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Educating to donate: science and citizenship in school activities on blood donation

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ABSTRACT

This study aimed to investigate how, whether, and what learning occurs from the relationship between Science and Citizenship, based on the topic of blood donation, in cooperative projects between schools and social organizations. The qualitative and narrative research drew on the author's experiences of the "Educating to Donate" project, developed by the Brazilian Bone Marrow Association (AMEO) in public schools in São Paulo. The analytical corpus consisted of field notes, recollections, and photographs produced during the elaboration and application of an investigative learning sequence (LS) in a Science Club. The results indicated the need to reformulate the LS to favor the understanding of the donor-recipient system and the construction of investigative activities, highlighting the integration between scientific, social, and health knowledge. The collaboration between AMEO and the school fostered socio-critical learning and the development of participatory and critical practices related to the public health issue. It is concluded that the articulation between science teaching, citizenship, and health promotion can foster the development of critical and committed subjects, building new generations of blood donors.

KEYWORDS: Science Teaching; Health Promotion; Citizenship; Learning Sequence.

Educar para doar: relação ciência e cidadania em atividades sobre doação de sangue na escola

RESUMO

O estudo teve como objetivo investigar como, se e quais aprendizagens ocorrem da relação entre Ciência e Cidadania, a partir do tema de doação de sangue, em projetos de cooperação entre escolas e organizações sociais. A pesquisa, de abordagem qualitativa e narrativa, baseou-se nas experiências da autora em ações do projeto "Educar para Doar", desenvolvido pela Associação da Medula Óssea (AMEO) em escolas públicas de São Paulo. O corpus analítico constituiu-se dos registros de campo, rememorações e fotografias produzidas durante a elaboração e aplicação de uma sequência didática (SD) de caráter investigativo em um Clube de Ciências. Os resultados apontaram a necessidade de reformular a SD para favorecer a compreensão do sistema doador-receptor e a construção de atividades investigativas, destacando a integração entre conhecimentos científicos, sociais e de saúde. Observou-se que a colaboração entre AMEO e escola promoveu aprendizagens sociocríticas e o desenvolvimento de práticas participativas e críticas relacionadas ao problema de saúde pública. Conclui-se que a articulação entre ensino de ciências, cidadania e promoção da saúde pode favorecer a formação de sujeitos críticos e comprometidos, construindo novos doadores.

PALAVRAS-CHAVE: ensino de ciências; promoção da saúde; cidadania; sequência didática.

INTRODUCTION

This study aims to contribute to research on science education for health promotion from a socio-scientific perspective, focusing on blood donation in educational practices within the final years of Elementary School. Recent researches highlight the importance of integrating public health topics into the curriculum, as it not only allows students to conduct investigations but also enables schools and the community to develop a critical and engaged understanding of public health issues from a scientific, socio-political perspective (Santos et al., 2023), encompassing an interdisciplinary approach to improve student engagement and concept learning (Hobusch et al., 2024; Bittencourt & Struchiner, 2015). Incorporating investigative activities related to blood donation can broaden not only students' scientific knowledge of blood components and the circulatory system but also foster civic awareness and social responsibility.

Blood donation is a critically relevant topic, involving scientific, technological, and social issues that constitute a problem in Brazilian public health, where only 1.9% of the population donates blood in a regular basis, and, according to the World Health Organization's recommendations, a rate between 1.5% and 3% is required to meet patients' needs (Meirelles et al., 2023; Bittencourt & Struchiner, 2015). Internationally, the difficulty in finding blood donors is similar. For example, Europe has 165 million eligible donors, but only 15 million have donated blood (Simonetti & Smit, 2023; Ciausescu et al., 2025). This scenario emphasizes the urgency of educational practices that address blood donation in an integrated way, promoting a deeper understanding of blood compatibility and the impact of this act on society, articulating the natural sciences with other fields of knowledge. Such practices are essential to develop informed citizens committed to collective health.

The proposal to produce and analyze a learning sequence (LS) on blood donation is based on the activities of the "Educating to Donate" project of the Brazilian Bone Marrow Association ("Associação da Medula Óssea" – AMEO), aiming to foster reflection on the urgency of the topic and to train future and new donors. The research was conducted as part of the specialization course in Science Teaching – final years of Elementary School (Science is Ten), at the Federal University of ABC. To this end, we consider that the articulation of theatrical and investigative activities can promote the understanding of scientific concepts, as well as critical engagement in discussions and the production of meaningful actions on public health and solidarity by the students.

AMEO is a civil society organization of public interest, founded in 2002, that works in bone marrow transplant programs in Brazil, with activities that include contribution to the formation of the Brazilian National Registry of Voluntary Bone Marrow Donors ("Registro Nacional de Doadores Voluntários de Medula Óssea" – REDOME) and the creation of welcoming and lodging spaces for patients undergoing treatment for blood diseases through the SUS (Brazilian Public Health System), via a support house and a transplant center. Furthermore, AMEO develops training programs, information dissemination, and educational projects within the formal education system.

We understand the potential of creating educational projects through collaboration between associations/organizations and schools, as it promotes the

implementation of innovative pedagogical practices that not only meet contemporary educational demands, but also prepare students to face real challenges in their contexts in partnership with teachers, specialists, and professionals working to combat the selected theme.

Therefore, we start with the following research question: How, if, and which learning occurs from the relationship between Science and Citizenship, based on the topic of blood donation, through integrated projects between schools and organizations? Our main objective is to study the production and application of a learning sequence (LS) based on activities proposed by the Educating to Donate project of AMEO. We assume three specific objectives: to produce a learning sequence of inquiry-based teaching on the topic of blood donation based on the activities of the Educating to Donate project; to investigate the relationship built between Science and Citizenship from the didactic relationship between teacher, student and knowledge, focusing on the possibilities of creating a participatory, committed subject; and to describe the potential of developing activities in the context of educational projects for health promotion, especially in science clubs in public schools in São Paulo, identifying the relationship between associations/organizations and schools.

