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Scientist at School: Connecting Elementary Students to University Clinical Research Scientists Through Live Streams During a Pandemic in Southern Brazil

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Abstract:

Introduction: *The social distancing generated by the COVID-19 pandemic had a great impact on education. Although very challenging to implement and adapt in an emergency scenario, distance learning opened novel opportunities to educational initiatives. The project Scientist at School, developed in southern Brazil during this period, had the goal to adapt postgraduate and elementary students' encounters to a live stream format.*

Methods: *This observational study analyzes the remote teaching process during the pandemic, with the project's experience from different points of view. In addition to consulting the recorded access data from transmissions, three questionnaires answered by viewers evaluated content quality.*

Results: *All live streams were classified as "excellent or good" by the students; with 66.7% of them affirming that the distance modality was not a limiting factor and that it could ease access to knowledge. Many of the organizers said that interacting with elementary school students and researchers from different fields helped them to expand their views on science production in the university and to improve their science communication skills. More than 85% of teachers and guests rated the activity as "excellent," however, one in two indicated that inequalities in internet access were a limitation for this learning modality.*

Conclusion: *The project was able to provide a new experience of teaching and promoting science communication at a community level, exchanging knowledge in accessible language.*

Keywords: *distance learning, education, scientific communication, live stream, pandemic*

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INTRODUCTION

The world health scenario has undergone changes in all social sectors, which is reflected in politics, economy, and especially in education. These changes occurred due to the discovery of a new coronavirus and the respective disease it caused called COVID-19. This initially manifested itself in the city of Wuhan in China, and later spread worldwide causing a pandemic of catastrophic proportions. Brazil, like other countries, adopted some drastic measures to contain this pandemic, which began in mid-February 2020 in the country (Pinheiro & Ruprecht, 2020). Social distancing was one of the first preventive measures, leading to the closure of activities and trades, including more than 180,000 Brazilian schools and educational institutions, affecting 47 million students (Aristovnik, Keržič, Ravšelj,

Tomaževič, & Umek, 2020; World Bank Group, 2020). In addition to face-to-face classes, several elective projects and extension studies were also interrupted. Faced with this difficult situation, emergency remote education showed itself as the main way to reduce the growing educational crisis in the country (Paz, 2020).

Misinformation has always been a concern for public health (Vasconcellos-Silva & Castiel, 2020), but now with its massive dissemination through social media, the so-called "fake news" can have greater impact, hampering social policy development and implementation across the globe. It is having drastic consequences on mitigating measures of the COVID-19 pandemic, leading to avoidable deaths worldwide and amplifying society's perception on the harm of "fake news". In this scenario, the need for scientific literacy of the population to discern false from serious news is paramount. Scientists and communicators (journalists, science vloggers) should assist the general public in identifying fake news, promoting the dissemination and access to reliable and evidence-based information by various media (Naeem, Bhatti & Khan, 2020).

The technological adaptations from in-person to remote education have been challenging for both teachers and students, but it also opened novel opportunities (World Bank Group, 2020). Taking into consideration the relevance of science communication to society and the need for remote education imposed by the COVID-19 pandemic, the project called "Scientist at School" arose in southern Brazil. The project was developed by the Graduate Program in Medical Sciences (PPGCM) of the Federal University of Rio Grande do Sul (UFRGS), in association with the elementary school Governador Ildo Meneghetti in the city of Porto Alegre. The project was already planned to be developed face-to-face in schoolrooms and required an adaptation to the on-line format. It is aimed to promote a closer contact of scientists and elementary school students by presenting projects developed in the university.

Universities are committed to society, and its scientific productions generate knowledge and promote culture at the local and national levels. However, much of this production does not translate to non-experts or lay peoples' language, remaining within "academic" walls. Scientists in general do not receive specific training to explain their research to a wider public in an engaging manner. Therefore, promoting science communication skills and science dissemination actions are paramount to popularize science to the general population (Illingworth, 2017).

The present work describes the experience and results of the project during its first five live streams, aired during the COVID-19 pandemic, exposing the didactic-pedagogical aspects related to the contents, activities, and developed educational resources. In addition, we describe the experience and perception of students, teachers and program participants. To achieve that, the community acceptance and feedback were evaluated through streaming accession data and questionnaires. Furthermore, the outcome of taking part in this distance learning activity as a remote teaching internship of graduate students is described by personal reports and opinions regarding the scientific dissemination project.

