

The Didactic Mediation of Authorial Texts and Reader-effect in the Initial Education of Biology Teachers

 Leandro Siqueira Palcha,  Odisséa Boaventura de Oliveira

Keywords Science teaching; Reading and writing; Teacher training.

Abstract This paper presents the results of research carried out in a Biology teacher education program at a Brazilian public university, during the performance of supervised internship in high schools. From the epistemic framework of Discourse Analysis with a French strand, the discursive positions (of teacher and student) were analyzed in the mediation promoted by trainee undergraduates when using their authorial texts in Biology classes. Our data sources were the teaching projects containing authorial texts, a field journal, and classes' video records. The results demonstrate that when considering the subject positions (author and reader), the trainees involved students in the activity of mediation and reading comics, structuring their practices within a controversial approach to the pedagogical discourse. Finally, we indicate to the research area the relevance of a discursive basis in studies on the role of reading and language in Science Education and, above all, to insert it as a relevant topic to be discussed.

Introduction

The internship in the initial teacher training can be considered a privileged space for dialogue between university and school. It increases the visibility of the circulation and formulation of speeches about teaching since it is the time for undergraduates to promote the mediation of science in the school culture.

In the epistemic framework of Discourse Analysis initiated by Michel Pêcheux (2002) and developed in Brazil by Eni Orlandi (2012), it is understood that “the discourse is an effect of meanings between speakers” (Orlandi, 2013, p. 21, our translation), that is, a historical, social, and ideological practice that exposes, through language, the conditions for the production of meanings and subjects. In turn, language must be thought of in terms of mediation, that is, “mediation as a constitutive relationship, an action that modifies, that transforms” (Orlandi, 2006, p. 25, our translation).

Submitted on 27 July 2020

Accepted on 01 April 2021

Published on 29 April 2021



Based on this framework, in recent years, we have been concerned with the activity of reading and writing in the training of Science and Biology teachers and, as stated by Orlandi (2001), when it is intended to teach reading and writing, one must think about learning as an inscription of subject-positions in networks of signifiers and that these activities are produced by a historical-social process between subjects and knowledge.

The question that arises is: “How do subject-positions manifest in the didactic mediation of texts in classes taught by undergraduate students during the mandatory supervised internship?”

We defend that the mediation of teaching content is built from the reading of different texts, as scientific knowledge can be present in different languages since with a focus on Natural Sciences, “the possibility of expanding scientific culture in these sciences should not depend only on the knowledge of formal languages with which they are produced” (Almeida, 2015, p. 46, our translation).

The student relates to scientific knowledge not only through formal languages. Therefore we defend that, in the internship, the undergraduate students work with different texts in the classroom to reflect on how they propose reading and the discursive position of students facing such activity.

As previously stated, we conceive learning as an inscription of subject-positions in networks of signifiers (Orlandi, 2001), which implies thinking about the author-role and the reader-effect. The author-role is understood by placing the subject “at the origin of the meaning and being responsible for its production” (Orlandi, 2001, p. 65, our translation). By placing oneself in this function, the subject builds and addresses a virtual (ideal) reader hoping that the planned meanings are read. In contrast, the reader-effect is found in the duel between the predicted and the performed reading, that is, “if we have, on the one hand, the author-role as a unit of formulated meaning, due to an image of a virtual reader, on the other hand, we have the reader-effect as an imaginary unit of a read meaning” (Orlandi, 2001, p. 65, our translation).

For this reason, didactic mediation allows the teacher in training to develop teaching situations, involving the problematization of teaching contents for the teaching-learning process.

Teaching content is the unit that develops in overcoming two distinct processes, teaching and learning, through the dialectical tension that is established between immediate and mediate knowledge, consequently generating the contradiction between both and the overcoming of the immediate in the mediate. (Oliveira et al., 2007, p. 146, our translation)

In our perspective, to consider didactic mediation in educational practice requires working with teaching content through different languages, such as written texts (letters, poetry, etc.), imagery texts (drawing, comics, etc.), and orality, to generate problematizations.

Based on this relationship between the subject and language in the formulation

and circulation of meanings, this study aims to analyze the reader-effect triggered by the author-role in the didactic mediation of texts produced by the trainee undergraduates for the Biology classes taught in the internship.

The research was carried out with undergraduate students in Biological Sciences from a Brazilian public university, enrolled in the Teaching Practice discipline, in which they undertook Supervised Internship in public high schools. In this scenario, the trainees should include a text written by themselves to be mediated in the Biology classes taught. We analyze here the discursive positions of two participants in the investigation.

