PRÁTICAS EDUCATIVAS, MEMÓRIAS E ORALIDADES

Rev.Pemo – Revista do PEMO

Prior knowledge of Biology teachers regarding potentially significant strategies and approaches

ARTICLE

Aleson da Silva Fonseca[i]
Universidade Federal do Rio Grande do Norte, Natal, UFRN, Brasil
Ivaneide Alves Soares da Costa[ii]
Universidade Federal do Rio Grande do Norte, Natal, UFRN, Brasil

Abstract
We investigated Biology teachers' prior knowledge of teaching strategies and approaches with the potential to promote more meaningful science teaching, focusing on socio-scientific issues (SSIs). The data were collected during a teacher training course using a semi-structured questionnaire administered during the first training session. Response analysis was conducted based on categorization. The results reveal teachers' limited knowledge regarding the use of teaching resources, especially regarding SSIs and thematic inquiry. Alternative conceptions of teaching planning focused on scientific literacy were also identified, reflecting a still reductionist and Cartesian view present in the minds of these professionals. We emphasize the importance of expanding teacher training programs to provide tools that favor the use of more meaningful teaching methodologies, fostering greater confidence and pedagogical autonomy among teachers.
Keywords: Socio-scientific Issues. CTSA Approach. Teacher Training. Science Education.

Conhecimentos prévios de professores de Biologia acerca das estratégias e abordagens potencialmente significativas

Resumo
Foram investigados os conhecimentos prévios de professores de Biologia sobre estratégias e abordagens didáticas com potencial para promover um ensino de Ciências mais significativo, com foco em questões sociocientíficas (QSC). Os dados analisados foram coletados durante um curso de formação docente, utilizando um questionário semiestruturado aplicado no primeiro encontro formativo. A análise foi conduzida com base na categorização das respostas. Os resultados evidenciam um conhecimento limitado dos professores em relação ao uso de recursos didáticos, especialmente no que diz respeito às QSC e à investigação temática. Também foram identificadas concepções alternativas sobre o planejamento de ensino voltado ao letramento científico, refletindo uma visão ainda reducionista e cartesiana presente no imaginário desses profissionais. Ressalta-se a importância de ampliar os programas de formação docente, com o objetivo de fornecer

ferramentas que favoreçam o uso de metodologias de ensino mais significativas, promovendo maior confiança e autonomia pedagógica entre os professores.
Palavras-chave: Questões Sociocientíficas. Abordagem CTSA. Formação Docente. Educação Científica.

1 Introduction

Socioscientific Issues (*SSI*) stand out as an essential tool in science education, allowing for the discussion of controversial, interdisciplinary, and socially relevant topics (Ratcliffe & Grace, 2003). This didactic approach integrates scientific and technological knowledge with complex social, political, and ethical–moral contexts, contributing to the development of critical and engaged citizenship. Furthermore, it fosters skills such as argumentation, analysis of scientific evidence, and informed decision-making (Dionor *et al.*, 2020; Conrado & Nunes-Neto, 2018).

The emergence of *SSI* is associated with the *Science–Technology–Society* (*STS*) movement in science education, although it differs by emphasizing ethical and moral issues that demand deep reflection on the social impacts of technoscientific advancement. Thus, these issues encourage engagement in public debates and promote the formation of sociopolitical actions (Conrado & Nunes-Neto, 2018; Souza & Gehlen, 2017; Keefer, 2003).

In the context of teacher education, several factors hinder the implementation of *SSI* in didactic sequence proposals. Among the main challenges, one can highlight the insecurity in addressing broad and complex topics, characteristic of this approach, which require more time for classroom development. However, factors such as limited curricular hours, the pressure to follow traditional curricula, little time for pedagogical planning, and the difficulties in bringing teachers together for collaborative work are some of the barriers educators face (Martínez-Pérez, 2012).

According to Santos (2007), *SSI* represent fundamental strategies to promote scientific literacy by problematizing socially relevant issues and contributing to a critical, reflective, and emancipatory education that prepares students for future

DOI: https://doi.org/10.47149/pemo.v7.e15997
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

challenges (Freire, 2005). Nevertheless, merely discussing these issues in the classroom is not enough to achieve this goal, as it requires public policies that encourage and enable their development.

It is important to consider the need to foster teacher education through the diversification of strategies and pedagogical approaches that promote meaningful learning. This is especially relevant in the process of empowering educators, strengthening their confidence and pedagogical autonomy in applying active teaching methodologies (Dionor *et al.*, 2020; Conrado & Nunes-Neto, 2018; Fourez, 2003; Auler & Delizoicov, 2001; Gil-Pérez & Carvalho, 2000). To this end, it is essential to start from teachers' prior knowledge, identifying formative weaknesses and strengths, since this initial diagnosis helps to guide more effectively the training processes related to *SSI*.

In this context, this study constitutes part of a research project in the field of science education, focusing on the integration of the *SSI* approach, based on the theme of water, thematic investigation in teacher education, and its connection with scientific literacy and environmental sustainability (Fonseca, 2021).

In light of the above, this study aims to analyze the prior knowledge of Biological Sciences teachers regarding strategies and didactic approaches with the potential to promote more meaningful science teaching, with an emphasis on *SSI*.

2 Methodology

In this study, data were collected during the master's research of the first author, linked to a training proposal for pre-service and in-service Biological Sciences teachers from various Brazilian higher education institutions. The research was previously submitted to and approved by the Research Ethics Committee of the Federal University of Rio Grande do Norte (*UFRN*), under registration CAAE 30106420.4.0000.5537 and opinion no. 4.329.978.

Rev. Pemo, Fortaleza, v. 7, e15997, 2025
DOI: https://doi.org/10.47149/pemo.v7.e15997
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

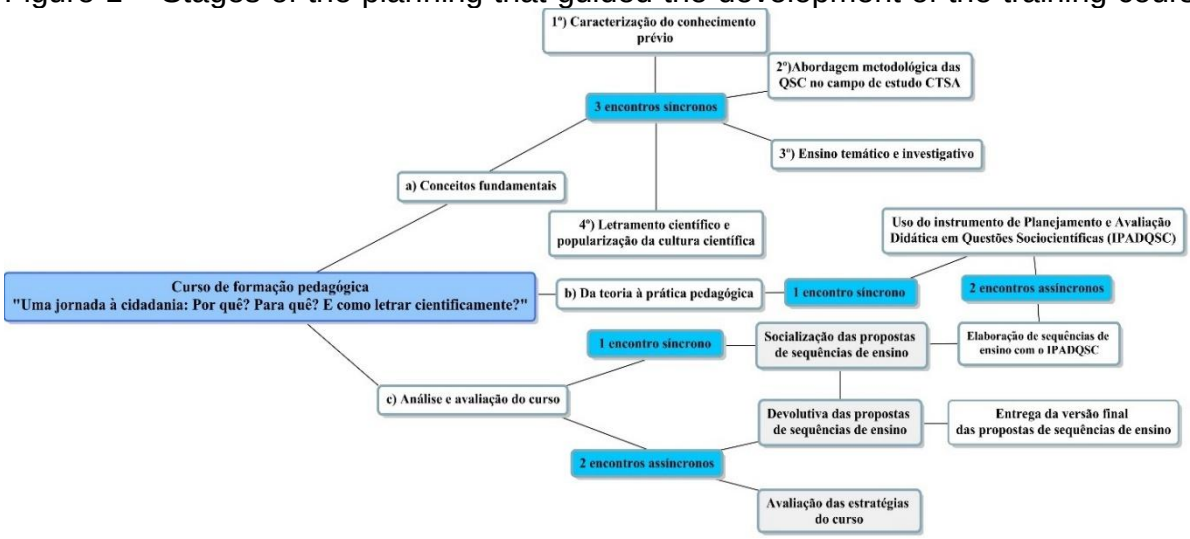
The training program was structured as a course entitled *"Innovative Strategies in Science and Biology Teaching: Socioscientific and Investigative Issues from the Perspective of Scientific Literacy on the Theme of Water,"* with a total workload of 60 hours. This initiative was registered as a university extension activity through the Office of the Dean for Extension (*PROEX*), under code CR422-2020, and was offered in a Distance Education format, in partnership with the Office of Distance Education (*SEDIS*), both affiliated with *UFRN*.

