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Article

Young scientists: facing arboviruses and youth participation in the territory

Jovens cientistas: enfrentamento às arboviroses e participação juvenil no território

Jóvenes investigadores: enfrentamiento a las arbovirosis y participación juvenil en el território

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Abstract
This study analyzes a Scientific Initiation program on arboviroses, from the perception of young high school students in Ceilândia – Distrito Federal. **Objective:** It aims to understand to what extent the SI mobilizes these young people to participate in surveillance and health promotion actions in the territory and understand their motivation to participate in this project. **Methodology:** The methodology included the analysis of the essays written for the selection to the Training Course for Scientific Initiation in Basic Education and the Arboviroses, the administration of this course, and later a focus group with students to analyze the SI educational process they experienced. **Results:** The result of the Content Analysis showed that the students' perception about the SI could be grouped into six categories: students' motivation for the scientific initiation; the learning process; the training of young scientists; health and environment; youth participation and empowerment, and perceptions of the Public health system in Brazil (SUS). **Conclusion:** Confronting arboviroses requires broad-spectrum policies and interventions, and the SI strengthened these young students as subjects of rights, broadened their perception of science, health, relationship with the environment, with the Sistema Único de Saúde and stimulated interest in preventive actions to combat arboviroses in these territories.
Keywords: Health education; Arbovirus infections; Adolescents; Public health.

Resumo
O estudo analisa uma formação em Iniciação Científica sobre arboviroses, a partir da percepção de jovens estudantes, em Ceilândia – Distrito Federal. **Objetivo:** compreender em que medida a Iniciação Científica mobiliza esses jovens a participarem de ações de vigilância e promoção da saúde no território, e entender sua motivação para participar do projeto. **Metodologia:** abrangeu-se a análise das redações escritas para a seleção ao Curso de Formação para Iniciação Científica na Educação Básica e as Arboviroses; a administração desse curso e; posteriormente, um grupo focal com estudantes para análise do processo educativo da Iniciação Científica que vivenciaram. **Resultados:** a análise de conteúdo evidenciou a percepção dos alunos sobre a Iniciação Científica, centrada em seis categorias analíticas: motivação dos alunos para Iniciação Científica; processo de formação do saber; formação de jovens cientistas; saúde e meio ambiente; participação e empoderamento juvenil e percepções acerca do Sistema Público de Saúde. **Conclusão:** o enfrentamento às arboviroses exige políticas e intervenções de amplo espectro, e a Iniciação Científica fortaleceu esses jovens estudantes enquanto sujeitos de direitos, ampliou sua percepção sobre ciência, saúde, relação com o ambiente, com o Sistema Único de Saúde e estimulou o interesse em ações preventivas no combate às arboviroses nesses territórios.
Palavras-chave: Educação em saúde; Infecções por arbovírus; Adolescente; Saúde pública.

Resumen
Analiza una formación en Iniciación Científica (IC) sobre arbovirus, desde la percepción de jóvenes estudiantes de secundaria en Ceilândia, Distrito Federal. **Objetivo:** el objetivo es comprender en qué medida la IC moviliza a estos jóvenes a participar en acciones de vigilancia y promoción de la salud en el territorio, así como entender su motivación para participar en proyectos de IC. **Metodología:** la metodología incluyó el análisis de las redacciones escritas para la selección al Curso de Formación para Iniciación Científica en Educación Básica y Arbovirus, la administración de este curso y, posteriormente, un grupo focal con los estudiantes para analizar el proceso educativo de IC que vivieron. **Resultados:** los resultados del Análisis de Contenido mostraron la percepción de los estudiantes sobre la IC enfocada en seis categorías analíticas: motivación de los estudiantes por la

iniciación científica; proceso de formación de conocimientos; formación de jóvenes científicos; salud y medio ambiente; participación y empoderamiento de los jóvenes y percepciones sobre el Sistema Público de Salud (SUS). **Conclusiones:** Enfrentar los arbovirus requiere políticas e intervenciones de amplio espectro, y la IC fortaleció a estos jóvenes estudiantes como sujetos de derechos, ampliando su percepción sobre ciencia, salud, relación con el entorno, con el Sistema Único de Salud y estimuló el interés en acciones preventivas en la lucha contra los arbovirus en estos territorios.
Palabras clave: Educación en Salud; Infecciones por Arbovirus; Jóvenes; Salud pública.

