

Science education with community agents: the education and training of community health workers in science education publications

ABSTRACT

This article aimed to analyze how Science Education (SE) has been addressed in the training and practice of Community Health Agents (CHAs) in research in the field of Education in Brazil. The study was characterized as a State-of-the-Art review, developed from scientific productions available in the CAPES Journal Portal, the Brazilian Digital Library of Theses and Dissertations (BDTD), and the UFRGS Lume Repository, covering the period from 2014 to 2024, using the descriptors community health agents and health training. Studies in Portuguese that addressed the training or practice of CHAs related to science teaching were selected. The corpus of analysis consisted of ten studies, organized into thematic categories related to sociodemographic profile, initial and continuing education, teaching methodologies, and integration between scientific and popular knowledge. The results highlight weaknesses in the scientific and pedagogical training of CHAs, especially regarding the continuity of training actions, but also point to potentialities related to the use of participatory and contextualized methodologies. It is concluded that Science Education can strengthen the role of CHAs as mediators between science and the community, provided that it is articulated with permanent public policies for training and professional valorization.

KEYWORDS: Community Health Agents; Science Teaching; Professional Education; Public Health; Education.

Educação em ciências com agentes: formação dos agentes comunitários de saúde nas publicações de ensino

RESUMO

Este artigo teve como objetivo analisar como a Educação em Ciências (EC) tem sido abordada na formação e atuação dos Agentes Comunitários de Saúde (ACS) em pesquisas na área de Ensino no Brasil. A pesquisa caracterizou-se como um estudo do tipo Estado da Arte, desenvolvido a partir de produções científicas disponíveis na Plataforma de Periódicos CAPES, na Biblioteca Digital Brasileira de Teses e Dissertações (BDTD) e no Lume UFRGS, no período de 2014 a 2024, utilizando os descritores agentes comunitários e saúde e formação. Foram selecionados estudos em língua portuguesa que abordassem a formação ou atuação dos ACS relacionada ao ensino de ciências. O corpus de análise foi composto por dez estudos, organizados em categorias temáticas referentes ao perfil sociodemográfico, formação inicial e continuada, metodologias de ensino e integração entre saberes científicos e populares. Os resultados evidenciam fragilidades na formação científica e pedagógica dos ACS, especialmente quanto à continuidade das ações formativas, mas também apontam potencialidades relacionadas ao uso de metodologias participativas e contextualizadas. Conclui-se que a Educação em Ciências pode fortalecer a atuação dos ACS como mediadores entre ciência e comunidade, desde que articulada a políticas públicas permanentes de formação e valorização profissional.

PALAVRAS-CHAVE: Agentes de Saúde; Ensino de Ciências; Educação Profissional; Saúde; Educação.

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INTRODUCTION

Community Health Agents (ACS) are essential professionals for the implementation of health education in Brazil, serving as a link between health services and the population. Their role goes beyond following protocols or performing technical tasks: it involves health promotion, disease prevention, and, above all, the mediation of knowledge, bridging the gap between scientific and traditional knowledge to make it understandable and applicable in the daily lives of communities.

According to Loureiro et al. (2017), “the CHA is a mediator between the community and the health service, acting in health promotion, prevention, and education.” This mediation requires communication skills, empathy, and a solid scientific foundation that allows for interpreting complex information, translating technical concepts into accessible language, and adapting guidelines to the cultural, social, and economic specificities of each territory. Studies by Coelho et al. (2018) indicate that active methodologies, such as participatory workshops, foster the understanding of scientific concepts and stimulate community engagement, allowing CHAs to promote not only the transmission of information but also the collective construction of knowledge, valuing the participants' prior experience (Bellás et al., 2025).

In this context, scientific literacy is understood as the ability to comprehend scientific concepts, processes, and methods to apply them in solving everyday problems and making informed decisions (Zerbeto et al., 2020). The appropriation of this knowledge strengthens the autonomy of CHAs and expands their potential to act as multipliers of qualified information.