The course was publicized between June 25 and July 3, 2020, using social media platforms such as Facebook, Instagram, and WhatsApp, as well as the official *PROEX/UFRN* website. The training began on July 6 and ended on August 7 of the same year. A total of 206 participants registered, of which 107 were validated. Participation was open to individuals holding or pursuing a degree in Biological Sciences.

The course offered to teachers was based on a teaching sequence entitled *"A Journey to Citizenship: Why? For What? And How to Read Scientifically,"* grounded in the perspective of scientific literacy, as proposed by Santos (2007). The sequence was organized into three stages: (a) Fundamental Concepts; (b) From Theory to Pedagogical Practice; and (c) Course Analysis and Evaluation (Figure 1). Classes were held in the evening, lasting three hours each, and conducted via the Google Meet platform.

Rev. Pemo, Fortaleza, v. 7, e15997, 2025
DOI: https://doi.org/10.47149/pemo.v7.e15997
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

Figure 1 – Stages of the planning that guided the development of the training course



Source: The authors (2020).

The results presented reflect the teachers' prior knowledge regarding didactic strategies and approaches, gathered during the first session, before the discussion of the "fundamental concepts." These data provide an initial analysis of the formative context under study.

Data collection was carried out through a semi-structured questionnaire developed in Google Forms and administered to the teachers attending the class. The form contained 21 questions – 19 multiple-choice and 2 open-ended – aiming to identify the teachers' preliminary knowledge about the topics to be addressed throughout the course.

The investigation employed a qualitative–quantitative approach, following the propositions of Gil (2008). For data analysis, the categorization method proposed by Bardin (2010) was adopted, allowing the data to be organized and classified according to specific criteria defined in the study. The data processing occurred in stages: initially, the information was digitized in an Excel spreadsheet for descriptive analysis; subsequently, tables and graphs were generated to present the results.

3 Results and Discussion

Rev. Pemo, Fortaleza, v. 7, e15997, 2025
DOI: https://doi.org/10.47149/pemo.v7.e15997
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

3.1 Identification of Biology teachers' prior knowledge

The analysis of participants' profiles revealed that, among the 107 teachers whose registrations were approved for the course, 69% were women and 31% were men. Within this group, 75.7% were engaged in continuing education processes, while 24.3% were enrolled in initial teacher training programs.

Regarding the academic qualifications of the already graduated teachers, 43% held a master's degree (of these, 61% worked in the *hard sciences* areas of Biological Sciences, and 39% held a master's degree in Education), 21% were specialists, 5% held a doctorate (none in the field of Education), and 30% had not pursued any postgraduate studies.

It is important to note that not all teachers whose registrations were confirmed attended the first session. Among those present who answered the prior knowledge survey questionnaire (*N* = 91), 59.3% stated that they were engaged in continuing education, while 40.7% were in initial teacher training.

The next question addressed participants' expectations regarding the course. In this sense, all participants expressed an interest in deepening their understanding of didactic strategies related to *SSI* and thematic–investigative teaching, aiming to explore ways to address water-related topics in pedagogical practice (Table 1).

Table 1 – Answers to the question: What motivated you to participate in this teacher training course?

Representative response excerpts	
Initial teacher training	**Continuing education**
I am very excited. I want to understand the importance of inquiry-based teaching and socioscientific issues in science education, aiming to put them into practice during my pedagogical activities (Prof. 49).	*I hope to learn more about these teaching approaches so that I can promote discussions increasingly closer to scientific knowledge in basic education (Prof. 70).*
I intend to learn how to incorporate this new teaching methodology in the classroom in the most effective way with students so that teaching and learning become more efficient (Prof. 69).	*To gain knowledge and enhance our learning journey, eager to learn from the successful experiences of colleagues who, with great dedication, developed and offered this course (Prof. 58).*

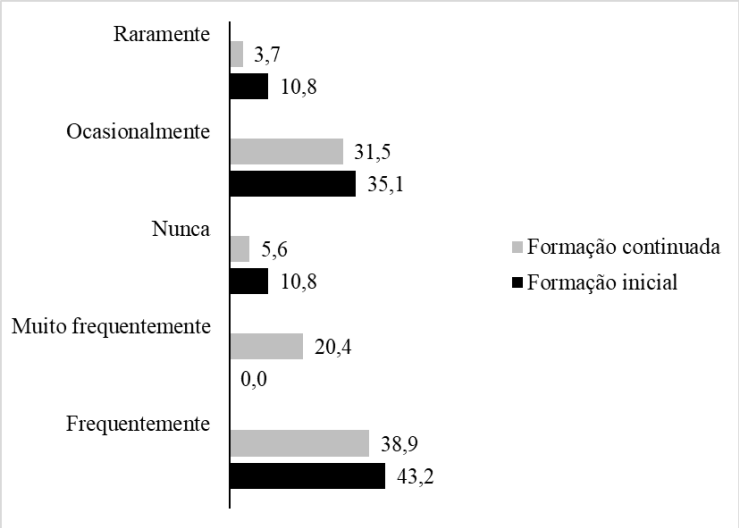
Rev. Pemo, Fortaleza, v. 7, e15997, 2025
DOI: https://doi.org/10.47149/pemo.v7.e15997
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

Source: The authors (2020).

The responses indicate that teachers were motivated to understand and apply potentially meaningful teaching methodologies, demonstrating an intention to incorporate them into their professional practices. This scenario reveals a relevant training opportunity, as it reflects genuine interest in improving educational practices and a commitment to the development of pedagogical work.

Teachers were also asked whether they had prior knowledge of *scientific literacy*. In this regard, most participants – both in initial and continuing education – selected the category “frequently” as their answer, representing 43.2% and 38.9%, respectively (Figure 2).

Figure 2 – Percentage of responses for each option to the statement: Have you ever heard of scientific literacy?

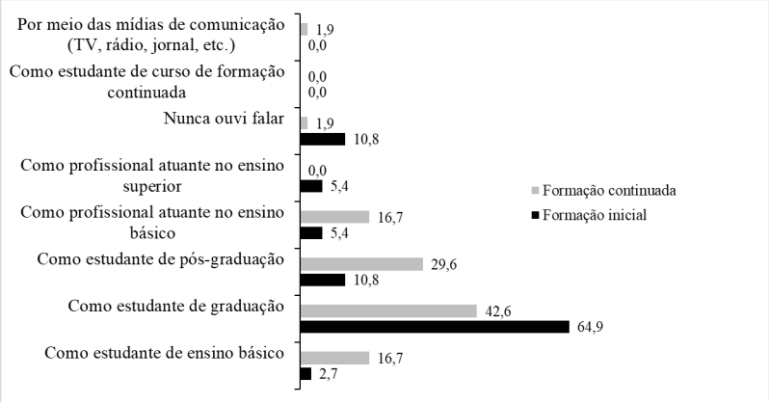


Source: The authors (2020).