Teacher training and reading: some studies

In this section, we describe some studies that investigated reading activities in the training of Science teachers since, according to Ribeiro et al. (2012, p. 148, our translation), “despite intense investigations focusing on students, we need to advance our knowledge about how Science teachers develop their reading practices”.

In this sense, Nascimento and Cassiani (2009) analyze the ways of reading scientific dissemination texts that were adopted in the classes taught by undergraduate students. Two reading intentions were observed, paraphrastic and polysemic. The first occurred when the undergraduate students ignored the dialogue with the student, not including the experiences of this interlocutor, aiming to obtain hegemonic meaning for the text. Polysemic reading, on the contrary, took place when the undergraduate students developed comparative activities between the dissemination text and the student’s daily life, using this text as a starting point for the discussion in which each student expressed their understanding. Another aspect observed by the authors was the oral re-elaborations, concerning the dissemination text, that some undergraduate students promoted in their classes. They were important to point out the types of mediation in the reading of a text that can lead to meanings that approach or distance themselves from the scientific concepts under study.

The results of Nascimento and Cassiani (2009) show the fundamental role that the teacher has as a mediator in the reading of texts in the classroom, whether of scientific dissemination or others, since it is s/he who determines the changes that this text must undergo, which define how the text works.

Similarly, Ribeiro et al. (2012) sought to characterize the reading practices in Science classes developed by undergraduates working in Youth and Adult Education (EJA). Through individual interviews and focus groups, the authors investigated personal experiences with reading, reading practices, and texts used when the undergraduates taught the classes. Besides, the purposes and intentions of these practices were raised. As a result, they indicate that all the research participants had a positive experience with the reading practice in the family context, while in the school context, the readings in Science were less remarkable.

Regarding their practices, the undergraduates referred that in reading activities, in the classes taught, there was an “extrapolation”, that is, EJA students associated

elements of the text with other knowledge, in general, arising from everyday life. These extrapolations were often caused by the undergraduate when questioning. Ribeiro et al. (2012) relate the term “extrapolation” to intertextuality, that is, the relationship of a text with others. However, the authors assert that this relationship would not be restricted to texts, but subjects. Thus, the focus of studies with reading should shift to the ways of building these relationships, answering questions such as “who builds relationships, for what purposes, how do others respond to the proposed relationships, which relationships are recognized as valid, and by who, etc.” (p. 147, our translation).

Ribeiro et al. (2012, p. 148, our translation) point out that concerning the surveyed undergraduates:

[...] the practices experienced by these readers are the starting point for building practices at school as teachers: the individual silent reading experienced in the family, associated with the reading of a single text that they bring from the school. Possibly, the interactions with their students create opportunities for the participants to recover the meanings of some elements that were present in their previous experiences: the collective reading, the reading of various texts. However, who initiates this transformation process seems to be the group of students from EJA when responding to the reading practices proposed by the undergraduate students.

Nicolli and Cassiani (2012) researched in what ways the stories of reading and writing infer the performance of trainees in Biological Sciences, that is, what meanings could be produced and determinants in the planning and inclusion of reading and writing activities in Science/Biology teaching. The research invested in the development of reading and writing activities, during the Supervised Internship II discipline, of the Biological Sciences course, at the Federal University of Santa Catarina, and to encourage the interest of the trainees diverse reading activities were proposed. However, it was found that throughout the development of the internship, academics did not propose reading and writing activities in their classes in basic education. The authors analyzed this situation considering that “the students/trainees, by not inserting reading and writing activities in their classes, reduced the possibilities for their students to mobilize their reading stories and build possible predicted (and others) meanings for a given text” (Nicolli & Cassiani, 2012, p. 76, our translation).

Based on the research, according to the authors, it is possible to recognize the importance of problematizing reading and writing activities in the Supervised Internship, so that we can expand the perception that undergraduate students have about reading and writing in Science education (Nicolli & Cassiani, 2012).

Cabral and Flôr (2013) also endorse the pertinence of developing reading and writing activities during the teacher training internship. To analyze the trainees’ reading stories, the authors mobilized reading and writing activities of the mandatory disciplines of Supervised Internship in Chemistry I and Supervised Internship in Chemistry II of the Chemistry Degree course, at the Federal University of Juiz de Fora. When analyzing the

reports on the activities developed during the internship, the researchers point out that in Chemistry courses there is a great appreciation of technical reports and resolution of calculations and, therefore, it is essential to work with issues related to language in teacher training. Above all, it is emphasized that the discussion and experiences of reading and writing practices in initial and continuing education can be a way to encourage such practices in basic education (Cabral & Flôr, 2013).