As a research hypothesis, we consider that the LS allows students to explore and critically reflect on public health issues, especially blood donation, developing a comprehensive and contextualized understanding of the interactions between science, technology, and society, thus assuming a civic attitude. For us, the activities already developed by the project are compatible with the principle of inquiry-based science education, considering that this can provide the development of structure, methodology, and a focus on critical and contextual skills of the students (Sasseron, 2018). Furthermore, we recognize that the disciplines of Natural Sciences and Physical Education encompass Health in a denser and broader way when compared to other areas of knowledge in school (Iachiite, Lima Junior & Pedersen, 2021), and we emphasize that the project in question proposes, at its core, transdisciplinary practices for the effective discussion and learning about blood donation. To that end, we consider it is necessary to promote, as a structural axis of the activities, a learning environment that connects scientific concepts to the sociocultural reality of the students, as well as to the aesthetic field, so that they can contribute consciously and actively to society and strengthen scientific education in the health promotion.

THEORETICAL FRAMEWORK

There is a plurality of discursive meanings regarding the concept of Citizenship, configuring diverse models for its exercise and configuration. Therefore, we consider as a starting point the existence of multiple meanings linked to the most diverse theoretical fields. In this research, we are concerned with articulating the concepts of Citizenship and Science, understanding them within the field of Science Education and, therefore, of Education.

From a legal-political perspective that encompasses common sense, the set of rights and duties constitutes the process of acquiring/having rights (Pinhão, Dorvillé & Kaplan, 2025). Brito (2018) opposes this idea when discussing Marshall's

work, “Citizenship and Social Class”, of 1950, arguing that it is centered on a logic of classical liberalism, encompassing social class issues by assuming Citizenship in civil, political and social dimensions, but maintaining a focus on legal equality, not discussing the possibility of citizens to promote a rupture of social inequalities. It is from this point that the author seeks to assume in her article the need to go beyond the thought elaborated and disseminated by Marshall to understand citizenship in the light of class struggle from a Marxist perspective.

This author presents to us the need to advance the discussion focusing on social awareness and the collective, understanding that the concept of Citizenship based on legal equality can mask inequalities, granting limited freedom to the individual citizen, as it does not question the disparities of power and inequalities between social classes. According to the author, it is necessary to promote “[...] a re-reading of the concept of citizenship from the point of view of ‘other’ excluded subjects (the colonized, the non-property owner, the female, the black, the worker subject)” (Brito, 2018, p. 136).

Therefore, Citizenship is marked by a contradiction: there is an affirmation about its universal character, focused on the process of acquiring rights, but it is marked by an individual configuration and serves the interests of capital. For Gohn (1995), individual citizenship is marked by the maintenance of exploitative structures, while collective citizenship seeks the extension of rights and duties to the entire population. However, for some authors such as Tonet (2005, p. 472), Citizenship “[...] would always be seen as an instrument to balance social inequalities and not to eradicate them”.

When linking the concept of Citizenship to Science Education we also find multiple possibilities, since curricula, and consequently teaching practices, are developed in light of the several perspectives of the concept, because “when we talk about science education aimed at building citizenship, there are many conceptions at play” (Piassi, 2011, p. 795). In this sense, there is a broad understanding of the role of Science Education in the citizens education, as well as in understanding “how citizens will use scientific knowledge and what its implications will be for society as a whole” (Rosa, Lima & Calvacanti, 2023, p. 3). It is worth noting that although there are new contours for the understanding and definition of Citizenship, “[...] its liberal concept is still quite present in legal, social and political culture” (Silva, 2015, p. 173), as is the case with curricular documents.

According to Piassi (2011), the Brazilian National Curriculum Parameters (“Parâmetros Curriculares Nacionais” – PCN) have a limited conception of citizen education, as they focus on the actions of the worker, consumer, and voter based on contextualized content, skills, and competencies defined in the document. Based on our reading of Piassi (2011), we understand that citizen education through the educational practices foreseen in this curriculum focuses on the development of the individual as a consumer-citizen capable of making informed decisions, but little is said about the ability to question social inequalities or, in fact, to act upon them.

Regarding the current context of the Brazilian Common Curriculum Base (“Base Nacional Comum Curricular” – BNCC), although Burgos (2025) considers its problematic aspects, such as learning for the job market, the author identifies potential in the development of citizenship education, as it guides competencies

built on attitudes learned in the face of the pedagogical, institutional, ethical, and responsive dimensions expressed in school institutions. Therefore, it requires the school to articulate these dimensions in order to truly promote citizenship education (Burgos, 2025). On the other hand, Koldehoff and Andreis (2023) indicate that citizenship education should foresee the education critical subjects capable of transforming realities, which goes beyond what the BNCC indicates as the predominant idea of citizenship as the inclusion of subjects in society, prioritizing insertion into the labor world.

In this sense, we consider it is necessary to go beyond the process of "information gathering" to achieve "awareness and action gathering" on the part of the student. We agree with Piassi's critique (2011) regarding one of the main limitations of PCN (Brazil, 1998), which is the student's education through information and analysis of phenomena without proposing and active, reflective participation in the issues surrounding teaching and life. Therefore, we want to say that "[...] the education for citizenship will imply the need for critical and interactive reflection on real and existential situations for students" (Santos, 2007, p. 5). And, for this, real situations should prioritize the most diverse themes for study and understanding in school, including those of health education. We know that current curricula, such as the Common Curriculum Base in the field of Natural Sciences, present an absence and reductionism of topics relevant to the critical-social education of students (Mattos, Amestoy & Tolentino-Neto, 2022). Therefore, there are new meanings of citizenship that the school must not only consider but also propose new constructions of bonds that go beyond the labor market and encompass the challenges of modern reflective scientific education (Pietrocola & Souza, 2019).