The following question aimed to investigate how participants had their first contact with or deepened their knowledge about *scientific literacy*. Most indicated that this contact occurred during their undergraduate studies – 64.9% among those in initial teacher training and 42.6% in continuing education (Figure 3).

Rev. Pemo, Fortaleza, v. 7, e15997, 2025
DOI: https://doi.org/10.47149/pemo.v7.e15997
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

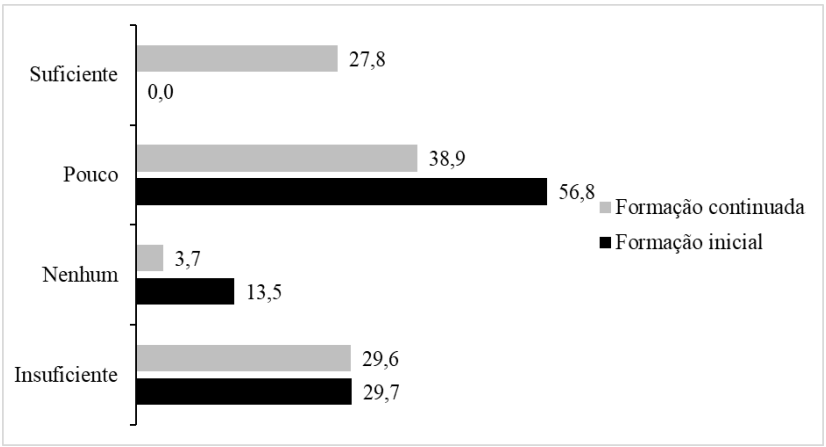
Figure 3 – Percentage of responses for each option to the statement: *How did you first approach or deepen your knowledge of scientific literacy?*



Source: The authors (2020).

Regarding the level of knowledge about the concept, principles, and application of *scientific literacy*, the majority selected the option “little.” The responses were distributed as follows: 56.8% for initial teacher training and 38.9% for continuing education (Figure 4).

Figure 4 – Percentage of responses for each option to the statement: How would you classify your level of knowledge about the concept, principles, and application of scientific literacy?

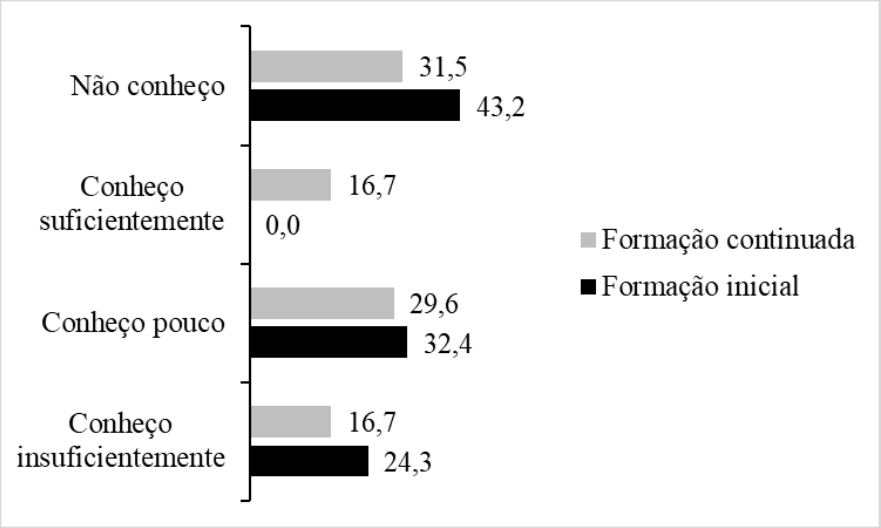


Source: Research data (2020).

Rev. Pemo, Fortaleza, v. 7, e15997, 2025
DOI: https://doi.org/10.47149/pemo.v7.e15997
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

When asked about their knowledge of the criteria used in planning and evaluating teaching sequences focused on *scientific literacy*, the most frequent response was "I am not familiar with them," representing 43.2% among those in initial training and 31.5% among those in continuing education (Figure 5).

Figure 5 – Percentage of responses for each option to the statement: Are you familiar with the criteria used in the planning and evaluation of teaching sequences focused on scientific literacy?



Source: The authors (2020).

The data presented above highlight a significant gap in teachers' knowledge concerning the formative aspects promoted by *scientific literacy*. Such a deficiency can lead to the development of teaching sequences that do not adequately address the demands of comprehension, interpretation, and communication related to science and technology, which, in some cases, may result in misconceptions. This scenario underscores a major challenge in teacher education, indicating the need for initiatives that expand educators' understanding in this area.

Consequently, teachers were asked which aspects should be considered in lesson planning from the perspective of *scientific literacy*. Several options were presented, allowing each participant to select only one. The most frequent answer reflected an alternative conception (Table 2).

Rev. Pemo, Fortaleza, v. 7, e15997, 2025
DOI: https://doi.org/10.47149/pemo.v7.e15997
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

Table 2 – Percentage of responses for each option to the statement: What should be considered in lesson planning from the perspective of scientific literacy?

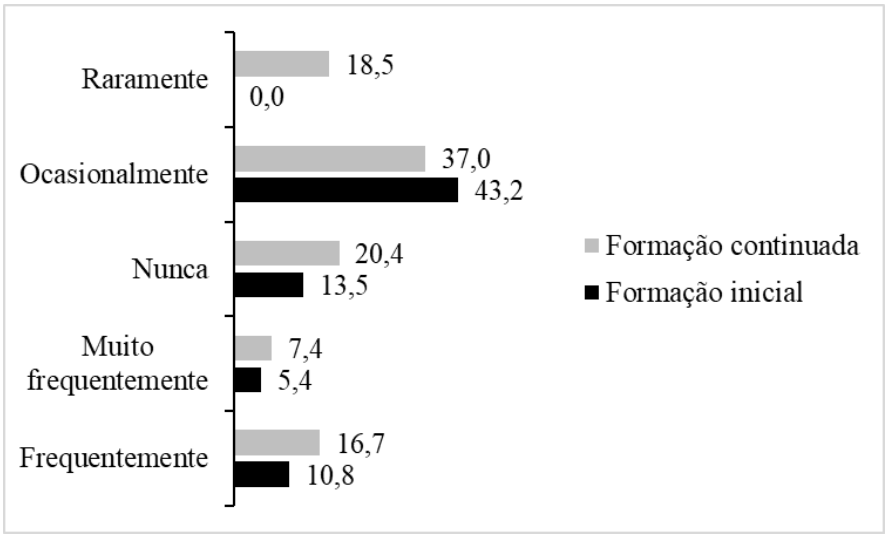
Statements	Training	
	Initial	Continuing education
Defining objectives that enhance the development of students' skills and competencies, considering the school curriculum and adapting them to students' local characteristics and needs in order to bring them closer to the object of study.	2,7 %	3,7 %
Using experiments or science kits in science teaching that help students understand how scientific knowledge is constructed.	75, 7%	72, 2%
Considering the level of content depth and seeking to work on conceptual and procedural aspects as fully as possible.	10, 8%	1,9 %
Defining a single inquiry-based teaching method considered potentially meaningful.	2,7 %	11, 1%
I don't know.	8,1 %	11, 1%

Source: The authors (2020).