METHODS

This is an experience report and an observational, analytical, descriptive study with a quantitative-qualitative approach of a project that aimed to bring together professors and graduate students of the Graduate Program in Medical Sciences of the Federal University of Rio Grande do Sul (http://www.ufrgs.br/ppgcm) and an elementary school community (including teachers, students, and their families) in the city of Porto Alegre, the capital of the southernmost state of Brazil, Rio Grande do Sul. Activities were announced by digital posters and were carried out by exhibitions and classes presented using the Google Meet digital platform (http://meet.google.com/) and broadcasted live on the official PPGCM YouTube channel (https://www.youtube.com/channel/UCwkSkURqNoVFuOvI3cOA1hg). Afterward, schoolteachers used the streams as themes for activities at the school's remote teaching platform (https://cortexai.com.br). The broadcast was conducted through the free streaming and recording program Open Broadcaster Software (https://obsproject.com).

Five live streams were performed on different themes: (1) "Donation of antibodies as a new treatment for COVID-19"; (2) "What is our place in the Universe? - The discovery of new galaxies by researchers at UFRGS"; (3) "Why does science take so long to solve a problem?"; (4) "Empowering IG: the rescue of the self-esteem of young people from public schools through empowerment and anti-racist education"; (5) "Nature Deficit Disorder: can the lack of contact with nature make us sick?". The content is available on the official PPGCM YouTube channel in Portuguese.

Each session lasted one hour via Google Meet with an estimated time of 20 minutes for the researcher's

presentation, 20 minutes for discussion of the topic with moderators (researcher guests, teachers from the graduate program, schoolteachers and school students), and 20 minutes for answering selected questions from the YouTube chat. Everyone who was not in the role of moderator followed the activities by live broadcast on the YouTube channel and could interact by the real-time chat. All chat questions were evaluated by the graduate program's students who were in the role of chat moderators and some were sent for discussion. Questions that haven't been answered due to the time limit were covered by the researcher in the YouTube comments section. After each activity's end, the recorded video was posted and shared on social media of the participating school and graduate program, from the original video that was made available on the YouTube channel.

Three questionnaires were applied. The first, after the second live stream, aimed to choose the topics to be addressed further (**Appendix 1**). Questionnaire two was directed to MSc and Ph.D. students to evaluate impressions of their didactic experience (**Appendix 2**). Finally, the third questionnaire, which was directed to the moderators, teachers, students and guests, assessed their satisfaction and experience in general (**Appendix 3**).

On the YouTube Studio platform (https://studio.youtube.com) the interaction registry of each activity performed was extracted. The data included information such as video overview (number of views, average viewing duration, and average view percentage), the reach and origin of traffic, engagement, the audience (unique viewers, average views per viewer, age and gender), and device used for access.

The quantitative data were descriptively expressed in percentage, as mean and standard deviation of the mean. The analyses were carried out in the IBM SPSS Statistics for Windows program, version 18.

RESULTS

From August 11th to December 8th, 2020, 1.699 web links accesses were obtained. The demographic characteristics were compiled and are depicted in **Table 1**. As a pilot of an online education modality, the two first topics were selected by the project organizers. The three most voted topics in Questionnaire 1 were elected as themes for the following broadcasts (Supplementary data).

While live-streamed, the topic with more participants was "What is our place in the Universe?", but topic one "Antibody donation as a new treatment for Covid-19" had more concurrent viewers while transmitted. The topic with fewer participants and concurrent viewers was the latest, "Nature Deficit Disorder".

YouTube analytics does not separate the public by regions, only reporting the geography by countries. The average transmission time was 1:11:02 hours and the average watch time was 17:14 minutes.

A closer examination of the public participation revealed that the greatest portion of participation came from external sources (64.2%±53.5) such as WhatsApp (26.6%±16.5), Facebook (10.6%±12.7), UFRGS page (4.5%±5.7), specific school platform for distance learning (5.0%±4.8), and Instagram (1.0%±0.0).