Science Education (SE), as a field of knowledge, is not restricted to the transmission of content but aims to form individuals capable of critically understanding reality and utilizing scientific knowledge in daily situations. Thus, scientific literacy becomes a central element for citizenship education, allowing for greater autonomy when facing social, environmental, and health issues. In the context of Primary Health Care (PHC), this perspective is particularly relevant, as CHAs act as mediators between the scientific and popular knowledge present within the territories.

However, studies such as that by Cabral et al. (2020) indicate that the training of these professionals is still fragmented, with insufficient introductory training, little depth in scientific content, and scarce use of active methodologies that promote meaningful learning. This gap may limit the CHAs' response capacity when facing complex situations, such as epidemiological outbreaks, changes in health guidelines, or the need to combat misinformation.

Given this scenario, it is essential to understand how SE has been incorporated into the training and practice of CHAs, recognizing their strategic role as knowledge mediators. By acting at the interface between scientific and popular knowledge, these professionals contribute to health promotion through contextualized, accessible, and culturally appropriate education. This study, therefore, seeks to investigate how this educational dimension has been addressed in the training and practice of CHAs, based on the scientific production of the last decade, adopting the State-of-the-Art methodology to identify trends, advances, and gaps, thereby

subsidizing public policies and continuous training programs that enhance the role of CHAs as science educators within the communities.

SCIENCE EDUCATION (SE) AND COMMUNITY HEALTH AGENTS

The training and practice of CHAs in relation to science education acquire great relevance when considering that one of the duties of these professionals is to act as mediators between scientific knowledge and community reality. Recent literature points out that, although there are specific advances in these relations, a low interest in the academic community still persists (Alfonso & Schirmer, 2025), along with structural deficiencies that compromise the consolidation of essential competencies for exercising this role. In this context, it is necessary to expand investment in research and formative practices that integrate scientific knowledge and community experiences, so as to strengthen professional practice and promote training that is more aligned with the real demands of the territory.

For Fourez (1995), scientific knowledge needs to be articulated with the social and cultural realities of individuals, favoring the construction of autonomy when facing the demands of practical life. In the context of CHAs, this means strengthening their capacity to act as mediators between scientific knowledge and the popular knowledge present within the territories. Furthermore, Santos (2007) highlights that SE should contribute to citizenship education, overcoming merely technical models and promoting contextualized and participatory educational practices. Thus, the training of CHAs needs to consider not only technical aspects of health but also the development of critical, communicative, and social competencies necessary for health promotion within communities. This perspective, in general terms, is also discussed by Lorenzetti (2017), who states that scientific literacy should enable individuals to critically interpret reality and utilize scientific knowledge in daily decision-making. In the case of CHAs, this dimension becomes essential, considering that these professionals act directly in the mediation between science, health, and the community.

From this perspective, Sutil et al. (2021) highlight that understanding, for instance, the relationships between Science, Technology, Society, and Environment (STSE) contributes to a more contextualized and critical SE, bringing scientific knowledge closer to the social issues experienced by individuals. For the authors, the articulation between science and social reality fosters more participatory and reflexive educational practices—a fundamental aspect for the work of CHAs within the territories, especially when facing challenges related to health promotion and combating misinformation.

As discussed by Pinhão et al. (2025), SE aimed at citizenship education must consider individuals in their social, cultural, and environmental dimensions, promoting educational practices committed to the transformation of reality. In this context, CHAs assume a strategic role in building more critical, participatory, and informed communities, especially since they act directly in the mediation between scientific knowledge and the lived experiences within the territories."

Recently, a major training program was launched targeting the more than 200,000 CHAs active in the country. The program, titled *Saúde com Agente*, began in 2022 and, in its second edition, was renamed *Mais Saúde com Agente*. It stands

as the largest national program ever organized with the goal of qualifying the work of these professionals throughout Brazil. The initiative seeks to strengthen PHC, increase efficacy in facing health challenges, promote better health conditions for the population, and value the workers who are on the front lines of care. The program is the result of a partnership among the Ministry of Health, the National Council of Municipal Health Secretariats (Conasems), and the Federal University of Rio Grande do Sul (UFRGS), with its second edition being concluded in the current year.