Introduction

Arboviruses are a growing public health problem worldwide. They are diseases caused by arboviruses, which include yellow fever, dengue, chikungunya and Zika viruses, among others. Their main vectors are the mosquitoes Aedes aegypti and Aedes albopictus, which for many years were geographically restricted to the African continent and Southeast Asia. Nowadays, however, they are present on practically every continent[1,2].

In Brazil, the first dengue epidemic was recorded in 1981, in Boa Vista, Roraima. Since then, several cases have been recorded in other states. In 2014, the first cases of chikungunya were recorded and, the following year, Zika became emergent. Although these three arboviruses circulate simultaneously in Brazil, the dengue virus (DENV) has the highest number of notifications and deaths[3].

In 2022, 1,450,270 probable cases of dengue were recorded in Brazil, with an incidence rate of 679.9 cases per 100,000 inhabitants[4]. This figure was 6.2% lower than in 2019[5]. On the other hand, in 2020 and 2021, the number of cases was considerably lower[4], and it is possible that there was an underreporting of arboviruses due to the mobilization of epidemiological surveillance teams to face the coronavirus pandemic (Covid-19) and also due to a fear of the population to seek care in health units[6].

According to the World Health Organization (WHO), in 2023 Brazil registered 2,909,404 possible cases of dengue, out of a total of around 5 million cases worldwide[7]. In 2024 the figures were even more alarming: in January and February more than 1 million probable cases of dengue were recorded in the country, four times more than the equivalent period in 2023[8]. The phenomenon seems to be related to the increase in temperatures and rainfall, which favor the proliferation of the mosquito, together with disordered population growth[9].

A significant milestone in the search for immunizers against dengue was the tetravalent vaccine QDenga®, developed in 2022 by the Japanese laboratory Takeda Pharmaceuticals, and approved by Brazil's National Health Surveillance Agency (ANVISA) to be incorporated into the SUS in December 2023[10]. At the moment, the country is still facing a growing number of dengue notifications, as the doses of the vaccine are still limited to a small number of people[9]. It should be emphasized that, as this is a problem with multiple determinants, tackling arboviruses requires broad-spectrum policies and interventions, involving various sectors of society, not restricted to the health area[1,2]. Among the ways of preventing and controlling mosquito vectors, health and environmental education and combating the vector remain essential.

The scenario involves historical components of the Brazilian health situation, aggravated by the deepening of socio-environmental problems arising from accelerated and precarious urbanization processes and unhealthy living conditions[11]. With the Covid-19 health crisis, there are additional challenges for arbovirus surveillance. In addition to the overload on the health system, it has become

more difficult for health professionals to control arboviruses in the home, intensifying the importance of mobilizing the population for continuous surveillance at home and in places such as schools[12,13].

The set of structural issues involved in the dynamics of the health-disease process and the prevention of arboviruses concerns the possibilities of critical and problematizing health education, enhanced by the participation of social actors, including the school community and the work of young students in the territories.

The "Scientific and Technological Research for Innovation in Education and Communication for the Prevention of Zika and Related Diseases in the Territories"[14] was implemented by the Oswaldo Cruz Foundation between the Zika virus and Covid-19 public health emergencies. The action-research project aims to develop a model for health and environmental education and the popularization of science, capable of demonstrating under what circumstances territorially-based surveillance and health promotion actions - in particular education, the popularization of science and social mobilization - generate lasting effects in the prevention of arboviruses[14]. The project seeks to mobilize available public policies, including programs aimed at the interrelationship between education, health, the environment, science and technology, such as the Scientific Initiation (CI) programs and the Science and Society Forum, which is an educational technology that promotes spaces for meeting and debate between research and teaching institutions, proposing to the different actors activities for the production and dissemination of scientific knowledge, based on research, field visits and debate, with the aim of stimulating attitudes and skills for critical reflection on arboviruses[15].

Betting on the school community as a space for health promotion is nothing new[16], but the idea of health promotion here was linked to a perception of science as a tool for empowering people to solve the problems they identify in their communities. Thus, in the context of this research[14], after entering the field and setting up a space for the governance of research in the territory, called the Local Management Committee (CGL), the Science and Society Forum - FCS 2018[17] was launched, with the theme "The issue of arboviruses in Ceilândia and the Federal District". The CI was an offshoot of the FCS 2018, delving deeper into the topic with the students who were willing to take part in the selection process for the activity.