Characteristics	LIVE 1 (n= 520)	LIVE 2 (n= 487)	LIVE 3 (n= 214)	LIVE 4 (n= 230)	LIVE 5 (n= 151)
Duration	1:02:51	1:09:50	1:26:32	1:10:27	1:06:47
Concurrent viewers	73	60	35	42	35
Average watch time	18:58	11:51	15:26	18:18	22:18
Total watch time	63:35:35	58:42:10	38:52:29	43:55:51	31:36:13

Views					
Livestream	201	297	151	144	85
Playbacks	263	170	55	89	55
Audience retention					
Average view duration	10:54	9:33	13:34	15:25	14:32
Average percentage viewed	17.3%	13.7%	15.9%	14.5%	21.8%
Traffic source types n (%)					
External	136 (51.5%)	105 (51.3%)	12 (45.3%)	40 (45.1%)	28 (50.0%)
WhatsApp	41 (30.5%)	45 (42.8%)	7 (60.8%)	26 (65.1%)	14 (51.4%)
Facebook	33 (24.6%)	8 (7.2%)	2 (16.5%)	4 (10.1%)	6 (20.8%)
ufrgs.br	13 (9.7%)	1 (0.4%)	-	2 (1.8%)	2 (5.6%)
com.cortexai.cortexaluno	11 (8.4%)	21(19.6%)	-	-	-
cortexai.com.br	4 (3.1%)	12 (11.2%)	-	3 (3.7%)	1 (2.8%)
instagram.com	-	-	-	1 (0.9%)	1 (2.8%)
Direct or unknown	46 (17.4%)	14 (21.2%)	6 (20.6%)	16 (17.6%)	7 (14.3%)
Channel pages	21 (8.0%)	14 (21.2%)	12 (6.6%)	15 (16.5%)	5 (8.9%)
YouTube search	19 (7.2%)	20 (11.9%)	9 (8.4%)	9 (9.9%)	10 (18.2%)
Suggested videos	13 (4.9%)	2 (3.7%)	8 (7.9%)	-	2 (3.6%)
Browse features	4 (1.5%)	6 (3.5%)	5 (7.0%)	6 (6.6%)	2 (3.6%)
Others	24 (9.1%)	9 (5.3%)	3 (5.4%)	3 (4.4%)	1 (1.8%)

Table 1. Baseline Viewers' Characteristics According to each Live Stream. Data are shown as time, n or n (percentage). Ildo Meneghetti School platform for distance learning: com.cortexai.cortexaluno (students) and cortexai.com.br (teachers). University site: ufrgs.br.

Perception of the Graduate Program's Students of the Science Communication Activity

Seventeen PPGCM students participated as project organizers. Students' tasks were allocated as follows: four served as panelists mediators, three as online media managers, and three as online chat controllers (taking turns by Live Streams). All participants helped make and promote the virtual posters which contained the direct YouTube link, as well as interacted with the audience during the activity.

A total of 10/17 (58.8%) graduate students completed the questionnaire, 40% of them were Ph.D. students. The graduate students classified all topics as "Excellent" or "Good", considering topic four, related to empowerment and anti-racist education, as foremost (**Figure 1a**).

In contrast, themes one and two were highlighted when evaluated for perceived negative aspects. (**Figure 1b**). About 80% of students classified the Scientist at School project as "excellent" without negative scores (**Figure 1c**) because of the promoted involvement of scientists with the society, discussing relevant issues in which the community elected the most pertinent topics:

- "[...] The perception that we (scientists) had is that there is a lot of incorrect information circulating in the media, causing confusion and spreading misinformation and sometimes panic. [...] We also note that young citizens, in general, rely on dubious digital sources of information, such as social media. This reaffirmed the importance of such a project, which adequately elucidates and guides based on recent scientific evidence and recommendations from health agencies. [...]" (graduate student)
- "[...] We believe that this contact has initiated a deconstruction process of the scientist figure, traditionally considered an inaccessible knowledge holder." (graduate student)
- "[...] We stopped being researchers for a moment and became spectators like all the children who were there, as if we were discovering the scientific method again, only this time, by a simpler, didactic, contextualized and amazed look. [...]" (graduate student)