The survey by the author Cabral et al. (2020) indicates that, although there is a predominance of CHAs with a completed high school education and a strong community bond, gaps in scientific training still exist. This reinforces the importance of continuous training programs that include topics such as environmental health, disease prevention, healthy eating, and the rational use of medicines, always articulating theory and practice.

On the other hand, Loureiro et al. (2017) point out that the initial training of CHAs rarely addresses SE content in depth, which limits their autonomy to interpret technical information and adapt it to the local reality. In this sense, investing in a solid scientific background is essential for these professionals to act as translators of academic knowledge into popular language, combating misinformation and strengthening evidence-based decision-making.

Thus, the analyzed studies converge in defense of a critical, permanent, and contextualized training for CHAs. Such training must go beyond the simple transmission of technical content and promote pedagogical practices that value popular knowledge, foster critical thinking, and prepare agents to act as mediators between science and society. It is only with this broader perspective that it will be possible to strengthen the role of CHAs as health educators, agents of social transformation, and defenders of evidence-based practices that are culturally rooted in the realities of the territories they serve.

Thus, the SE carried out by CHAs can materialize through:

- Community educational actions;
- Integration with schools and local associations for intersectoral projects;
- Use of participatory methodologies that value popular knowledge and promote dialogue with Scientific knowledge;
- Production and adaptation of educational materials suited to the social-cultural context of the community;
- Action as multipliers of reliable information during health emergencies.

By strengthening their educational dimension, CHAs stop acting merely as mediators between health services and the population, moving on to play a strategic role in health promotion, disease prevention, and the construction of collective knowledge within communities. In this sense, their work contributes to the development of individual autonomy, stimulating care practices, awareness, and social participation. Furthermore, because they are directly embedded in the families' reality, CHAs are able to identify specific demands, vulnerabilities, and needs of the population, favoring more humanized and effective interventions. Thus, their educational and social practice consolidates these professionals as important agents of social transformation, capable of collaborating to build more informed, critical, participatory, and healthy communities, strengthening the

principles of primary care and the Family Health Strategy (Caldeira, Vieira, Figueiredo, 2024).

METHODOLOGY

This study utilized the literature review approach known as State-of-the-Art, whose purpose is to map, organize, and critically analyze academic production on a specific theme, highlighting both advances and existing gaps and debates. According to Romanowski and Ens (2006), this methodology allows for an understanding of how knowledge is produced within a field, identifying authors, theoretical frameworks, methodological procedures, and the main gaps in the literature.

Unlike systematic reviews, which follow rigid search and analysis protocols, the State-of-the-Art approach adopts a more flexible and interpretive perspective, aimed at an expanded understanding of the investigated field and the construction of critical syntheses of scientific production.

The choice of this approach is justified by the objective of understanding, beyond mere description, how SE has been addressed in the training of CHAs, considering the intertwining of the fields of health, education, and science.

Data collection was carried out in the CAPES Periodicals Platform, BDTD, and Lume UFRGS databases between January and October 2025. The selection of these databases is due to their comprehensiveness and academic relevance, gathering peer-reviewed national and international journals, which ensures the quality of the sources. The search was performed using the *Portuguese descriptors* "*agentes comunitários de saúde*" and "*formação*", so as to increase the sensitivity of the research while maintaining the necessary specificity for the theme.

The following inclusion criteria were established for the selection of the articles:

- Articles published in Portuguese;
- Full-text articles available;
- Articles that directly addressed the education or practice of Health Agents, with a focus on science teaching.

The exclusion criteria were:

- Duplicate articles;
- Studies that did not directly address the central theme;
- Publications that, although mentioning CHAs, did not address training aspects or those related to science teaching.

The screening of the articles followed three sequential steps:

- Title reading: For the exclusion of studies clearly unrelated to the central theme.
- Abstract reading: To verify adherence to the inclusion criteria.
- Full-text reading: To confirm the relevance of the studies and extract the necessary data.