CI offers a possible strategy for re-signifying science teaching, opening up the school to topics on the frontier of knowledge with a major social impact. In Brazil, CI in high school began with the Scientific Vocation program at Fiocruz's Joaquim Venâncio Polytechnic Health School in 1986. In 2003, a public policy emerged aimed at expanding CI to secondary education throughout the country, with the Junior Scientific Initiation project and, later, with the Scientific Initiation Program for Secondary Education, PIBIC-EM (2010)[18,19]. The expansion of CI to basic education comes as part of a narrative about the "knowledge society"[20], where it is necessary to learn to know, but also where the world of work demands workers capable of being creative and investigative. This relevance of CI is justified both by the discovery of young talents and by its potential as a pedagogical strategy that adds greater dialogue between the practice of research and the needs of the school community, emphasizing the commitment of education, schools and science to social transformation[18].

CI projects have been growing in Brazilian schools and show that science education in basic education has great potential to give new meaning to learning experiences, not only by awakening scientific vocations in many students[21], but also by contributing to the construction of a scientific culture accessible to all social segments. CI promotes the construction of knowledge that is relevant to solving problems in the community where these young people live, and the territory of life becomes

an educational field in the relationship mediated by science and the experience of the students. In this way, CI presents itself as a tool for action in the world, enabling experiences of intellectual autonomy and action in reality.

Carrano[22] draws attention to the significance of the youth experience as a socio-historical construction, a relational and borderline situation, characterized by the search for autonomy in the face of rules and norms given by past generations. The author emphasizes that "the foundations of the new youth solidarity are not to be found in adherence to what is already given, but in the capacity and responsibility to choose"[22,p.118]. In view of the above, young people must be seen as social protagonists in order to confront the vulnerabilities to which they are subjected, and scientific education can represent a strategy for strengthening young people's capacities to understand, organize and interfere in the formulation of actions to confront arboviruses in the territories. This recognizes two new subjects in the educational process: young people and the city.

Therefore, this study analyzes the experience of CI training on arboviruses from the perception of young students, as educational protagonists in the territory of Ceilândia - Federal District (DF), with the aim of broadening the understanding of the effects of CI in basic education, particularly from the perspective of empowering the school community to prevent arboviruses and promote health at school. What motivates young people to participate? To what extent does CI mobilize young people to work to promote health at school? How important is the course for CI at school? How do young people perceive the relationship between science, health and the environment?

Methodology

This is qualitative research, with the methodological proposal of action research, which links scientific research and political action, advocating the involvement of subjects through a cyclical process of reflection on the process, with the production of new knowledge, answers and solutions to the problems faced by a particular social group[23].

In this proposal, the methodological path was structured in three stages, which can be seen in Box 1:

Box 1. Summary of the methodological path.

Instruments	Subjects	Objectives
Stage 1: Documentary analysis of the essays	19 essays by young participants in the 2018 Science and Society Forum on arboviruses	To analyze the previous knowledge and expectations of adolescents in relation to the Scientific Initiation (SI) process on the subject of arboviruses.
Stage 2: Training Course for Basic CI and Arboviruses	19 young people take part in CI project on arboviruses	To train adolescents in the CI process for the construction of their scientific projects on the subject of arboviruses, based on knowledge of their local reality and the exercise of proposing solutions.
Stage 3: Focus Group	12 young people who took part in the CI project on arboviruses	To understand the perception of young people, based on the focus group, about the CI educational process they experienced and its reflection in the protagonism of their school communities in the territory of Ceilândia - Federal Distict.

Source: the authors.

Place, period, selection and profile of study participants

The study was carried out in four schools in the Administrative Region of Ceilândia (FD), from 2018 to 2020, with young students aged between 15 and 18. As mentioned, the 2018 FCS was held on the subject of arboviruses. As a means of selection for the CI, the students who took part in the 2018 FCS were asked to write an essay about their perceptions of the forum and the issue of arboviruses in Ceilândia and the Federal District. After reading the 36 essays submitted, 19 students were selected to take part in the course.

Stage 1: Document analysis - expectations and prior knowledge of the course

At this stage, the essays of the 19 students selected for the CI activity were submitted to Content Analysis[24] along with the empirical material from the research focus group.