Therefore, we assume that the curriculum presents us with a model of the citizen it intends to form. In the field of didactics, we can reflect on how the curriculum impacts the construction of teaching sequences that focus on proposing the learning of content as indicated in the curriculum, as part of the demands of the school system and, consequently, reproducing implicit valuesof the official document. In school practices, a pedagogical discourse has been constituted around the concept of citizenship, based on the idea of developing the student as a citizen, expressing diverse conceptions that are often based on common sense and as slogans, with no link to critical reflection on the concept (Tonet, 2005; Piassi, 2011; Rosa, Lima & Calvacanti, 2023; Koldehoff & Andreis, 2023; Carnio, 2024), which implies the development of pedagogical activities that not always allow for overcoming the liberal vision.

In order to understand how these views are being adopted and developed in Science Teaching we will present below the state-of-the-art research by Gabriela Rosa, Nathan Lima and Cláudio Calvacanti (2023), which sought to examine several productions in the field of science teaching and education to understand how the field idealizes the role of the citizen in society, how science content can contribute to the citizen's performance in society, and what trend in citizenship models these studies promote. We consider this study important for situating our work in relation to these models and reflecting on the type of citizen we intend to form, as well as understanding the potential and limitations of our actions.

In this sense, the aforementioned authors discuss models of citizenship, also acknowledging the plurality of the concept. To this end, they list three types of

optimal citizens that are intended to be formed, aligned with democratic models produced by various considerations of the concepts of citizenship, as well as the role of Science Teaching in this education: a) Individually responsible citizen: understands the impact of their attitudes on the community, with science teaching contributing for keeping them informed – aligned with liberal democratic perspectives; b) Participatory citizen: seeks to find solutions to community problems, being involved in collective projects for social well-being, with science teaching contributing with resources to enable the citizen to make decisions within their community and express themselves on socio-scientific issues – aligned with democratic perspectives of a socializing logic; c) Citizen oriented towards social justice: able to identify the structural causes of social problems and seeks to overcome oppression – aligned with participatory democratic perspectives (Rosa, Lima & Calvacanti, 2023).

We can therefore understand the influence of education and teaching on the type of citizen one intends to form. If we consider the field of Didactics, we identify that the pedagogical trends, from a historical perspective, propose ways to develop educational practices aligned with the political objective of the time and, consequently, the type of citizen being formed. Thus, trends of a liberal (traditional, renewed, and technocratic) trend and those of a progressive (liberating and critical-social of content) nature establish curricula and proposals for didactic practices (Libâneo, 2013), influencing the creation and structure of practices.

As previously mentioned, we know that science teaching is greatly influenced by liberal trends. Specifically, regarding activities that propose scientific education for citizenship, Piassi (2011) distinguishes activity proposals based on the concepts of school content. For the author, Science Teaching usually focuses on knowledge systematized through fundamental concepts and terms, and facts and phenomena of science and everyday activity, while proposals aimed at citizenship education encompass elementary laws as a way of explaining the properties and phenomena of reality, as well as the study of scientific methods and the history of their production, proposing connections with economic, political, social, and cultural problems.

Given the several pedagogical trends, research on Science Teaching and Citizenship presents multiple perspectives on citizen education. Rosa, Lima, and Calvacanti (2023) identified characteristics related to Citizenship by analyzing 64 articles on the subject, encompassing empirical and theoretical research. Regarding empirical research with teachers and students, it was identified that most professionals hold a view associated with liberal democratic models, contributing to the education of individually responsible subjects.

Considering that the focus of our article relates to the construction of a learning sequence, we chose to highlight, based on the research of Rosa, Lima and Calvacanti (2023), the discussions on intervention activities in the school environment. According to the authors, the activities carried out aimed to: a) the promotion of individually responsible citizens in relation to Environmental Education issues such as waste production, medicinal plants, issues concerning the Caatinga biome, sustainability, and sustainable consumption; while relevant to teaching, the study found that students adopted a passive stance towards these problems, as the sequences focused on what we call “information gathering”

rather than direct action in society; b) the promotion of participatory citizens through educational and scientific workshops on health topics and in exploring problems, causes, and potential solutions within a community, and scientific literacy focused on popular knowledge, identifying greater engagement of young people and in learning; c) focus on social justice when the activities, in their minority, proposed investigations with students in socially vulnerable situations, promoting discussions about access to city centers and future prospects articulated with topics of Science, Technology, Agroecology, and Politics.

Piassi (2011) helps us think about how to promote science teaching that proposes a transformation of social practices. According to the author, in discussions with various researchers in the field, teaching cannot be based solely on systematized knowledge, since the transformation of individuals must involve the formation of habits and convictions, articulating them with concepts, while being careful not to maintain an academic character. However, "understanding the mechanisms of dengue transmission, for example, does not necessarily imply being engaged in the problem (convictions), being able to identify (cognitive capacity) and concretely solve (skills) risk situations" (Piassi, 2011, p. 796). Therefore, we reaffirm the idea that it is necessary to articulate school content, in its various dimensions, with themes for reflection and action, enabling changes in the way we see and understand the world.