Although the number of selected studies was small, the works showed high adherence to the research objective, making it possible to identify relevant trends, gaps, and approximations regarding SE in the training of CHAs. This selection is coherent with the State-of-the-Art approach, since this methodology privileges depth of analysis over quantitative breadth. In this type of study, the focus is not on the numerical exhaustiveness of the productions, but on the ability to identify trends, convergences, contradictions, and gaps in the investigated field. Thus, even with a reduced set of studies, it was possible to achieve sufficient analytical saturation to understand the main regularities regarding the training of CHAs and its interface with SE, ensuring interpretive consistency to the results.

Data analysis was performed qualitatively, using the thematic categorization technique. In this approach, according to Bogdan et al. (1994), researchers adopt an inductive process, building interpretations and abstractions as specific data are grouped. This technique allowed for the organization of information into categories that reflected the main dimensions addressed in the studies, in a non-exclusive manner.

1. **Sociodemographic profile of CHAs:** Characteristics such as gender, age, education level, and community ties.
2. **Initial education:** Training received by CHAs prior to the beginning of their practice.
3. **Continuing education:** Training opportunities and frequency throughout their career.
4. **Teaching and learning methodologies:** Strategies used in the training processes.
5. **Integration between scientific and popular knowledge:** The articulation between technical knowledge and community wisdom.

It is worth highlighting that the presented categories are not mutually exclusive; they can interrelate and complement each other in the analysis of the studies, since the training, methodological, and sociocultural aspects of CHAs frequently overlap and mutually influence one another. It is understood that this methodological structure can enable not only a description of the studies found but also allow for comparisons between approaches, the identification of emerging trends, and the highlighting of gaps that can guide future research and training policies for CHAs. By adopting the State-of-the-Art approach, this study provides a critical and contextualized view of the practices and challenges faced by CHAs regarding their training and the implementation of science teaching methodologies.

RESULTS AND DISCUSSION

The search in the selected databases identified thirty-eight works. After screening, ten studies fully met the inclusion criteria. Although they present distinct methodological approaches, they all converge in highlighting structural challenges and potentialities in the training and practice of CHAs in the field of SE. The research encompasses investigations into public policies, training guidelines, sociodemographic profiles, and practical training experiences, making it possible

to map structural aspects of training and concrete results of educational interventions.

The classification of the studies into multiple categories was adopted when the analyzed content simultaneously contemplated different training and pedagogical dimensions. For example, Santos (2015) was included in the categories of initial education, teaching methodologies, and integration between knowledge, as it addressed these dimensions concomitantly. This strategy highlights the complexity of CHA training and allows for a more integrated analysis, showing that training, methodological, and sociocultural aspects do not occur in isolation, but interact and mutually influence one another, as presented in Table 1.

Table 1 - Studies included for the State of the Art

Author/Year	Objective	Methodology	Main findings	Thematic category
Áurea Candeias dos Santos (2015)	To analyze the perceptions of CHAs who graduated from a Technical Course	Critical and problem-posing perspective	Theoretical deepening, Participatory methodologies	2,4,5
Monteiro et al. (2017)	To discuss the professional education policy for CHAs	Document analysis	Need for alignment between policies and training practices	2,3
Loureiro et al. (2017)	To analyze the work and education of CHAs	Qualitative study	Insufficient initial training, absence of in-depth scientific content, and the need for continuous updating.	2,3
Coelho et al. (2018)	Elaborar um projeto pedagógico para saúde do trabalhador	Develop an educational program on occupational health	Unanimity regarding the need for training	3,4
Michele Neves Meneses (2019)	To understand the meaning of the training experience in the EdP opSUS for CHAs	Qualitative research: Case study	Experiential training, valuing popular knowledge, participatory methodologies, and challenges in practical application.	4,5
Cabral et al. (2020)	To describe the sociodemographic profile and education of Health Agents	Descriptive quantitative study (n=63)	87% women, average age of 35, 11.6% with ongoing postgraduate studies, and difficulties in facing workplace problems.	1
Zerbeto et al. (2020)	To evaluate the training of CHAs on health and science topics	Intervention study with participatory workshops	Increased participants' knowledge and engagement, fostering practical application in the territory.	3,4,5
Celcino Neves	To study the training scenario	Qualitative research	Active learning methodologies	2,4,5