Stage 2: Training Course for Scientific Initiation in Basic Education and the Arboviruses

The activity's methodological premise was the scientific education contained in CI. The course was structured into axes and modules with content from four major areas: health and its social determination; health surveillance and arboviruses; science and other types of knowledge; and scientific methodology and Scientific Initiation. The choice of these contents took into account the themes debated at FCS 2018 and Fiocruz's approach to health promotion and its social determination[25]. Based on the methodological assumption of scientific education, the students developed CI projects in their school communities, as a teaching-learning strategy in the area of health education, considering their own knowledge of their local reality and the exercise of proposing solutions relevant to the territory. With regard to arboviruses, the CI was planned as an opportunity to delve deeper into the subject, exploring its various nuances based on the local reality, from the perspective of scientific thinking and health promotion.

Stage 3: Focus Group - Understanding subjects' perceptions of training for Scientific Initiation.

The focus group (FG) is a non-directive technique that enables discussion in small, homogeneous groups, working from the perspective of "speech in debate", indicated to obtain information through interaction between participants[26]. The technique enables the investigation of beliefs, attitudes, opinions and processes of group influence, allowing the evaluation of the confrontation of divergent and shared aspects among the members of the group[27]. It was applied using a script with guiding questions, which aimed to assess young people's perceptions of the CI educational process and its impact on protagonism in their school communities in the Ceilândia – Federal District territory. The trigger questions were: 1) What motivated your participation in the CI course? 2) What did you learn from the Scientific Initiation course? 3) How did the course influence your daily life within your school community? 4) Have you noticed any changes in your area as a result of your school's participation in the project? 5) Do you consider yourself to be doing science? 6) From this experience, how do you see your relationship with the SUS?

Analysis of empirical material

The interpretative analysis of the empirical material was carried out using thematic content analysis, as recommended by Bardin[24], which consists of a set of communication analysis techniques aimed at overcoming uncertainties and enriching the reading of the data collected, describing the content emitted in the communication process. Content analysis was therefore structured into the following stages:

1. Pre-analysis: a floating reading of the students' essays was carried out, as well as the transcript of the focus group speeches, promoting the systematization of the study's preliminary ideas.
2. Exploring the material: the messages collected from all the empirical material (writing and focus groups) were categorized and coded, giving rise to six analytical categories: students' motivation for scientific initiation; the process of knowledge formation; the formation of young scientists; health and the environment; youth participation and empowerment; and perceptions of the Public Health System (SUS).
3. Treatment of results and interpretation: meanings were attributed to the patterns identified during the analysis, interpreted in the light of the research's theoretical frameworks.

Ethical considerations

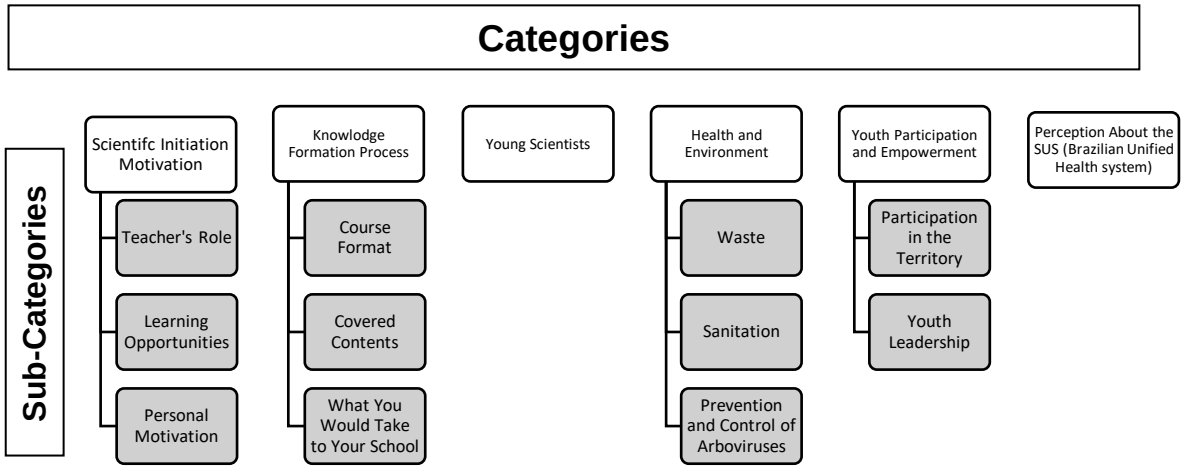
The research was approved by the Fiocruz Brasília Ethics Committee, under CAAE 69630217.0.0000.8027. All those responsible for the participants signed the Informed Consent Form, and the young people signed the Assent Form, respecting all the ethical procedures described in CNS resolutions 466/2012 and 510/2016[28,29]. The names of the participants were replaced by pseudonyms of renowned scientists in the field of health and education.