We consider that developing science teaching activities focused on the education of participatory citizens committed to social justice is not an easy task. One of the tools for building citizenship in formal education is the Service-Learning (SL) methodology (Silva & Araújo, 2019). According to Silva and Araújo (2019), the education of sensitive citizens committed to the demands of the world requires specific teaching strategies that promote student engagement. According to the authors, SL focuses on working directly with real social or environmental problems, linked to the systematic, intentional learning of concepts, skills, and values, whether linked to the curriculum or not. Furthermore, its consolidation occurs through practices developed through the protagonism of the students but also requires a process of critical reflection on the problem based on concepts.

We understand that the students' direct involvement with the problem can strengthen their connection to the issue, enabling them the initial contacts and interest in matters aimed at social transformation. To this end, we believe it is necessary to build educational processes that aim to raise awareness among individuals about several problems. We acknowledge that this awareness does not occur linearly, as there is a complexity in transforming naive views into critical ones, considering a collective perception, the discovery of problems, the progression of the subject's experience of reality towards awareness through a critical process, thus aiming for the evolution of consciousness (Freire, 1979).

The development of SL suggests the integration and establishment of partnerships between schools and community institutions, where students, teachers, educators, and agents work together (Silva; Araújo, 2019). In this sense, we recognize that partnerships are a potentiating element in educational processes that aim to work with real-life situations and social needs using diverse methodologies. For us, the methodological approach of SL allows students to identify a problem, develop a study with the teacher's guidance and in partnership with associations, and, finally, create an intervention that not only impacts

students in the immediate moment but also aims to build concerned, active, and participatory agents in the face of the problem studied, going beyond a strictly school-based logic.

We know that NGOs and associations carry out several types of activities in the school environment, building possibilities for partnerships with public schools. According to Silva (2010), some of these activities focus on providing complementary support, such academic support, promotion, and retention of students in school, and offering recreational and sporting opportunities, among others. On the other hand, they contribute to non-formal education through new educational channels, as well as forming alliances with schools in cooperative activities.

In this research, we consider that the complementarity between the educational spaces of social organizations and schools offers new opportunities and curricular flexibility (Guará, 2003). From this perspective, many problems can be investigated in partnership, considering this flexibility in the sense of promoting new ways of knowing and recognizing the problems, as well as in proposing actions to address them. Among the many problems that can be addressed in the relationship between schools and associations/NGOs, we highlight the problem of the blood donor's scarcity in Brazil (Meirelles et al., 2023). Given that blood donation is a public health issue, we consider it necessary to address this matter so that students can analyze the current situation in the country regarding the lack of donors, understand the social and health issues involved in the process, recognize the scientific aspects of donation, such as blood typing, share their own experiences related to the topic, so that we can build future blood donors (Meirelles et al., 2023; Meirelles, Vergueiro & Alencar, 2019).

Typically, the topic of blood donation in schools is only superficially addressed in science classes; conversely, when integrated into Health Education programs, this can occur through interventions from the sector as prescriptive, content-focused, and not considering students' knowledge and experiences (Bittencourt & Struchiner, 2015). Therefore, to address the topic of blood donation in schools, we believe it is necessary to promote an environment of discussion and reflection that primarily integrates a sense of collective responsibility.

We agree with Ciausescu et al. (2025) in indicating the following expected effects of blood donation education in schools: increased knowledge about the subject and the development of positive attitudes and engagement towards donation, as occurs in other important contemporary themes, such as environmental education; discussion of false beliefs, myths and fears, focusing on combating misinformation; and bringing students closer to the act of donating, understanding the process as a human responsibility and a public health issue. In this sense, the socio-scientific problem addresses not only the importance of building a future donor, but also how this future donor understands the aspects surrounding blood donation, such as legal, socio-cultural, and scientific aspects, stimulating social awareness and commitment to the needs of the collective in an engaged manner.

METHODOLOGY

This research is qualitative in nature, with a narrative approach. According to Clandinin and Connelly (2011), we understand narrative research as that which considers the researcher's lived experience from a three-dimensional perspective, in order to understand what was experienced and what was narrated, especially in the field of education. In this sense, there is a relationship between the researcher and the object studied, since the researchers position themselves, through their narrative, in relation to the object, highlighting the main points experienced by them.

Therefore, to understand how, if, and what learning occurs from the relationship between Science and Citizenship based on the Blood Donation topic, we propose the production of data through the field notebook developed by the author from the application of a learning sequence that integrates the Educating to Donate project, articulated with photographs of the students' productions that make up the narrative record, as well as recollections of her experience as an educator in the project. We understand that lives and stories in movement and interaction integrate the narrative, both that of the researcher and that of the research subjects, within a temporal continuum of lived experience in a specific situation/place, establishing a three-dimensional space for the research (Clandinin & Connelly, 2011).

RESEARCH CONTEXT – EDUCATING TO DONATE PROJECT AND THE REFORMULATION OF THE LS

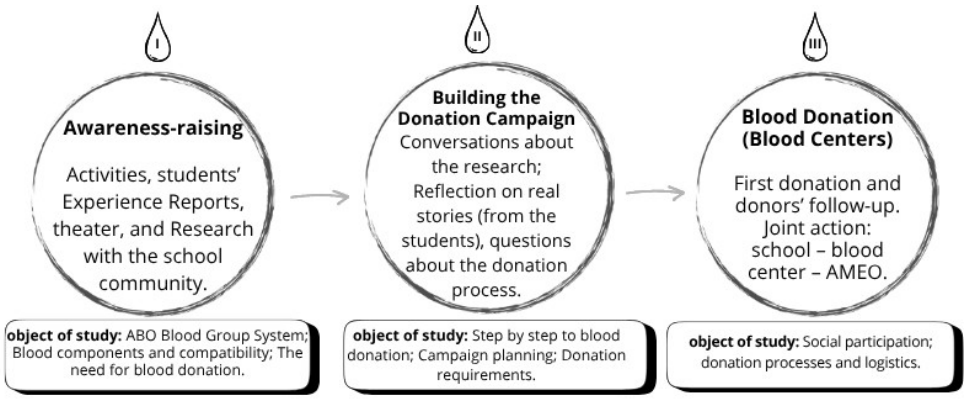
The Educating to Donate project was created in 2013 as one of the educational initiatives of the Bone Marrow Association of the State of São Paulo. Based on the experiences of the Blood and Tissue Bank of Catalonia, Spain, regarding blood donation education programs, AMEO institution conceived the project to be implemented in public and private schools in the State of São Paulo, focusing on discussions about the importance, requirements and needs of blood donation, aiming to educate future donors. (Meirelles et al., 2023).