Author/Year	Objective	Methodology	Main findings	Thematic category
Moura (2021)	of CHAs in Brazil			
Diane Bressan Pedrini (2021)	To implement an educational program aimed at CHAs	Educational intervention	The role of CHAs as mediators between science and the community	4,5
Musa Denaise de Souza Morais (2023)	To analyze the <i>Saúde com Agente</i> Program	Descriptive quantitative research	Lack of public policies for permanent education	1,3

Source: The author (2026). "Own authorship"

Regarding the sociodemographic profile, a female predominance is observed, with an age group concentrated in young and middle-aged adults, completed upper secondary education, and a strong community bond. These factors foster engagement and community trust, which are essential for the mediation work between science and the population. However, although positive, the community bond does not replace the need for robust scientific training capable of supporting evidence-based decisions and effective health interventions.

In this study, the 'initial education' category refers to the pre-service training of CHAs, understood as the basic training received before starting professional practice. In this context, the analyzed studies indicate that this initial training does not fully cover essential scientific content. This finding reinforces the need to rethink initial training curricula and programs, incorporating content that connects scientific theory to community practice, with an emphasis on scientific literacy and a critical approach, according to Chassot (2003).

In terms of continuing education, the provision of training is irregular, often sporadic, and disconnected from the actual needs of the territory. Monteiro et al. (2017) and Morais (2023) emphasize that public policies must guarantee continuous, contextualized programs aligned with local demands. The absence of structured continuing education compromises professional updating and the ability to cope with changes in health guidelines, epidemiological emergencies, or new social demands.

The analysis of teaching and learning methodologies shows that participatory and contextualized practices significantly increase engagement and knowledge application. Studies by Coelho et al. (2018), Meneses (2019), and Santos (2015) demonstrate that workshops, case studies, field visits, and talking circles allow CHAs to experience real-world situations, articulate different types of knowledge, and apply scientific concepts in practice. This perspective is reinforced by Pinhão (2025), who highlights the importance of connecting science and citizenship, questioning what, for whom, and how to teach, and highlighting the need for contextualized training that considers the social and cultural reality of the subjects.

Regarding the integration of scientific and popular knowledge, the difficulty of articulating technical concepts and community knowledge remains a central challenge. Studies by Pedrini (2021) and Meneses (2019) indicate that well-structured interventions, capable of translating scientific concepts into accessible

and culturally contextualized language, strengthen the role of CHAs as educational mediators. In this sense, mediating between science and the community stands as a strategic competence for health promotion, which depends on continuous training, participatory methodologies, and sensitivity to the sociocultural context.

Loureiro et al. (2017) reinforce that initial education, in many cases, does not fully address science content, which demands constant updates to cope with complex territorial demands. Given this, it becomes clear that the discussion on science education and the training of CHAs cannot be restricted to providing sporadic training. It is necessary to understand how policies, methodologies, and sociocultural contexts interact to shape the practice of these professionals.

Monteiro et al. (2017) emphasize that, for this practice to be effective, training policies must be aligned with the real demands of the territory, ensuring that the scientific content addressed is relevant and applicable to the daily lives of the assisted families. Mediation between science and the community is, therefore, a strategic competence that depends on continuous training, participatory methodologies, and sensitivity to the sociocultural context.

Regarding the integration of scientific and popular knowledge, it is observed that the difficulty of articulating technical concepts and community knowledge remains a central challenge. Pedrini (2021) and Meneses (2019) demonstrate that well-structured interventions, which translate scientific concepts into accessible and culturally contextualized language, strengthen the CHA as an educational mediator. This strategic competence is essential for health promotion and highlights that training must integrate technical knowledge, participatory methodology, and cultural sensitivity. Moura's (2021) thesis adds that the initial training of CHAs remains limited by a technocratic bias, disconnected from the daily demands of the communities. The author advocates for the construction of an interdisciplinary and critical education, guided by participatory methodologies, which allows CHAs to act not merely as protocol executors, but as political subjects capable of fostering reflection and promoting the collective construction of health knowledge.