Results and discussion

The Training Course for Scientific Initiation in Basic Education and the Arboviruses adopted a model that set out to discuss a broad approach to the arboviruses and society. This qualification proposes a methodology based on health territorialization as a pedagogical strategy and, at the same time, a method of research and work in health surveillance[30]. Thus, theoretical classes were always followed by field activities, in which students were invited to carry out the exercise of identifying in their social reality the content discussed in class, in the process of building their research projects. Another assumption of the course was Ferreira's concept of the popularization of science[31], which is understood as dialogical and propositional, which is in line with the ideas of emancipatory social movements, especially in Latin America.

After taking part in the CI activity, the entire group (16 students) was invited and 12 students agreed to take part in the focus group, which aimed to understand their perceptions of the educational process and its impact on their protagonism and responsibility in the territories. In this way, the 19 essays analyzed and the speeches of the 12 students who took part in the focus group made up the empirical material submitted to content analysis[24] and were categorized into six analytical categories, as shown in Figure 1.

Figure 1. Summary of the categories constructed in the study.



Source: the authors.

Each of the six categories that emerged from the analysis of the empirical material will be discussed below.

Motivation for Scientific Initiation

The results showed that students, when integrated into science popularization processes through CI, have various sources of motivation and show an interest in contemporary social issues. The role of the teacher as an inspiration and motivator was mentioned in many of the statements, such as "the teachers were what motivated me" (Anna Nery) and "the way the teacher spoke" (Leolinda Daltro). This provokes reflection on the role normally attributed to teachers as mere transferors of knowledge to a place of involvement and proactivity, driven by science education.

Another motivation pointed out by the group was the opportunity to learn from taking part in the project, with the following words standing out: "[...] the Fiocruz project gave the students a new air, giving us the opportunity to create ideas and projects, stimulating creativity" (Leolinda Daltro). Personal motivations were also mentioned, such as "[...] I wanted to know more because my mother had it (dengue)" (Adolfo Lutz) and "[...] I would like to pursue a career as a biologist [...]; who knows, maybe I'll be a 'little castle' scientist" (Darcy Ribeiro).

Thus, science education in the teaching-learning process, when it allows full participation, is a motivating strategy that strengthens the self-esteem and self-confidence of young people as subjects of rights, capable of organizing themselves and interfering in solving problems in their territories[32].

Process of knowledge formation

Arboviruses are known to be a pressing issue in Ceilândia. Therefore, the modeling of the CI course sought a broad and contextualized approach to the problem, through studies and field trips, which aimed to recognize the concrete reality of the subjects involved and the generating themes that would guide the young people's CI.

According to Paulo Freire[33], the generating themes are the subjects that centralize the teaching and learning process, and around these themes debates, research and analysis take place. The investigation of the generating themes is carried out using an awareness-raising methodology that allows students to start thinking critically about the world. One of the principles of the CI course was to debate the choice of generating themes, always taking into account the reality of the area and the stories of experiences that the students brought during the classes. Thus, it is true that the generating themes cannot be separated from reality, nor can the perceptions of the theme only be perceived in this relationship between people and the world[33].

This dialogic pedagogical choice was reflected in the students' perception of the format and content of the course, who said: "I decided to stay more because of the method they used to teach" (Oswaldo Cruz). This was a recurring comment from students, who emphasized the importance of qualified listening in the educational process: "I think I really liked the field trips, the classes, the approaches they use; [...] they involve [...] I really like the concern about us being heard, our point of view [...]" (Leolinda Daltro). These representations signal the awakening of these young people's autonomy and their satisfaction in constructing reflections, perceiving themselves as protagonists in the history of their territory. A historian's consciousness is then formed: man is led to construct his own history[33].