In total, the project was carried out in 79 schools with approximately 5,068 students (internal project data – survey in August 2025), mostly in public institutions, covering the final years of Elementary School, High School, and Youth and Adult Education. Additionally, some classes of the initial years of Elementary School, Center for Children and Adolescents ("Centro para Crianças e Adolescentes" – CCA), and Higher Education also participated in the Educating to Donate program. In recent years, the project has focused on developing its activities in schools in peripheral regions and areas of high social vulnerability. In each class, we propose alignment of the activities planned by the project to meet the needs of the school in question, as well as understanding the educational needs of each class. It is worth noting that the partnerships were established through direct contact between AMEO and the schools, with the aim of presenting and offering the project to the institutions, as well as through the schools themselves contacting the association because they were seeking educational programs about blood donation.

Based on the SL methodology, we propose the following pedagogical and didactic structure for carrying out the project (Figure 1): I) The first meeting consists of presenting the issues surrounding blood donation. As an initial step, we conducted an activity to encourage students to reflect on their own actions in solving problems that require the help of others. Next, through a dramatic reenactment of an accident and the need for a blood transfusion with the students themselves, we discuss aspects of donation and blood characteristics. Finally, they are asked to conduct a survey within the school community in order to map out if there are blood donors and, mainly, to provide a space for conversation between the student and the interviewee on the topic. II) The second meeting consists of presenting the results of the survey, providing an opportunity to exchange stories that the students heard about donations. It is a moment for students to share their discoveries. We revisit the questions that arose in the first meeting, discussing the donation process and the path taken by blood from the donor to the recipient. Then, the class begins to create a campaign to recruit blood donors. III) The third day consists of the students meeting with potential donors at the blood center closest to the school. In some cases, the students themselves donate blood for the first time, accompany family members and acquaintances to donate, and sometimes take a technical tour of the blood center. In other cases, the third meeting consists of the practical action of the blood donation campaign, where the students develop intervention actions for and with the community.

Figure 1

Summary of the organization of Educating to Donate activities – LS.



Source: prepared by the author, 2025.

As one of the objectives of this research, we propose to produce an inquiry-based teaching learning sequence on the topic of blood donation based on the activities of the Educating to Donate project, adapting it to the context of a science club. In accordance with the proposed final course activity for the specialization course in Science Teaching in the final years of Elementary School - Science is 10, this research considered revisiting and reformulating part of the Educating to Donate project activities, focusing on the structure of its activities considering investigative principles (Sasseron, 2018). For that purpose, we considered the field of Didactics to provide us with resources for the development of learning sequences. Thus, we considered as the first stage of the research the LS study and development based on didactic engineering, considering the elaboration of

preliminary analyses in relation to the epistemological, cognitive, and didactic dimensions (Artigu, 1988), and we included the sociological dimension, as well as the LS conception and the post-hoc analysis.

As a second stage of the research, with the aim of investigating the relationship built between Science and Citizenship based on the learning constructed in the didactic relationship in the LS and to describe the potential of developing activities in the context of educational projects between associations/organizations and schools, we applied the LS in a Science Club and carried out the post-hoc analysis.

SUBJECTS COMPRISING THE NARRATIVE RESEARCH – APPLICATION OF THE LS IN A SCIENCE CLUB AT A PUBLIC SCHOOL

The LS was applied in a Science Club at a final year of Elementary School municipal school in the city of São Paulo, located in the city's East Zone. The Club is run by two teachers from the institution, 20 students from 7th to 9th grade, and volunteer monitors. The science communication and education activities produced within the Club are carried out by the students themselves, with the participation of former students, external guests, and actions linked to public universities. It is worth noting that the club members develop a monthly schedule of topics of interest for study, which allows teachers and monitors to develop and seek partnerships for development of educational activities within the Club. The activities produced are presented on the group's social media. The activities of the Educating to Donate project took place following the organization of actions between the AMEO educator and the teacher responsible for the Club in meetings about the project's suitability, application of activities in two meetings in the first semester of 2022, the production of the campaign by the students to attract donors, and the donation day at a blood center.

DATA PROCESSING AND ANALYSIS

Data processing was carried out considering the two stages of research. The first stage consisted of developing the LS, including reformulating the initial proposal to include and/or expand the inquiry-based teaching rationale. Data were organized using the EnFN classification system (E = significant element; n = number of the element's extraction order, 1, 2, etc.; FN = field notebook). To this end, we conducted a learning sequence analysis, considering the epistemological, cognitive, didactic, and sociological dimensions. These dimensions guided us in understanding which elements could be modified aiming to propose a stage focused on investigation, specifically of scientific concepts. The second stage consists of reading the reports produced in the field notebook, identifying categories that comprise characteristics of the Association/School relationship, as well as learning elements about the Science and Citizenship relationship. The reports were produced considering a recollection of the author's work on the project throughout the years of its development and also reports relating to the application of the project to the science club.