The next question sought to determine whether participants had previous contact with the concept of *SSI*. The most frequent response was "occasionally," representing 43.2% among teachers in initial training and 37% among those in continuing education (Figure 6).

Figure 6 – Percentage of responses for each option to the statement: Have you ever heard of Socioscientific Issues (SSI)?

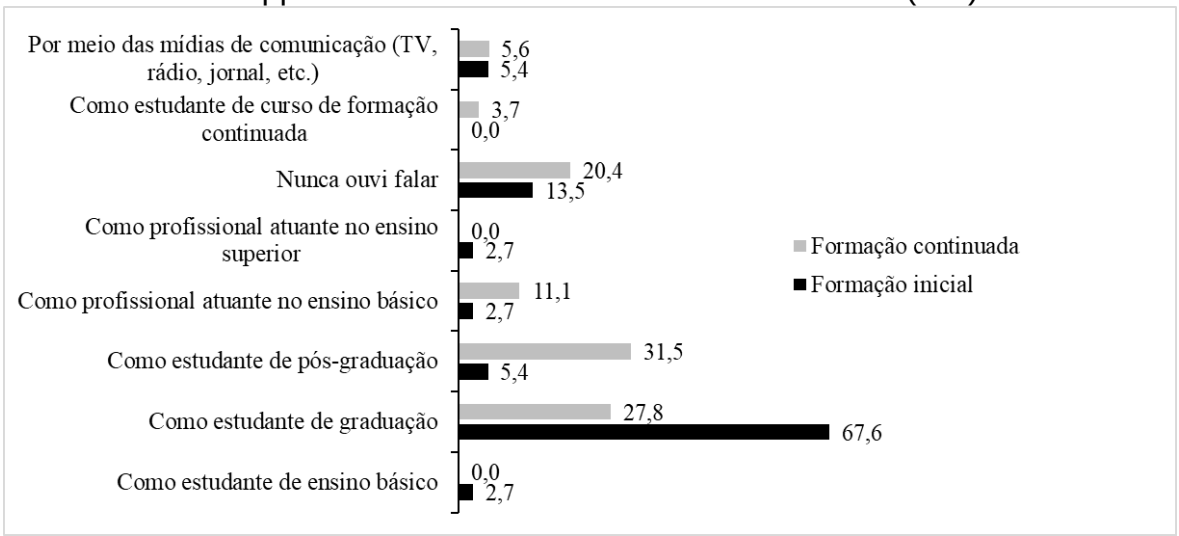
Rev. Pemo, Fortaleza, v. 7, e15997, 2025
DOI: https://doi.org/10.47149/pemo.v7.e15997
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X



Source: The authors (2020).

Subsequently, teachers were asked how they first came into contact with or learned about *SSI*. For those in initial training, the most frequently mentioned category was “as an undergraduate student” (67.6%), while among teachers in continuing education, the most common answer was “as a graduate student” (31.5%) (Figure 7).

Figure 7 – Percentage of responses for each option to the statement: How did you first approach or learn about Socioscientific Issues (SSI)?

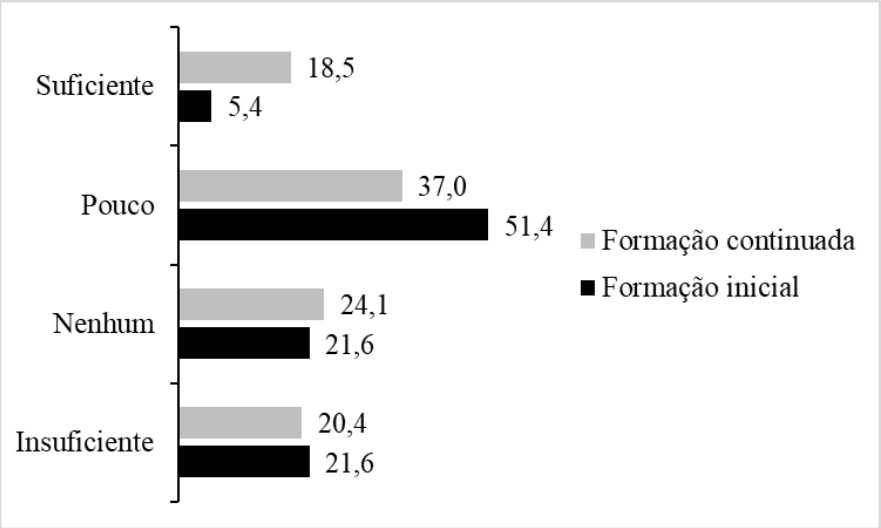


Source: The authors (2020).

DOI: https://doi.org/10.47149/pemo.v7.e15997
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

Next, teachers were asked to assess their level of knowledge about the concept or principles of *SSI*. Once again, the most selected category was "little," with 51.4% among participants in initial training and 37% among those in continuing education (Figure 8).

Figure 8 – Percentage of responses for each option to the statement: How would you classify your level of knowledge about the concept or principles of Socioscientific Issues (SSI)?



Source: The authors (2020).

Following that, participants were asked what should be considered in lesson planning from the perspective of *SSI*. Several statements were presented, and participants could select only one. The most frequent answer in both training categories corresponded to the only valid statement, as shown in Table 3.

Table 3 – Percentage of responses for each option to the statement: What should be considered in lesson planning from the perspective of Socioscientific Issues (SSI)?

Statements	Training	
	Initial	Continuing educa

Rev. Pemo, Fortaleza, v. 7, e15997, 2025
DOI: https://doi.org/10.47149/pemo.v7.e15997
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

		tio n
The clear definition of controversial aspects of the content and its capacity to help students understand scientific and social concepts and topics that may lead to decision-making.	62, 2%	59, 3%
The definition of complex content and teaching strategies that help students learn scientific and social concepts, but with a focus on the teacher's role.	8,1 %	3,7 %
The definition of topics neglected by science and the teaching strategies that help students learn them.	2,7 %	9,3 %
I don't know.	27, 0%	27, 8%

Source: The authors (2020).

Participants were asked for their opinion on the relationship between the *Science, Technology, Society, and Environment* (*STSE*) field and *Socioscientific Issues* (*SSI*). Both training categories agreed that *SSI* are articulated as a science teaching approach linked to the *STSE* field, as shown in Table 4.

Table 4 – Percentage of responses for each option to the statement: In your opinion, is there a relationship between the field of study Science, Technology, Society, and Environment (STSE) and Socioscientific Issues (SSI)?