In this way, during the CI, dialogic education was favored, as opposed to banking education, described by Freire[33] as the act of depositing, in which the students are the depositories and the educator the depositor, with no promotion of dialog in the process of building knowledge. Since dialog is a requirement of human existence, it is essential to provide space for these young people to speak and listen, building new ways of perceiving dialogic education.

These practices are reflected in the students' perception of what they would take away from the CI as good practices for their respective schools, reporting the need to be motivated to learn new things, without a prior judgment of their tastes or choices: "(the teachers say) 'they won't like it, they only like movies' because they've never given us a tour that motivates us to get to know a bit more about nature and everything else" (Maria Montessori).

Young scientists

It is possible to see, both in the essays and in the statements made in the FG, that the students showed an interest in “learning science” and “doing science”: “[...] I intend to be a scientist, so the project helps me a lot with my development” [Rita Lobato]; “[...] the part I liked most was the research, not just the field trips” [Anísio Teixeira].

In the GF, there is a certain broadening of the conceptions of science and what it means to be a scientist, beyond the stereotypical conception of the bench scientist, although this is still perceptible: "I don't think I consider it much (to be a scientist), but a little, yes, [...] it's not that science, science, but it's a basic science [....]" (Adolfo Lutz); “[...] because [...] the scientist isn't just the one who wears a mask, [...] the real scientist, not to detract from the one who stays there, is the one who goes out to find out what the person really knows about it, the question of research itself, of going to the person and asking what it is” (Maria Montessori).

Science teaching aims to provide a teaching and learning context that contributes to the understanding of natural phenomena, based also on social, cultural and political analysis, among others[34,35]. However, very often lectures, with abstract and strictly theoretical content, without contextualization, end up reducing student interest and the quality of science teaching in the classroom. Therefore, science teaching should value investigation, maintaining the "curious spirit" and developing a critical vision[34,36], aspects that were considered fundamental in the development of this project.

In both the projects and the FG's comments, there was an association between science and its potential to transform reality within the students' social context. It is therefore believed that the format of the CI course encouraged students to construct concepts based on their own reflections on facts and their reality, rather than leading them to predefined conclusions, which helped them to expand the construction of scientific concepts and see themselves as protagonists, whether changing their reality or disseminating scientific knowledge.

Health and the environment

This category exemplifies young people's clear perception of environmental aspects that favor the proliferation of vectors that transmit arboviruses. Factors related to sanitation problems, the accumulation and improper disposal of waste, and inadequate water storage were recognized as detrimental to the prevention and control of these diseases.

The proximity to the local socio-environmentally susceptible reality, historically portrayed by the precariousness of the Brazilian peripheries in general and, in particular, in the Ceilândia territory, seems to have favored young people to point out inadequate practices that aggravate the spread of arboviruses, as the following speech indicates: "[...] I reflected for a long time on 'how we dispose of waste incorrectly' and changed my attitude as a citizen [...] that's what Fiocruz changed in me, my habits, my way of acting and thinking" (Darcy Ribeiro).

The narratives of young people lead us to recognize the distance between public policy and the guarantee of health and environmental sanitation. Vilani and collaborators[37] state that the scenario for controlling diseases such as dengue is not encouraging in Brazil's urban reality. Health and environmental risks leave the local population more vulnerable to the spread of epidemics; and actions to promote good environmental quality and human health should be prioritized in Brazil's peripheries.

The centrality of themes related to the problem/disposal of "garbage" in the students' speeches is noteworthy for the shift away from the "mosquito-centric" concern, widely pointed out in other studies on the prevention of arboviruses[38–41]. Of the 13 CI projects proposed by students as a product of the course, six directly addressed the issue of garbage and another three used the garbage debate to complement their studies, taking the discussion of garbage accumulation and arboviruses to raise awareness in the community in which they live. This monothematic predominance was also problematized with the students, since the issue of arboviruses requires a critical and multidisciplinary approach, and it is inconsistent to transfer the unilateral approach of combating the vector to an exclusively "trash-centric" debate.

Youth participation and empowerment

From this study, we can see that young people understand protagonism as a possibility for social transformation, since all the reflections and experiences that come from the space for debate and practice are materialized in actions in the places where they live every day, whether in the school environment, with family or among friends.