We will seek, in our analysis and discussion, to establish relationships with these and other studies, concerned with promoting a contribution to a deeper understanding of reading in the initial training of Science teachers, since it is an area with a certain lack of research as pointed out above by Ribeiro et al. (2012), thus seeking to broaden the connection between theoretical and practical approaches on the functioning of texts in the teaching activity.

Reading in the internship: from the author-role to the reader-effect

We consider the internship an ideal space to problematize the pedagogical discourse of the future teacher, that is, her/his conceptions about school knowledge, learning, social interactions, among other elements. Reading in the pedagogical practice of Science teachers is one of those elements that we have privileged. This activity is usually conceived as spontaneous and the signification process appears as something alien to historical, social, and ideological conditions. That is because the images that teachers have about the reading activity are often established by the experiences they had during their schooling process (Almeida et al., 2008).

We believe that addressing reading and its types of mediation is a way for the future teacher to promote a polemical approach to pedagogical discourse, because: “When opening space for polysemy in the classroom, we seek to establish a discourse that is close to the controversial, which is the one where there is a dispute of meanings in the game between paraphrase and polysemy and brings life from outside to inside the school” (Cassiani et al., 2012, p. 57, our translation). In the words of Orlandi (2013, p. 86, our translation), the controversial discourse is “the one in which polysemy is controlled, the referent is disputed by the interlocutors and they remain in presence, in a tense relation of competition of meanings”. One possibility for controversially putting her/himself is for the teacher to construct her/his text, aiming at “exposing her/himself to possible effects, is to leave a space for the listener’s existence as a ‘subject’. That is, leaving a space for the other (the listener) within the discourse and building the very possibility of her/himself (speaker) placing her/himself as a listener” (Orlandi, 2006, p. 32, our translation).

We take the class as a practice that is constituted through relations of confrontation and tension between knowledge that is formulated and circulated among the subjects (teacher and students) in the teaching context. Thus, meaning is produced amid confrontations (effects) between the interlocutors. Therefore, we have tried to expose the

trainee-subjects to the understanding that in reading: “Each one has a gesture that only makes sense in their event. But listening, interpretation can be worked on, transformed” (Orlandi, 2003b, p. 21, our translation).

Concerning reading, the author-role has a double effect on the reader-effect:

And this is built on the materiality of the text. One cannot speak of the other’s place. However, through the anticipation mechanism, the author-subject projects her/himself in the place where the other waits with her/his listening and, thus, ‘guided’ by this imaginary, constitutes, in textuality, a virtual reader that corresponds to her/him (Orlandi, 2001, p. 61, our translation).

Enrolled in the author-role, the subject foresees a reading for the meanings produced and, thus, builds a virtual (ideal) reader for those who address it, projecting a way for the meanings to be read. Therefore, the effective (real) reader is faced with this proposed reading and with another one s/he performs, that is, “the reader-effect occurs in the recognition of one reading among others” (Orlandi, 2003a, p. 14, our translation).

The reader-effect is a product of the author-role, constructed and affected by the imaginary of a place in the discourse that was designed for itself, that is, by the author’s imaginary that is constructed by elements provided by the discursive memory (the aforementioned that constitutes the subject). The reader-effect results from this projected image of the reader and the reading s/he performs. In the confrontation between the positions of the author-subject and reader-subject, the idealized reader-effect can be confirmed or deconstructed in reading. Therefore, analyzing the reader-effect can be a way of understanding how the meanings are selected and manifested by students in Science classes.

With that, we seek to approach reading in the disciplines of the teacher training program, trying to show that the gesture of interpretation “already has a history. It does not take place outside the world. Identity is not taught, but identification processes can be worked on. One can expand the subject’s ability to interpret” (Orlandi, 2003b, p. 20, our translation). Thus, we consider the training experience promoted by the Internship a favorable moment for future teachers to invest in the possibility of working with schools as mediators in the reading activity through different languages. We will explore this role below.

Dialectical mediation: from immediate knowledge to mediate knowledge

When discussing school knowledge and its intrinsic characteristics, Lopes (1999) proposes the concept of didactic mediation in a dialectical sense, that is, “a process of constituting a reality based on contradictory mediations, of complex, not immediate relations. A deep sense of dialogue” (pp. 208–209, our translation).