Statements	**Training**	
	Initial	**Continuing education**
No, I believe that *Socioscientific Issues* (*SSI*) are a methodological approach, while the *Science, Technology, Society, and Environment* (*STSE*) approach is a field of study.	2,7 %	0,0 %
Yes, I believe that the *SSI* approach is articulated as a science teaching approach linked to the field of *Science, Technology, Society, and Environment* (*STSE*).	91, 9%	96, 3%
Yes, *SSI* are the only way to work from the *STSE* perspective.	5,4 %	3,7 %

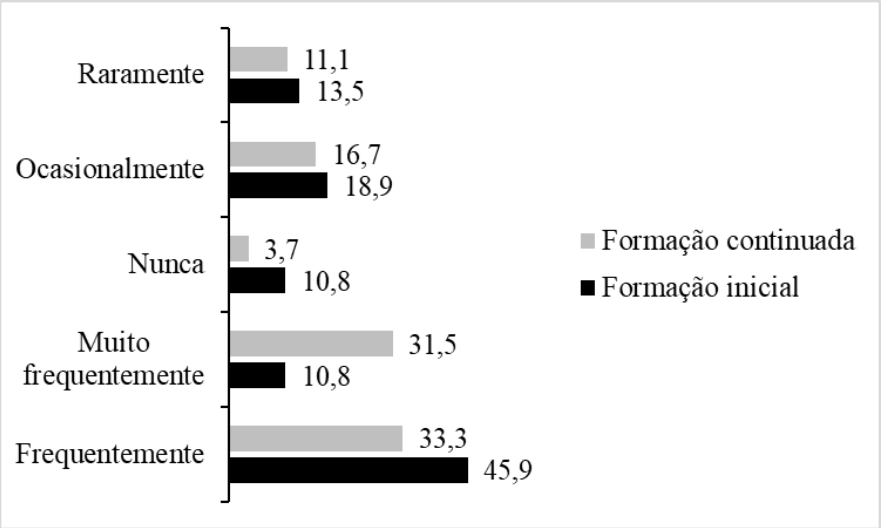
DOI: https://doi.org/10.47149/pemo.v7.e15997
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

Source: The authors (2020).

SSI are integrated into the *STSE* field, as they focus on analyzing scientific and technological contradictions and controversies that impact society, highlighting ethical and moral issues that generate divergent opinions and demand sociopolitical decisions. In turn, the *STSE* field inseparably addresses the effects of science and technology within social and environmental sustainability contexts (Martínez-Pérez, 2012).

The next question invited teachers—both from initial and continuing education programs—to indicate whether they had previously encountered the concept of *inquiry-based teaching*. The results showed that the most frequent response was “frequently,” representing 45.9% in initial training and 33.3% in continuing education (Figure 9).

Figure 9 – Percentage of responses for each option to the statement: Have you ever heard of inquiry-based teaching?

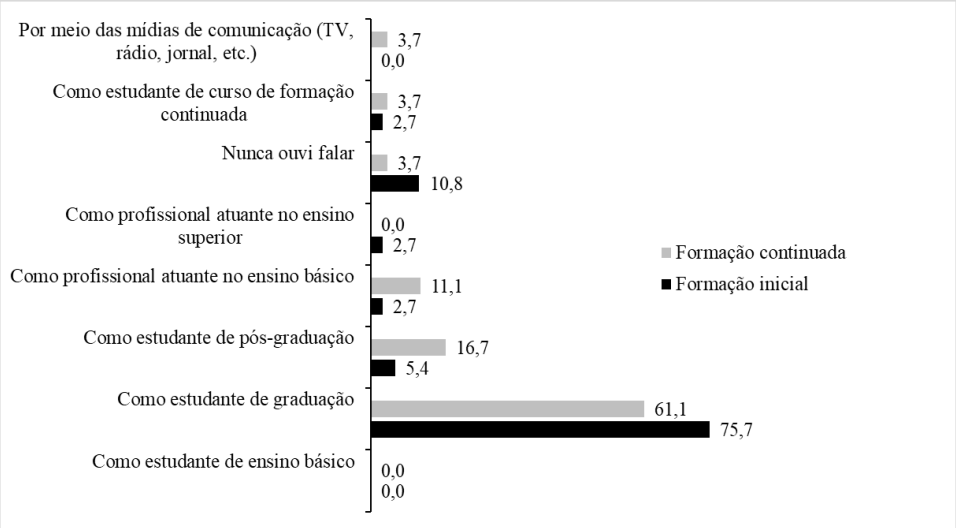


Source: The authors (2020).

Most teachers reported having first encountered or learned about inquiry-based teaching “as undergraduate students.” This response accounted for 75.7% among those in initial training and 61.1% in continuing education (Figure 10).

Rev. Pemo, Fortaleza, v. 7, e15997, 2025
DOI: https://doi.org/10.47149/pemo.v7.e15997
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

Figure 10 – Percentage of responses for each option to the statement: How did you first approach or learn about inquiry-based teaching?

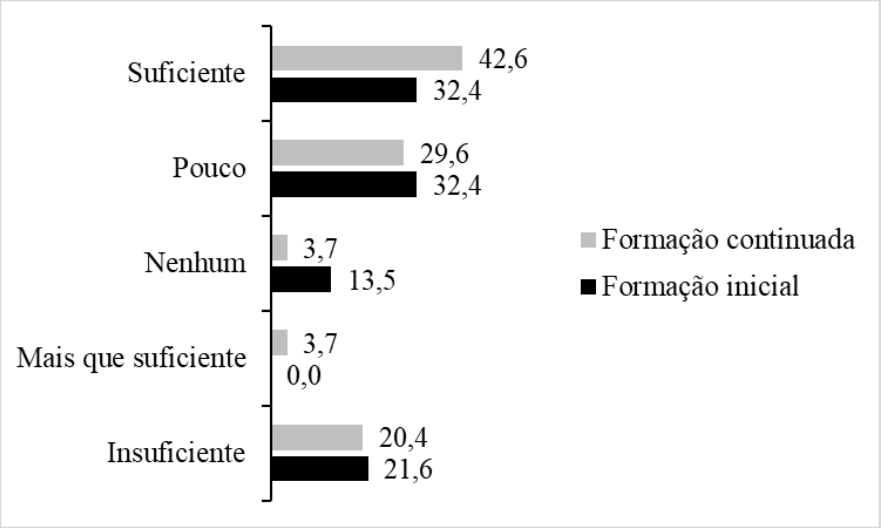


Source: The authors (2020).

Participants were then asked to assess their level of knowledge about the concepts and/or principles of inquiry-based teaching. Among continuing education teachers, the most representative response was “sufficient” (42.6%). In initial training, there was a tie between “sufficient” and “little,” both with 32.4% (Figure 11).

Figure 11 – Percentage of responses for each option to the statement: How would you classify your level of knowledge about the concept or principles of inquiry-based teaching?

Rev. Pemo, Fortaleza, v. 7, e15997, 2025
DOI: https://doi.org/10.47149/pemo.v7.e15997
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

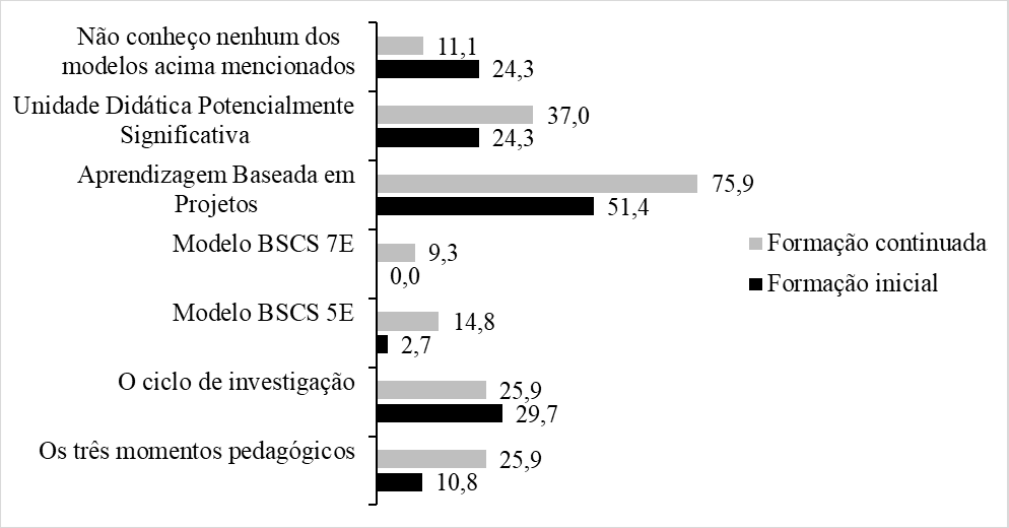


Source: The authors (2020).