Strengthening the sense of participation, Souza[42] translates the understanding of the concept as a social process, in which man discovers himself as a political subject, with the capacity to become directly involved in social challenges. In this way, youth protagonism is understood as a component of the practice of education for citizenship, in which young people occupy a central position in the development of activities, which contributes to providing positive meanings and life projects, and at the same time enables the reconstruction of ethical values, such as solidarity and social responsibility[43]. And for youth protagonism to be enhanced, young people must feel empowered, taking control of their own affairs, becoming aware of their capacity and competence to produce, invent and lead their destinies and positively influence the community[44].

Thus, in their speeches, we can see that they value the spaces in which citizen education takes place, the place of welcome, empowerment and, consequently, the stimulation of youth protagonism: "[...] being the difference and proving to my friends and colleagues that it is possible to change our habits and way of thinking" (Darcy Ribeiro). Or: "[...] a situation in which I was at home [...] they were discussing dengue fever, the diseases that were coming and they were complaining about the garbage [...] I joined in the debate and started to talk properly in that circle [...]" (Carlos Chagas).

It is therefore important to realize the potential of young people, providing them with spaces where they can be heard and express themselves legitimately. Furthermore, it should be emphasized that strengthening youth protagonism requires the existence and resistance of spaces capable of promoting a sense of belonging and citizenship.

Perceptions of the SUS

During the debate in the FG, the young people highlighted the changes in their perceptions of the SUS over the course of the CI, reflected in the proposals for their research projects, which began to consider the SUS as a scenario for practices and a protagonist in the fight against arboviruses. One student reveals: "Before visiting Posto 11 I had a view that [...] it was something you couldn't benefit from, but when I went there and researched [...] I realized that the mistake was not so much with the post but with the people. [...] and fake news has a big influence on this, SUS doesn't provide care, it's better to go private' [...]" (Maria Montessori).

It is known that this predominantly negative imagery of the SUS has been fostered for decades by the media[45,46]. The stereotype of an inefficient public health system is convenient for health market interests, in which private health is exalted to the detriment of the SUS[12]. Therefore, the experiences of these young people in the "SUS that works" scenarios in their territories mobilize critical and reflective learning about the relevance of public health for the Brazilian population.

The expression of her protagonism as a young scientist is also expressed in her understanding of the importance of her citizen participation in the SUS: "From the moment we go to the community where we live and create a project with the intention of reducing the issue of waste and, in a way, influencing people to take action to reduce waste, we are walking together with the SUS because from this we are doing health [...]" (Maria Montessori).

Final considerations

The study analyzed the experience of CI training on arboviruses, based on the perception of young people, and highlighted the need to revise the perceptions of the state and society in relation to young people as creative protagonists capable of interfering in public policies and the production of health in the territories. In this way, teaching methodologies must adapt to this conception of young people and to the problems of concrete life, and scientific education, the popularization of science and critical and emancipatory education offer viable paths for this journey.

This study showed that the students were interested in "learning science" and "doing science", driven by their curiosity about the project, the possibility of carrying out research activities and the possibility of being agents capable of promoting changes in society. This was partly attributed to the nature of the CI course, which valued research and stimulated the "curious spirit", contributing to the development of a critical vision and broadening their perception of science, health and their relationship with the environment. It's worth pointing out that the work was only possible thanks to the teachers' commitment to the CI project in the schools, which is also a learning and development experience for the teacher. CI, used as a tool to intervene in health problems, has the potential to improve science education in basic education, with gains for teachers and students and an increase in the school's role in the community.

It is understood that young people are social protagonists in tackling the vulnerabilities to which they are subjected and the course, followed by the Scientific Initiation project, strengthened them as subjects of rights, stimulating innovation in preventive actions to combat arboviruses in the territory.

At the time of writing, the world is witnessing the greatest health challenge of our time - the Covid-19 pandemic. The difficult pandemic scenario is renewing society's perceptions of the SUS and science, which have long been neglected in our country and yet are now key players in tackling this problem. CI in basic education can foster the renewal of social trust in scientific knowledge, so we ratify the importance of public policies that strengthen the renewal of educational spaces, scientific education and scientific popularization, in particular, as rights and conditions for the full exercise of citizenship in the face of global health challenges.

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Conflict of interest
The authors declare that there is no conflict of interest.

Authors' contribution
All the authors contributed equally to the conception/design of the article, data analysis and interpretation, writing the article, critically reviewing its content and approving the final version.

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