the fact that there is currently an increasing interest in science communication issues but very few courses and resources on this subject available in Portuguese and in our country to meet the demand. Indeed, according to a survey of nearly 100 Brazilian participants we conducted via social media, 72% answered that they had never attended a science communication course or workshop. These observations suggest that science communication is an emerging subject in our country, and scientists as well as science teachers are probably eager to learn more about it, demonstrating the importance of initiatives such as *DivulgaMicro* in Brazil.

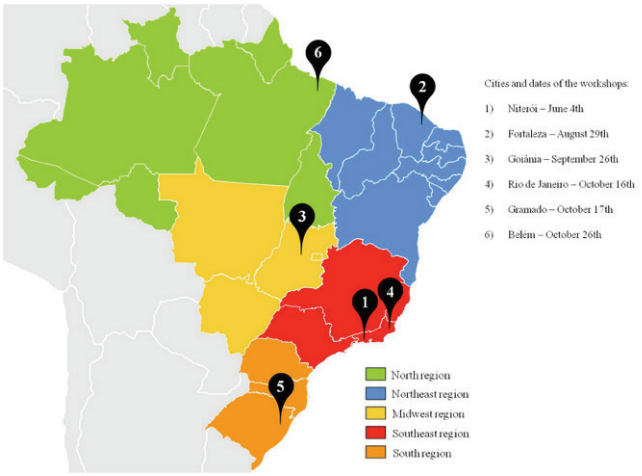

FIGURE 1. Map of Brazil showing the five macro regions of the country and the places and dates of the six science communication workshops offered by *DivulgaMicro* in 2018.

SUPPLEMENTAL MATERIALS

Appendix 1: Detailed description of K–12 activities provided by *DivulgaMicro* in Portuguese

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