Teachers were also asked which theoretical models of thematic and/or inquiry-based teaching they knew. The questionnaire listed several options, allowing participants to select more than one. The analysis showed that “project-based learning” was the most frequently chosen option in both categories—51.4% for initial training and 75.9% for continuing education (Figure 12).

Figure 12 – Percentage of responses for each option to the statement: Are you familiar, at least partially, with any models of thematic or inquiry-based teaching approaches? (You may select more than one option.)

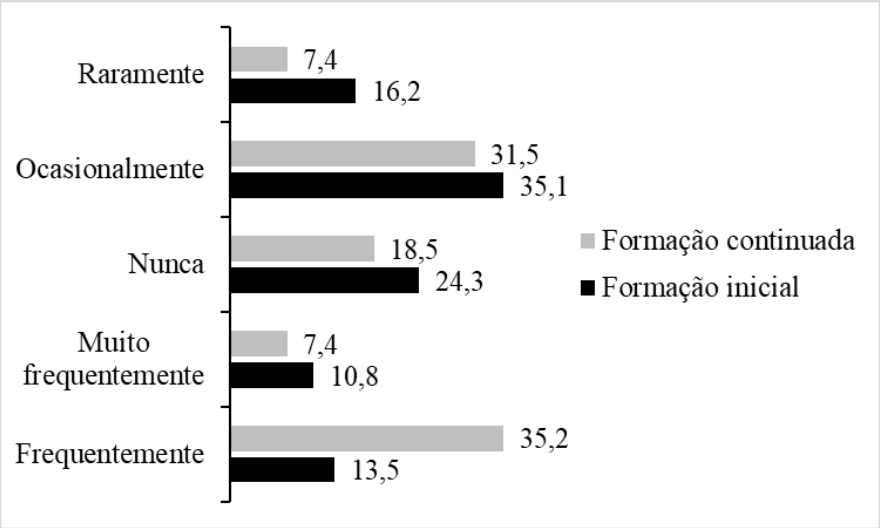
Rev. Pemo, Fortaleza, v. 7, e15997, 2025
DOI: https://doi.org/10.47149/pemo.v7.e15997
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X



Source: The authors (2020).

Next, participants were asked how often they had heard about *science popularization*. For both initial and continuing education categories, the most frequent response was "occasionally," representing 35.1% and 31.5%, respectively (Figure 13).

Figure 13 – Percentage of responses for each option to the statement: Have you ever heard of science popularization?

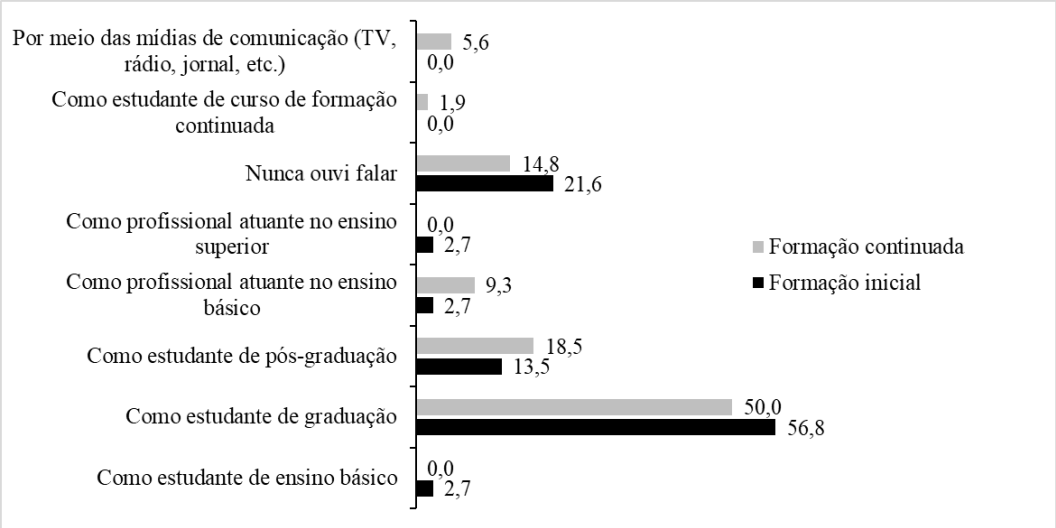


Source: The authors (2020).

Rev. Pemo, Fortaleza, v. 7, e15997, 2025
DOI: https://doi.org/10.47149/pemo.v7.e15997
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

Teachers were then asked how they first encountered or learned about science popularization. The most frequent response was “as an undergraduate student,” with 56.8% in initial training and 50% in continuing education (Figure 14).

Figure 14 – Percentage of responses for each option to the statement: How did you first approach or learn about science popularization?

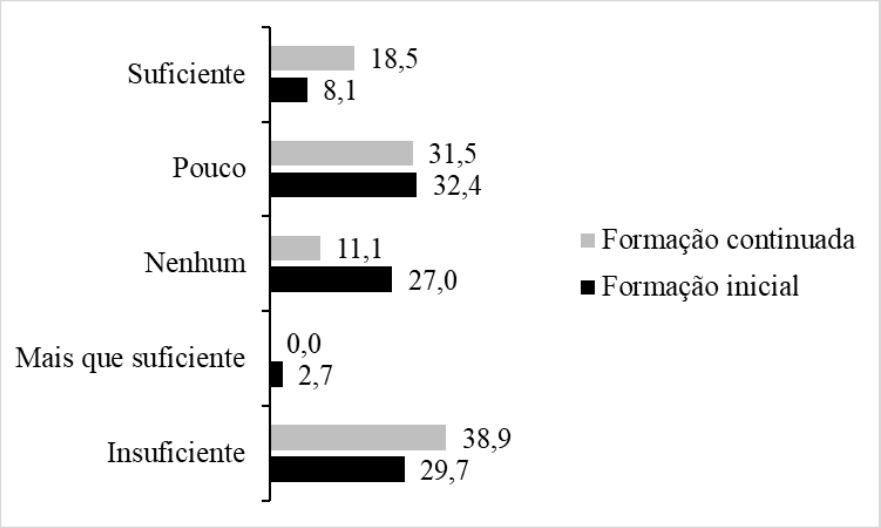


Source: The authors (2020).

Regarding their level of knowledge about the concepts and/or principles of science popularization, the “insufficient” category was the most frequent in continuing education (38.9%), while “little” was the most representative in initial training (32.4%) (Figure 15).

Figure 15 – Percentage of responses for each option to the statement: How would you classify your level of knowledge about the concept or principles of science popularization?