RESULTS E DISCUSSION

The presentation of results and discussion will be made considering the two research stages in which this study was developed. In both cases, we propose to elucidate the author's voices, understand how these produce an effect in the past, present, and future (Clandinin & Connelly, 2011), seeking to answer how, if, and what learning emerges from the relationship between Science and Citizenship through the production of a learning sequence on the Blood Donation topic, as well as to understand the potential for carrying out projects between schools and organizations for the education of the learner subject.

STAGE A – LS REFORMULATION

This research considers the reformulation of the LS as an initial stage of the investigation. To this end, the study of the Learning sequence production from the field of didactic engineering (Artigu, 1988) is an essential part, assuming didactic background and positions through the choice of activities that address blood donation, aiming to promote investigation with the students about the issues surrounding the topic. As mentioned, the initial LS is being developed by the project team, including the author of this article. In this case, the knowledge gained from experience (Simas, Prado & Domingo Segovia, 2019) formed a framework for the investigation of the LS building, since reports of practices already developed, as well as memories of learning situations, allowed for the construction and reconstruction of previous educational processes, thus reflecting on the students' difficulties in the project and how to develop/deepen them in the educational process.

Starting from experiential elements, the didactic engineering process was reformulated considering previous teaching and learning phenomena as a source for the LS reconfiguration. We assume that proposing the study based on didactic engineering makes it possible to transform the observations and understandings of the reports into explanations of the intended relationships within the scope of the Educating to Donate educational project, in order to understand the means of reproducing the processes that promote socio-scientific learning and social participation. In general, the experimental process of Didactic Engineering is carried out through the LS conception, implementation, in situ observation, and LS analysis (Artigue, 1988). For the purpose of organizing this article, we have chosen to present in this section the final LS reorganization, seeking to highlight which elements of the learning objectives were included, identifying the reasons for this, and based on the preliminary and a priori analysis developed in one of the stages of this research.

In our a priori analysis, we identified the potential difficulty of the students in understanding the ABO blood group system, particularly regarding blood type compatibility. A priori analysis of the LS was influenced by experiential knowledge (Simas, Prado & Domingo Segovia, 2019), allowing us to highlight the epistemological and experiential difficulties of the students in this activity. The adaptive explanation of blood type classification and characterization is necessary since the Educating to Donate program is developed across various stages and modalities of education. Therefore, we chose to delve deeper into this stage of the

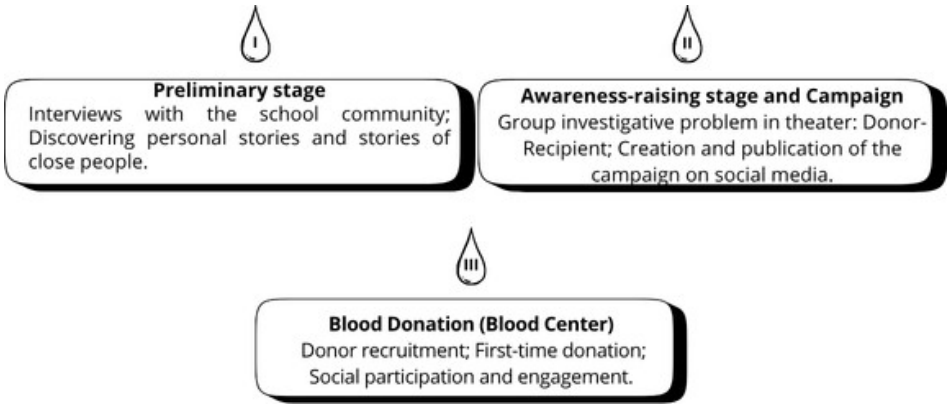
LS in order to add an investigative activity. This is one of the steps necessary to understand one of the blood donation dimensions (donor-recipient). Another dimension refers to the students' engagement with the topic, seeking to build a participatory citizen beyond school activities, providing opportunities for practical action in building campaigns, engaging with the cause, and making the first donations.

The preliminary analysis made it possible to identify, from a sociological perspective, how adolescents and young people initially participate in socio-scientific and political themes (Beck, 2006). This indicates to us the need for adolescents and young people to participate in activities with such themes so that they can understand and recognize the risks and difficulties and build new ways of acting on the issues.

Considering these aspects, the activities (re)formulation was created by adding the possibility of practical investigation of the didactic problem: Who can donate blood to our friend? What blood types are compatible? This activity was developed as part of the first stage of the project action (Figure 1). The implementation of a stage that involves group and investigative work aimed, in its conception and foundation, at working with a real problem, elaborating and testing hypotheses, considering the students' prior knowledge and that discussed in previous moments in the activity, aiming at the construction of a scientific, argumentative language (Carvalho, 2013). As a synthesis, we indicate in Figure 2 the elements of the LS reconfiguration, considering the preliminary and a priori analysis and the organization of the project defined with the teacher responsible for the Science Club.

Figure 2

New and organizational elements of Educating to Donate project in the Science Club.



Source: prepared by the author, 2025.

STAGE B – PROJECT ANALYSIS

We propose to build the trajectory of the project in the Science Club with elements that emerge from the thematic units listed in the field notebook. The first point of the trajectory that we will address is the relationship between Science and

Citizenship and, subsequently, the Association/School relationship. The significant elements allowed us to interpret the project's potential for constructing a participatory, committed citizen subject, as well as the learning that emerged.