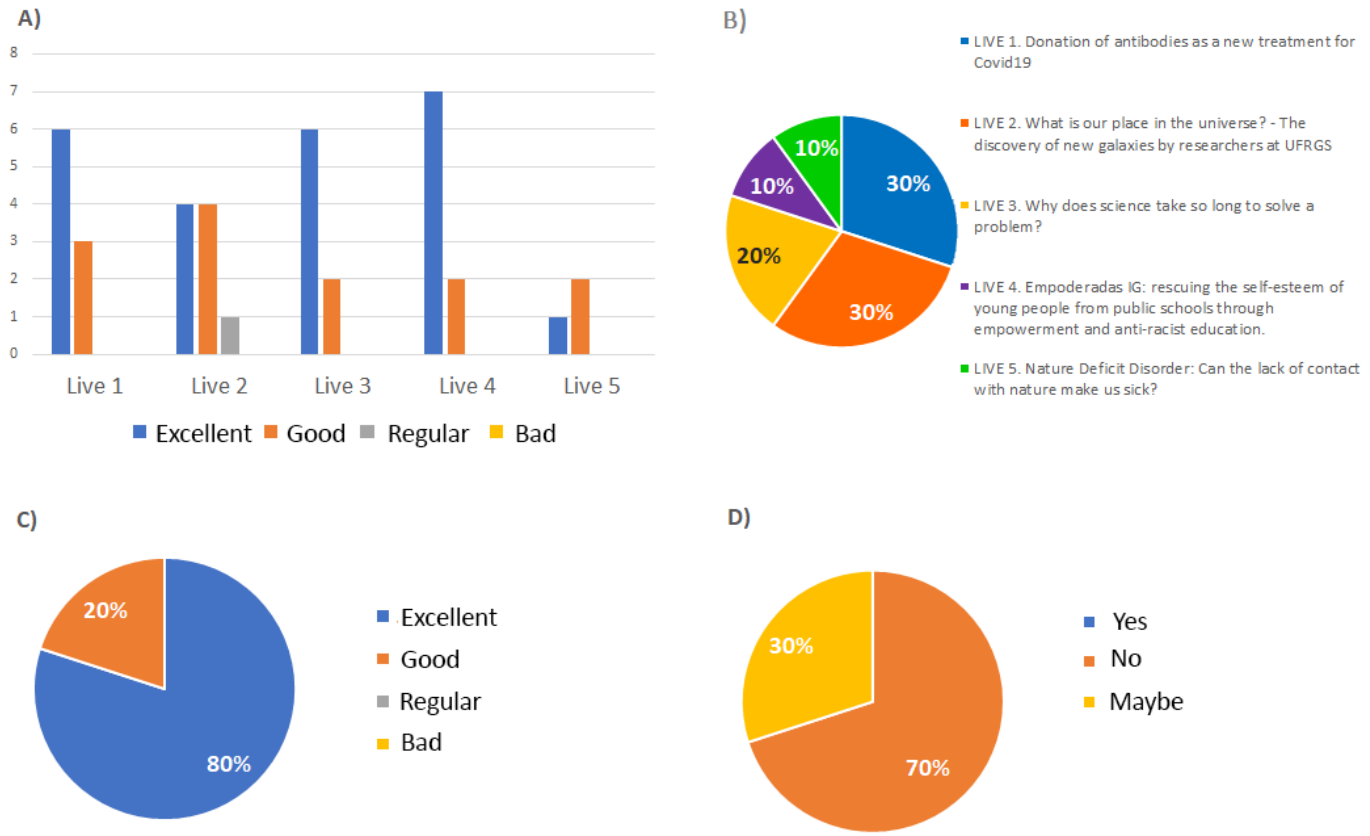

Figure 1. Graduate students' Perception of Scientist at School Lives. A) Overall quality evaluation of each Live. B) Lives with greater index of limiting aspects for comprehension. C) Evaluation of the general quality of the Scientist at School project by students. D) Evaluation of the project with distant learning modality as a limiting factor.

Everyone listed inexperience in live streaming platforms and networks as the main limitation to the project. Thirty percent of students considered that distance learning might be a limitation (**Figure 1d**). On the other hand, the graduate students perceive an opportunity to disseminate reliable knowledge and acquire support from the population:

- "The community was more attentive to the role of science. In addition, people began to seek information through video lessons and live streams during this period. These factors help the dissemination and appreciation of science among the general population"
- "[...] I think it has awakened the curiosity of the community with science."
- "[...] By encouraging students to be curious, critical, and to seek knowledge, we are improving their critical sense and giving them an instrument for use in life."
- "There is a lot of misinformation and mystification about science and its areas [...] We have to bring quality information and return to society so that they can understand the importance of producing knowledge, reflecting on greater support and development in the future."

Perception of Live Stream Moderators (School Teachers and Guests)

Sixteen people participated as panelist moderators, eleven being teachers from the Ildo Meneghetti school, one nine-year-old school student, two external student guests, and two PPGCM professors. In the third questionnaire answers, of 14 respondents, 12 rated that the developed activity was "Excellent", two valued as "Good" and none rated it negatively (**Figure 2a**).