Rev. Pemo, Fortaleza, v. 7, e15997, 2025
DOI: https://doi.org/10.47149/pemo.v7.e15997
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X



Source: The authors (2020).

Finally, the last question asked participants to consider the theme of water and describe how they would plan a lesson based on the perspective of *scientific literacy* and *active citizenship*. The purpose of this open-ended question was to identify answers aligned with the course's proposal – that is, those incorporating a variety of didactic strategies and/or active methodologies related to a water-related issue. From these responses, three main categories of alignment emerged (Table 5).

Table 5 – Percentage of responses for each option to the statement: Considering the theme of water, how would you plan a lesson from the perspective of scientific literacy and active citizenship?

Alignment with course perspective	**Representative excerpt**			
	Initial training	**%**	**Continuing education**	**%**
Fully aligned	*[...] I would pre*	37,8	*I would bring*	37

Rev. Pemo, Fortaleza, v. 7, e15997, 2025
DOI: https://doi.org/10.47149/pemo.v7.e15997
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

	sent the problem for investigation according to the students' reality and daily life. I would develop a sequence of reflective questions and hypothesis		*controversial and sociocientific questions from students' daily lives that impact various dimensions (health, environment, economy,*	

DOI: https://doi.org/10.47149/pemo.v7.e15997
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

	generation, and later promote the formal systematization of knowledge, bringing a more scientific approach into the classroom. In another sta		*ethics, politics, sustainability, etc.). I would propose a problem-based question to stimulate thinking and, from it, work on the planned co*	

Rev. Pemo, Fortaleza, v. 7, e15997, 2025
DOI: https://doi.org/10.47149/pemo.v7.e15997
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

	ge, I would contextualize the content so that students could connect the investigated problem to a social issue. Finally, I would conduct an assessment		*nte nt.*	

Rev. Pemo, Fortaleza, v. 7, e15997, 2025
DOI: https://doi.org/10.47149/pemo.v7.e15997
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

	that involved actions and attitudes related to the theme.			
Partially aligned	*[...] as a future teacher, I believe I would use illustrative and realistic methods base*	45,9	*First, I would provide students with some information about this important eleme*	57,4

	d on stu de nts' dail y ex per ien ces . Sin ce the top ic is bro ad, I wo uld ad opt a hig hly did acti c ap pro ac h, de pe ndi ng on the stu de nts' gra de lev el.		*nt, wa ter , so tha t the y ca n bet ter sit uat e the ms elv es. I wo uld or ga niz e a dis cu ssi on cir cle ab out the top ic an d pr es ent ex am ple s to sti mu lat*	

Rev. Pemo, Fortaleza, v. 7, e15997, 2025
DOI: https://doi.org/10.47149/pemo.v7.e15997
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

			e debate. Then, I could provide scientific articles on different themes related to water so that we could understand its importance.	
Not aligned	*I don't*	16	*I would*	5,6

Rev. Pemo, Fortaleza, v. 7, e15997, 2025
DOI: https://doi.org/10.47149/pemo.v7.e15997
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

	know how to answer because I'm not familiar with the topic.	, 3	*n't know how to apply this scientific literacy perspective yet, but I will learn during the course.*	

Source: The authors (2020).

The data presented above reveal a limited understanding among teachers regarding the use of these didactic resources as a means to enhance *scientific literacy*. This limitation is reflected in the difficulties teachers face when designing lesson plans that incorporate this perspective—an issue observed in the categories that emerged from the evaluative item related to alignment with the pedagogical approach proposed in this training, described as "partially" or "did not know how to answer."

It is important to note that such limitations in theoretical and methodological perspectives may ultimately result in practices that are insufficient to foster a critical, reflective, and active stance in society (Dionor *et al.*, 2020). However, the level of

Rev. Pemo, Fortaleza, v. 7, e15997, 2025
DOI: https://doi.org/10.47149/pemo.v7.e15997
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

knowledge evidenced in this study—particularly regarding the *SSI* approach, thematic–investigative teaching, and the overcoming of alternative conceptions—constitutes a challenge to fostering a critical and reflective attitude toward the implications of science and technology within the social context, aligning with the objectives of science education (Brazil, 1997).

Thus, it becomes essential to design teacher education programs that incorporate these strategies and methodologies (Fonseca & Costa, 2022), considering their potential to strengthen *scientific literacy* and promote it within the context of social practices (Santos, 2007). The results presented demonstrate significant formative potential, expressed through teachers' willingness to deepen these discussions in order to improve their pedagogical practices and encourage more active student participation in the classroom.

Given that these teachers were engaged in a pedagogical development process, their participation in the proposed activities contributed to addressing training gaps, promoting greater professional autonomy, and encouraging the adoption of such methodologies in science teaching (Fonseca, 2021; Fonseca & Costa, 2022). For this reason, it is crucial to continuously invest in teacher training programs aimed at fostering more meaningful educational practices aligned with a critical and emancipatory scientific education (Martins, 2005; Freire, 2005).

4 Final considerations

From the analysis of the data on teachers' expectations regarding the course, it became evident that participants were interested in expanding their knowledge of more effective teaching methodologies, particularly emphasizing the *SSI* approach and thematic–investigative teaching as their main motivations.

However, it was observed that, among both pre-service and in-service teachers, mastery of these pedagogical strategies and approaches remains limited. Although some participants had prior contact with the *SSI* methodology during their

Rev. Pemo, Fortaleza, v. 7, e15997, 2025
DOI: https://doi.org/10.47149/pemo.v7.e15997
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

undergraduate studies, this exposure was generally superficial and insufficient to ensure consistent practical application.

The findings point to the need to reconsider prevailing conceptions of science teaching, which are often reflected in alternative understandings. In this regard, varied perspectives were identified among teachers: some recognize the importance of using experiments and science kits to demonstrate how scientific knowledge is constructed, while others maintain a more restrictive view focused on a single investigative model. This tendency reflects an approach still shaped by reductionist and Cartesian thinking, which may hinder the implementation of more humanized and participatory pedagogical practices—essential for the full development of students' skills and competencies. Such a scenario represents a significant challenge for teacher education.

Considering this context, the course was structured with the purpose of strengthening teacher education by broadening participants' understanding of different theoretical and methodological perspectives. The aim was to provide teachers with greater confidence and preparedness to diversify didactic resources in their professional practice, thereby fostering self-confidence and professional autonomy when applying these strategies and pedagogical approaches in Science and Biology teaching.

References

AULER, Décio; DELIZOICOV, Demétrio. **Alfabetização científico-tecnológica para quê?** *Ensaio: Pesquisa em Educação em Ciências*, Belo Horizonte, v. 3, n. 2, p. 122-134, 2001. DOI: https://doi.org/10.1590/1983-21172001030203. Disponível em: https://www.scielo.br/j/epec/a/XvnmrWLgL4qqN9SzHjNq7Db. Acesso em: 28 jul. 2024.

BARDIN, Laurence. **Análise de conteúdo.** Lisboa, Portugal: Edições 70 LDA, 2010.
BRASIL. **Parâmetros curriculares nacionais: ciências naturais.** Brasília: MEC/SEF, 1997.

Rev. Pemo, Fortaleza, v. 7, e15997, 2025
DOI: https://doi.org/10.47149/pemo.v7.e15997
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

CONRADO, Dália Melissa; NUNES-NETO, Nei. **Questões Sociocientíficas: fundamentos, proposta de ensino e perspectivas para ações sociopolíticas.** Salvador: EDUFBA, 2018.