Corroborating this perspective, Santos (2015) points out that, based on experiences with technical courses, CHAs began to value methodologies that articulate theory and practice and promote the exchange of experiences among participants. The reports indicate that when training processes consider the reality of the territories and the knowledge accumulated by the agents, there is a strengthening of the bond between science and the community, as well as an increase in these professionals' confidence to face complex challenges.

Overall, the findings indicate that CHA training is still characterized by fragmentation and dependence on sporadic initiatives, but it shows significant potential when articulated with active methodologies, contextualized training experiences, and the integration of knowledges. The interrelation among these elements shows that the CHA can effectively act as a science educator, provided that consistent public policies sustain continuing education programs and value their educational role.

Furthermore, the analyzed studies show that the effectiveness of the CHAs' practice is not restricted to technical content, but depends on how it is transmitted and applied. The use of participatory methodologies contributes to autonomy,

engagement, and the capacity to adapt to diverse contexts, strengthening the impact of educational actions within communities.

The results reinforce that structured programs, such as Saúde com Agente and Mais Saúde com Agente, are fundamental to consolidating the CHA's role as a mediator between science and the community. These programs promote continuous updating, offer educational resources, and stimulate participatory pedagogical practices, bringing together theory and practice, science and popular knowledge. However, the absence of permanent public policies still represents a significant limitation, making the implementation of structured professional training strategies urgent.

Finally, the analysis highlights that although the community bond represents a positive resource for the CHAs' practice, it must be articulated with solid and continuous training, as well as the use of participatory methodologies. In this sense, science education plays a fundamental role by enabling mediation between scientific knowledge and popular knowledges, strengthening educational practices in health and qualifying the CHAs' role as subjects capable of translating and contextualizing scientific knowledge within the territory. The institutional recognition of CHAs, aligned with consistent public policies and interdisciplinary approaches, is essential to consolidate their strategic role as mediators of scientific knowledge, promoting contextualized scientific literacy processes and strengthening the autonomy of the served communities.

FINAL CONSIDERATIONS

The analysis conducted based on the State-of-the-Art methodology showed that the training of Community Health Agents (CHAs) in the field of Science Education still presents significant structural weaknesses. In many cases, initial training does not cover enough scientific content to prepare CHAs for the complexity of territorial demands, while continuing education remains irregular, sporadic, and frequently disconnected from consolidated public policies. Despite these limitations, the review identified important potentials, especially when training is articulated with active and participatory methodologies, contextualized experiences, and the utilization of community bonds—elements that strengthen the role of CHAs as mediators between science and the community. Structured initiatives, such as the Saúde com Agente and Mais Saúde com Agente programs, demonstrate that when combined with solid scientific content and participatory pedagogical practices, continuing education contributes significantly to expanding the autonomy, engagement, and critical capacity of these professionals.

Thus, the analyzed studies converge in advocating for a critical, permanent, and contextualized training for CHAs. The results of this investigation reinforce that the effectiveness of CHAs' practice depends not only on acquiring technical knowledge but also on how it is transmitted, contextualized, and integrated with popular knowledge. Cultural and pedagogical mediation between science and the community constitutes an essential strategic competence for health promotion, scientific literacy, and strengthening community autonomy. In this sense, structured and permanent public policies are indispensable to sustain professional training programs that promote the consolidation of initial education, guarantee

regular and contextualized continuing education, encourage participatory methodologies, and strengthen the integration between scientific and popular knowledges.

It is concluded, therefore, that investing in the scientific and pedagogical training of CHAs is fundamental to consolidating their role as knowledge mediators and health promoters, enabling them to act in a critical, contextualized, and transformative manner. CHAs should not be understood merely as information transmitters, but as educational subjects capable of articulating science, culture, and social reality, thereby contributing to communities that are more informed, autonomous, and empowered to make evidence-based decisions.

NOTAS

1. Salvo indicação em contrário, todas as traduções para o inglês apresentadas neste artigo são de autoria de Christofer Felipe Ribeiro Castro.

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