Evaluations were overwhelmingly positive, highlighting the project as a remarkable opportunity to bring the community and researchers closer:

- "Undoubtedly, the approximation between the university and basic education institutions of the public network brings benefits for both sides, encouraging our students and broadening the prospects of social change in the communities. Similarly, this "floor of reality" is fundamental for researchers, bringing theoretical knowledge closer to practice and delivering the results of studies conducted to the public for which they are intended. This exchange is very rich and we get to know the interests of the students better, also contributing to our pedagogical practice." (school teacher)

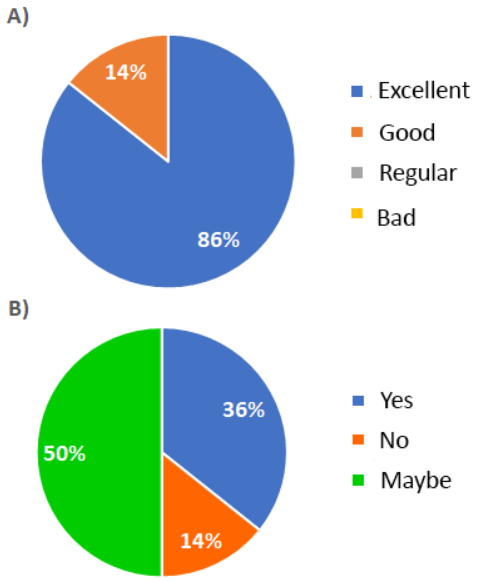

Figure 2. Moderator's Perception of Scientist at School Live Streams. A) General classification by the moderators. B) Perception of distance activity as a limiting factor.

- "This project embodies one of the principles of the University, community approximation. UFRGS is no longer an unreachable place, to which the periphery does not have access and often does not even know its existence; and becomes a possible place, desirable to those who are far from it. This project informed and enhanced critical thinking, which is urgent in the era of fake news." (school teacher)

Half of the moderators stated that distance-learning might be a project limitation (**Figure 2b**). School teachers emphasized lack of accessibility to technology by the school community as the main cause:

- "Unfortunately, with the fake news and discredit given by some governments to science, often the incorrect information on prevention and non-dissemination of the virus can be harmful at this time."
- "The lack of access due to the social and economic inequalities have increased in this period and may have generated a fragility in the dissemination of science to communities, enhanced by "fake news", which have no scientific basis."

DISCUSSION

As a pilot in several aspects, the Scientist at School project had a great engagement of all involved actors.

With the arrival of the pandemic, this project saw an opportunity to develop in graduate students a different methodology of curriculum didactics. This initiative was applied to a science communication action during a public health crisis and contributed to the scientific literacy of elementary school students and the school community, which may have future social and cultural impact on the local sphere.

During the discussion of the first live stream related to plasma exchange treatment for COIVD-19, which received several questions from the community, it was possible to notice the influence that many media sources have on the construction of knowledge and the importance that scientific dissemination projects have in promoting healthcare information (Vabret et al., 2020).

After the second live stream, several researchers from UFRGS submitted their research projects to be selected by the school community, in an online vote, as the topics to be presented to them. Being able to choose multiple options, 49 individuals responded. Among the most voted themes, issues of racial empowerment, lack of contact with nature, and the time that science takes to solve problems were the ones that aroused greater curiosity. There was a great diversity of topics submitted such as hereditary cancer risk, development of drugs for children, freehand drawing, antifungals, DNA editing, and several projects related to bioengineering (**Supplementary Figure 1**).

The way the public accessed and participated was mainly from social media platforms. This goes in the same direction with the means of advertising used by the project group (Facebook, Twitter, Instagram, WhatsApp, PPGCM page, e-mails and personal contacts), as there is a growing trend by the general public to seek information online (Ali & Bhatti, 2020; Johannsson & Selak, 2019). The teaching platform used by the school was made available by the City Hall and was used for playback views only. The platform was fundamental, to develop subsequent school evaluative activities involving the broadcasts' themes and related discussion.

In the perception of graduate students and invited moderators, the overall quality of the transmissions was rated positively and the factors that influenced this evaluation were mainly didactics, debate, and participants' engagement (**Figure 1a**). Theme four highlighted that ethnic-racial issues require greater attention, being a demand of the community (**Figure 1a**). However, the main limitations found were complex language, a theme far from the public background, insufficient time for debate, technical failures in the transmission, and few questions or questions outside the context of the theme raised in the chat (**Figure 1b**). The community also points to economic disparities as a strong limiting factor.