DIONOR, Grégory Alves; CONRADO, Dália Melissa; MARTINS, Liziane; NUNES-NETO, Nei de Freitas. **Análise de Propostas de Ensino Baseado em QSC: uma revisão da literatura na educação básica.** *Alexandria: Revista de Educação em Ciências e Tecnologia*, v. 13, n. 1, p. 197-224, 2020. DOI: https://doi.org/10.5007/1982-5153.2020v13n1p197. Disponível em: https://periodicos.ufsc.br/index.php/alexandria/article/view/1982-5153.2020v13n1p197. Acesso em: 28 jul. 2024.

FONSECA, Aleson da Silva. **Diversidade metagenômica do fitoplâncton e risco social de florações de cianobactérias em reservatórios do semiárido brasileiro: mediação da pesquisa e ensino para o letramento científico.** 2021. 317 f. Dissertação (Mestrado em Desenvolvimento e Meio Ambiente) – Centro de Biociências, Universidade Federal do Rio Grande do Norte, Natal, 2021. Disponível em: https://repositorio.ufrn.br/items/49d83c7d-9e2a-4be4-8988-3c958861b0fd. Acesso em: 28 jul. 2024.

FONSECA, Aleson da Silva; COSTA, Ivaneide Alves Soares da. **Instrumento de Planificación y Evaluación Didáctica de Cuestiones Sociocientíficos (IPADQSC) como material didáctico de apoyo al profesor.** *Paradigma*, v. 43, n. 2, p. 154–192, 2022. DOI: https://doi.org/10.37618/PARADIGMA.1011-2251.2022.p154-192.id1183. Disponível em: https://revistaparadigma.com.br/index.php/paradigma/article/view/1183. Acesso em: 29 jul. 2024.

FOUREZ, Gérard. **Crise no ensino de ciências?** *Investigações em Ensino de Ciências*, v. 8, n. 2, p. 1-21, 2003. Disponível em: https://sites.usp.br/nupic/wp-content/uploads/sites/293/2016/05/Gerard_Fourez_CRISE_NO_ENSINO_DE_CIENCIAS.pdf. Acesso em: 28 jul. 2024.

FREIRE, Paulo. **Pedagogia do oprimido.** Rio de Janeiro: Paz e Terra, 2005.

GIL, Antônio Carlos. **Métodos e técnicas de pesquisa social.** São Paulo: Atlas, 2008.

GIL-PÉREZ, Daniel; CARVALHO, Anna María Pessoa de. **Dificultades para la incorporación a la enseñanza de los hallazgos de la investigación e innovación en didáctica de las ciencias.** *Educación Química*, v. 11, n. 2, p. 244-551, 2000. DOI: https://doi.org/10.22201/fq.18708404e.2000.2.66460. Disponível em: https://revistas.unam.mx/index.php/req/article/view/66460. Acesso em: 28 jul. 2024.

KEEFER, Matthew. **Moral reasoning and case-based approaches to ethical instruction in science.** In: ZEIDLER, Dana Lewis (Org.). *The role of moral reasoning on socioscientific issues and discourse in science education.* Dordrecht: Kluwer Academic Press, 2003. p. 201–214.

MARTÍNEZ-PÉREZ, Leonardo Fabio. **Questões sociocientíficas na prática docente**: ideologia, autonomia e formação de professores. São Paulo: Editora UNESP, 2012.

MARTINS, André Ferré Pinto. **Ensino de Ciências: desafios à formação de professores**. Educação em Questão, Natal - RN, v. 23, n. 9, p. 53-65, 2005. Disponível em: https://periodicos.ufrn.br/educacaoemquestao/article/view/8342/5998. Acesso em: 28 jul. 2024.

RATCLIFFE, Mary; GRACE, Marcus. **Science education for citizenship: teaching socioscientific issues.** Maidenhead: Open University Press, 2003.

SANTOS, Wildson Luiz Pereira dos. **Educação científica na perspectiva de letramento como prática social: funções, princípios e desafios.** *Revista Brasileira de Educação*, v. 12, n. 36, p. 474-550, 2007. DOI: https://doi.org/10.1590/S1413-24782007000300007. Disponível em: https://www.scielo.br/j/rbedu/a/C58ZMt5JwnNGr5dMkrDDPTN#. Acesso em: 28 jul. 2024.

SOUZA, Polliane Santos de; GEHLEN, Simoni Tormöhlen. **Questões sociocientíficas no ensino de ciências: algumas características da pesquisa brasileira.** *Ensaio: Pesquisa em Educação em Ciências*, v. 19, p. 1-22, 2017. DOI: https://doi.org/10.1590/1983-21172017190109. Disponível em: https://www.scielo.br/j/epec/a/mc7GqQVD97gT6SfhXQjNS9z/abstract/?lang=pt. Acesso em: 28 jul. 2024.

VILCHES, Amparo; GIL-PÉREZ, Daniel; PRAIA, João. **De CTS a CTSA: educação por um futuro sustentável.** In: SANTOS, Wildson Luiz Pereira dos; AULER, Décio (Orgs.). *CTS e educação científica: desafios, tendências e resultados de pesquisa.* Brasília: Editora Universidade de Brasília, 2011. p. 55–78.

[i] **Aleson da Silva Fonseca,** ORCID: https://orcid.org/0000-0002-7148-9208
Doutor em Educação para a Ciência pela Universidade Estadual Paulista "Júlio de Mesquita Filho" (UNESP), mestre em Desenvolvimento e Meio Ambiente pela Universidade Federal do Rio Grande do Norte (UFRN). Graduado em Licenciatura em Ciências Biológicas pela UFRN. Docente da Rede Estadual de Ensino do Estado do Rio Grande do Norte (SEEC/RN).

Rev. Pemo, Fortaleza, v. 7, e15997, 2025
DOI: https://doi.org/10.47149/pemo.v7.e15997
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

Authorship contribution: Text writing.
Lattes: http://lattes.cnpq.br/7428339911970142.
E-mail: aleson.fonseca@unesp.br

[ii] **Ivaneide Alves Soares da Costa,** ORCID: https://orcid.org/0000-0002-1606-5015
Doutora em Ecologia e Recursos Naturais pela Universidade Federal de São Carlos (UFSCar). Mestra em Bioecologia Aquática pela Universidade Federal do Rio Grande do Norte (UFRN). Graduada em Licenciatura em Ciências Biológicas pela UFRN. Docente associada ao Departamento de Microbiologia e Parasitologia da UFRN.
Authorship contribution: Supervision and text review.
Lattes: http://lattes.cnpq.br/2971840301895348.
E-mail: ivaneide.alves.costa@ufrn.br

Responsible publisher: Genifer Andrade

***Ad hoc* experts:** Gutemberg de Castro Praxedes e Leonardo Alcântara Alves.

How to cite this article (ABNT):
FONSECA, Aleson da Silva.; COSTA, Ivaneide Alves Soares da. Prior knowledge of Biology teachers regarding potentially significant strategies and approaches. **Rev. Pemo**, Fortaleza, v. 7, e15997, 2025. Disponível em: https://revistas.uece.br/index.php/revpemo/article/view/15997

Received on June 1, 2025.
Accepted on August 17, 2025.
Published in 23 de October de 2025.