When we talk about Science and Citizenship, we are concerned with how Science Teaching strengthens the construction of a concerned, critical, and active subject, as well as the construction of habits (Piassi, 2011) and the recognition of the implication of scientific knowledge in society (Rosa, Lima & Calvacanti, 2023). This concern is implicit in the reports of the field notebook, in which the researcher indicates at the beginning of her recollection:

> E1FN- "Completing the Educating to Donate project for ten years in various schools and regions of São Paulo has shown me the **difficulty of implementing a project** aimed at initiating awareness among students of several ages about blood donation topic. I know that it is necessary for **students to be interested in the topic** and, even more importantly, for the concern to come from them. What my experience with the project allows me to say (write) is that when young people (not all of them) come into contact with real stories, including **when they discover stories from acquaintances, their engagement with the topic is driven by emotion, empathy, and curiosity** to know how the donation process occurs. **Knowledge about blood components**, etc., **allows for** a broader **understanding of the entire process**." (emphasis added)

The scientific knowledge studied in the project allowed students not only to discover how and why blood components are separated for donation but also offered valuable information about why blood donation is a public health problem, understanding what Ciausescu et al. (2025) consider as desirable elements for blood donation education. Therefore, we recognize that the students identified the implication of scientific knowledge in society, since they reflected on the subject and began to use this information to build their social campaigns, as we will show later. In addition to the information offered/planned by the study objects defined in the LS project, the focus was on raising students' awareness and how they could begin to question and act on the problems, in this case, the emergency of blood donation.

In the Science Club, the students' interest in scientific knowledge arose from the first discussion, which addressed their experiences related to blood donation, especially through reports of acquaintances who had needed blood at some point in their lives and even through personal stories, as we will demonstrate below:

> E2FN- "It was not different at the club. Club members reported, based on interviews they conducted, stories of **relatives who needed blood transfusions: car accidents, shootings, and surgeries**. When I mentioned that premature babies typically need blood early in life, the club members were shocked and said they would try to find out from their relatives. **At that point, questions began to arise about scientific topics**, such as **blood compatibility, whether the mother's blood type must be the same as the babies', and some donation requirements.**" (emphasis added)

The scientific discussion was expanded upon in the dramatization, in which the students, with the educator's guidance, enacted a serious situation where a club member would need blood. Upon identifying the blood type of the injured club member in the scene (AB-), we propose the following question: E3FN- "What blood type can be donated to our friend?". In two groups, the club members began the investigation, using the didactic resource "red blood cell cushion" (Figure 3) as an aid, where they constructed blood types and compared them with the

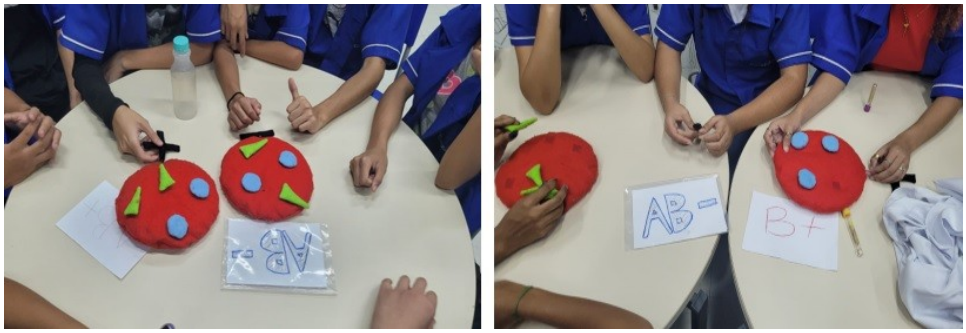
recipient's blood type. We emphasize the importance of the problem for the beginning of knowledge construction (Carvalho, 2017), where conditions for its resolution were proposed: review of prior knowledge about blood components and their functions, initial explanation about the characterization of blood typing, and didactic resources for investigating their hypotheses.

The group work, as presented by Carvalho (2017), provided an opportunity for the exchange of ideas within the group, based on the object of study of blood typing. We consider that the involvement with the topic, through the sharing of their stories about blood donation, as well as acting in the dramatization, enhanced involvement in the search for a solution to the investigative activity and in the construction of scientific learning. This can be identified in the significant element highlighted below and by Figure 3.

> E3FN2 - "The initial experiment, with the whole group and some club members at the front of the room, **generated several questions about blood typing and the donor-recipient relationship**. It was the initial moment when I proposed doing the ABO blood type classification collaboratively. They answered correctly about the characteristics of the red blood cell, but many club members had doubts about the donor-recipient relationship. The **investigative activity in small groups greatly facilitated the resolution of the problem**. They used red blood cell cushions, which allowed them to test their hypotheses, 'assembling the blood type' and comparing them. Each group made notes on each test."

Figure 3

Trial and error by students in the Donor-Recipient / ABO System activity.



Source: Author's archive, 2024.

Another significant element we identified in the field notebook was the doubts and problems presented by the students throughout the entire LS. In summary, we listed the main themes of the doubts: who establishes the laws regarding blood donation and how; what policies regulate the supply and distribution of blood in Brazil; differences between Brazil and other countries regarding blood donation; religious issues in donation; the prohibition of certain social groups from donating blood and its historical context. This demonstrates the students' concern and curiosity about the topic of donation beyond scientific issues and, for us, indicates the type of citizen capable of being built from the project's activities. Although we were unable to discuss in depth all the topics surrounding the political, cultural, and social issues of blood donation, it was possible to combat misinformation and discuss myths and falsehoods (Ciausescu et al., 2025); furthermore, we believe that the interest and curiosity expressed in

such topics demonstrate the possibility of educate a participatory citizen committed to social justice (Rosa, Lima & Calvacanti, 2023).

As another step in the LS, the creation of a blood donation campaign was proposed. It is worth remembering that, although the project includes this step, not all participating schools carry it out, and sometimes institutions focus on developing a campaign intervention as an ultimate step. In this school, the Club's teachers and students organized themselves to plan and carry out a donation day in partnership with a blood center in the city of São Paulo. All contact with the blood center was handled by AMEO. This is another significant element for us, as it demonstrates the desire to develop a direct intervention in the community, with blood donation, in a participatory and committed way. One of the requests made by the school was to hold the campaign near its location, not only because of the distance between the school and the blood center, but also because of the desire to act in its own locality.