Tele-education, although very useful, highlights the long-existing economic, social, and cultural inequalities. With the migration to online learning models, families with little training and conditions find themselves unassisted and with the enormous responsibility to meet the educational demand of their children and young people. Education and information are not equally available to all students (Santos, 2020). There is a demand to be better exploited. The students affirm that, with the course of the pandemic, the communities, in the search for quality information, improve critical thinking about the content they read, but still suffer strong influence from misleading information. Projects such as the Scientist at School help in this process, developing thinking and questioning about information:

- "[...] In the University environment, we are used to focusing only on usual and formal productions. Because it is an extremely competitive environment, sometimes we forget the real purpose of why we are there and for whom. Therefore, being part of this project helped me in my reunion with the purpose to be a scientist." (graduate student)
- "[...] The profession of a scientist requires a lot of effort, preparation, knowledge, research, time, and dedication, but also great commitment. […]" (graduate student)
- "[...] As we specialize, we forget about basic things, such as disclosing what we produce. […] We forget to observe the small demands of the population. This project brought new perspectives on how to approach and transmit knowledge so that it can be understood and shared. [...] Science is built in daily life in different ways and communication is a bridge of great value. [...]" (graduate student)

The evaluation of the Scientist at School project was also rated positively by both researchers and the school community (**Figure 1c** and **Figure 2a**). In reporting the experience they had, in addition to the language and material used, the researcher-community approach weighted on the evaluation of both graduate students and school community participants who were in the role of moderators.

When questioning the participants whether the model used could be a limiting factor, two realities were

perceived. First, 70% of graduate students considered the format not an effective limiting factor (**Figure 1d**). From the point of view of community moderators, only 14% believe that the model was not a limiting factor (**Figure 2b**). As justifications for this evaluation, the organizers affirm that technology expands access opportunities, facilitating knowledge reach and availability. Still, from the pandemic point of view, it became a safer way to acquire knowledge. All participants contemplated that the project should be expanded to other schools. However, the reports indicate that the remote model becomes a limiting factor, weakening the student-speaker interaction, limiting dynamics and being a dispersing factor of attention.

The information supplied in person by the school was unavailable during the pandemic and social isolation. Also, the lack of appreciation of science and the uncontrolled increase in fake news hinders the dissemination of important research and reliable data. In a more optimistic view, there is a perceived growing demand for professional scientists and their work.

Projects such as the Scientist at the School contribute not only to science dissemination but also to the didactic improvement of graduate students. For them, contact with the school community, its needs and opinions, as well as sharing experiences with colleagues from various areas of knowledge, provided an enriching experience. It came off the traditional science teaching model to a broader format aimed to effectively communicate and disseminate science. The concept of teaching has now been reconstructed for them in a more interactive and media-connected way, focusing not only to communicate but also to comprehend society. Language should be used in a more accessible way and researchers must be committed to it.

At the project beginning, a knowledge-deficit model was considered, where the university would inform the community. However, during its development, a two-way interaction model was perceived, with great bidirectional exchanges among colleagues, students, and teachers, displaying how science gets communicated and debated in real-world settings (Scheufele, 2014). The role of science dissemination actions in modern society could be acknowledged, accounting not only for the scientist-community interactions, but also the mediated realities that reach and inform people in everyday life. In this context, there is a need to employ more effective communication strategies by scientists and communicators, in benefit of the scientific literacy of the population.

The possible biases of this study are those of elucidation, selection, and measurement. These biases were addressed when possible by stratified analysis and they do not appear to change the validity of the data or conclusions. It is unknown which communication channel was more effective in the dissemination and whether there would be a need to adopt other media for greater engagement of the school students. Due to the lack of classification by the platform, it was not possible to distinguish precisely geographic data regarding state and city, how long each person remained online watching the activity, which device was used, age group, and gender. We also emphasize that this article is written from the graduate students' perspective.

CONCLUSION

This project allowed the development of a graduate program teaching activity and provided those involved with an opportunity to reconstruct concepts. A researcher-community relationship was created through the exchange of information and experiences on both sides with a bidirectional dialogue. Encouraged by the pandemic and the emerging demand for reliable information, the model proved to be an alternative to misinformation. However, socioeconomic vulnerability is a challenge for events of this modality. With this study, the need for scientific communication beyond academic walls in an accessible language is refined and reinforced, accounting for the larger political contexts in which science–public interactions take place. It also highlights the need for scientists and universities to develop proactive communication environments, providing efforts to keep the audience engaged on issues regarding the public agenda.

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Conflict of Interest

We have no known conflict of interest to disclose.

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