The development of the social media campaign was a key element in the practical engagement action of students in the search for donors. It is worth noting that they were not old enough to be donors and, therefore, focused on recruiting donors among teachers, monitors (former club members), family members, and acquaintances. Through the students' work, we identified that engagement in blood donation enabled the development of socio-critical learning. Figure 4 highlights some of the participants' work, selected and recorded in the field notebook.

Figure 4

Blood Donation Campaign produced by the Science Club.

Source: Author's archive, 2024. These productions refer to campaign posters and were made in Portuguese. They contain the following phrases: "Every 2 minutes, 1 person needs to receive blood. Donate!"; "Donating blood is an act of love"; and "Donate blood, donate life", in addition to the location of the blood center, date and time for blood donations.

The construction of these learning experiences occurred starting from the project developed in cooperation between Ameo (Association) and the Science Club (School). Silva and Araújo (2019) indicate that it is necessary to propose

specific strategies to foster learning in this collaboration (NGOs/association - school), as this relationship favors a learning space beyond the formal curriculum.

Based on the significant elements highlighted in the field notebook, which indicate the stages of contact, planning, development, application, and evaluation of the Educating to Donate project in the Science Club, we can provide a summary of the activities developed, considering what we understand as necessary for building cooperation: a) AMEO's interests are not separate from the school's interests. That is, the topic of blood donation is a concern for the school community, and there is a demand and/or acceptance from the school to develop a project on this topic because they consider the importance of the subject beyond the formal concerns of the curriculum; b) The school community plays an active role. It is necessary for a teacher to be engaged with the topic and the development of the project since it is a collaborative activity. Some actions are developed by the association's educator and others by the class teacher; c) The school needs to be a "facilitator" of the students' actions, offering support for their ideas and actively participating in the project's stages; d) The association needs to understand the characteristics of the school culture, comprehending the limitations and possibilities of the unit, promoting the formation of alliances between both by understanding, adapting, planning, building, and implementing the project; e) Although the project integrates the curriculum planning, it should be developed with curricular flexibility (linking with various disciplines); f) The student is considered as an active and critical subject, considering their lived experiences on the topic, their interests, and possible disinterests.

In this sense, we consider that this configuration enabled the students not only to understand the need for blood donation through the information assimilated and the experience of donating (Ciausescu et al., 2025), but also to engage in the issue (through the effective implementation of a blood donation campaign), identify political and social problems (such as the prohibition of some minority groups from donating blood during certain periods), and seek to resolve these problems (by finding blood donors, including former student monitors of the club). We therefore consider this as the first step in building habits that allow students to act on a public health issue. Finally, it is worth highlighting that this was an initial experience in a school and that, as we mentioned in our field notebook, "E5FN - habit formation is not guaranteed, but we know it happens over time. In other experiences, such as a school that has been carrying out the project for 8 years, former students have become repeat donors and engaged with the cause, as well as the project being part of the school's culture", promoting education for blood donation.

FINAL CONSIDERATIONS

This study sought to investigate how, if, and what learning occurs from the relationship between Science and Citizenship, based on the "Blood Donation" topic, through cooperative projects between schools and organizations. Considering this relationship, we sought to understand how to propose the formation of a participatory, committed subject through the formulation of a learning sequence based on the "Educating to Donate" project actions. The study was based on narrative and autobiographical reports of the first author for the

elaboration of two parts of the research: the production and implementation of a learning sequence and the empirical analysis of the project. The study of LS development made it possible to identify the didactic difficulties of one stage of the project, linked to scientific knowledge (donor-recipient), proposing a reformulation based on investigative activities.

In a second phase, we understand that the relationship between Science and Citizenship is permeated by multiple meanings and that, for us, it encompasses the formation of a participatory subject committed to socio-scientific problems, capable of reflecting on and acting upon such issues. The formation of this subject is not an easy task and involves scientific and socio-critical learning. Therefore, we conclude that the project's actions act as a "starting point" for the evolution of individual awareness, since the issue of blood donation begins to be discussed from another perspective, beyond its disciplinary function. Contact with the topic aimed to consolidate a critical and reflective perspective, which allowed students to position themselves on the topic and also to incorporate their own stories and experiences into the educational process. In this sense, a didactic relationship is established beyond scientific concepts, providing opportunities for students to learn and act in other spheres of society. The collaboration between AMEO and the school's Science Club enabled the expansion of students' knowledge, demonstrating that joint action between the association and the school can broaden educational processes, such as deepening scientific themes and creating social campaigns aimed at building scientific habits among the subjects.

Finally, we emphasize that revisiting the elements and general perspectives of the project in other schools helped us to (re)formulate the DSD and, thus, to list in advance the possible difficulties the students may face in the Science Club. Although we have cited passages from previous actions of the Educating to Donate project, we consider, as a possibility for future studies, investigating the impact of the project in schools that have already participated and/or still participate in our actions, seeking former students who have become donors to conduct interviews, with the aim of understanding the transition from *information gathering* to *awareness of the subjects*, identifying their actions as donors (or not) as a habit.

Thus, we understand that the "Educating to Donate" project, by linking science teaching to health promotion, contributed to broadening students' critical understanding of blood donation, strengthening the education of conscious subjects committed to public health issues. Although the project already presents previous results regarding students' engagement on the topic, the main challenge is considered to map their actions beyond the specific activities of AMEO in the institutions. Finally, when the project becomes part of the school's culture, the education of future blood donors becomes integrated into the concerns of the institution's health promotion and science education activities.

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