The sense of dialectical didactic mediation aims to understand the class and its complexity since “Thinking about the class in a dialectical perspective implies conceiving

it as praxis, the educational practice, explaining that the act of thinking the practice cannot be performed exclusively during the practical action itself” (Oliveira et al., 2007, p. 127, our translation).

Furthermore, according to Oliveira et al. (2007), dialectical mediation refers to a methodological construction for educational practice that confronts the knowledge that students bring with them and what should be taught in the classroom.

This perspective suggests that the student arrives in the classroom with a set of initial representations that need to be analyzed and questioned for learning to occur.

In general terms, dialectical mediation has the student’s immediate knowledge as a starting point, problematization as an intermediary, and mediate knowledge as an arrival point.

The immediate knowledge point is the confrontation between the student and the teaching contents, which can be analyzed by rescuing and registering their initial representations. For Oliveira et al. (2007, p. 149, our translation), “Rescuing has the meaning of resuming and recovering the initial ideas, the representations that students have about the (immediate) teaching content”. While “Registering relates to registration, to the notes that students make about their representations of the immediate, using the different modalities of language” (Oliveira et al. 2007, p. 149, our translation). Thus, the actions of rescuing and registering contribute for students to express the meanings brought with them about the content to be discussed in class.

The contradiction, located between the immediate point and the mediate, is triggered by the activities of problematizing knowledge. In this way, the teacher helps the student to realize how close her/his initial representations are to scientific content. “To problematize is to place the subject in a problematic teaching situation, capable of leading her/him to mentally understand the divergences between her/his immediate knowledge and the mediate knowledge worked by the teaching process” (Oliveira et al., 2007, p. 151, our translation).

The point of mediate knowledge refers to the learning of teaching contents mediated by the teacher, through the stages in which s/he must systematize and produce knowledge. For Oliveira et al. (2007, p. 154, our translation), “To systematize is to develop teaching situations that enable the student to understand the relations of meaning between aspects of her/his immediate knowledge and elements of the intended mediate knowledge”. In the production stage, it is necessary to “develop teaching situations so that the student can express the cognitive syntheses elaborated when experiencing the stages of dialectical mediation” (Oliveira et al., p. 154, our translation).

It must be emphasized that in order to break with the immediate representations and advance in the perspective of understanding the teaching contents, the student needs to systematize her/his knowledge and produce syntheses through different texts and languages that allow her/him to construct contextualized scientific explanations.

Research structure

This research was part of a larger study developed over a year in the discipline of Teaching Practice in Science and Biology, taught by the researchers, in a Brazilian public university and which has the mandatory Supervised Internship as part of the activities. All ethical and legal principles for conducting the investigation were followed. Nine trainees accepted to participate voluntarily in the research, providing the materials produced by them during the internship and signing the consent form for further analysis, discussion, and publication.

One of the activities of the internship was the elaboration of the teaching project, that is, an intervention plan for classes at school, which could be done in pairs or trios, containing introduction (justification, problem, objectives), theoretical assumptions, methodological procedures, bibliographic references, and annexes (lesson plans). Trainees should also produce a text to be included and used as a reading activity in the classes they would teach at school. In the journals, they would analyze this reading activity and reflect on the results of teaching.

The data sources taken for analysis in this study were: a) a teaching project with the author's text produced by the trainees; b) trainees' field journal; and c) video recording of the trainees' classes. From these sources, we analyzed how the research subjects previously formulated the meanings for the didactic mediation of biological knowledge, because, as stated by Oliveira et al. (2007, p. 153, our translation), the problematization activities provoke "the opposing of points of view on the same teaching content and perform different actions in the discussion, aiming to explain to the student the relationship of tension between their initial (immediate) knowledge and the scientific (mediate) concept". Through the analysis of the journal and the recording of classes, we researched how the meanings were constituted in the classroom, since "the meanings are how they are constituted, how they are formulated and circulated" (Orlandi, 2001, p. 12, our translation).

The analytical device of the research is guided by the theoretical-methodological framework of the French Discourse Analysis (Orlandi, 2013; Pêcheux, 2002), understanding that the construction of this device:

[...] results in the change of the reader's position to the place built by the analyst. Place where the scientist's otherness is shown, the other reading s/he can produce. In that place, s/he does not reflect but situates, understands, the movement of interpretation inscribed in the symbolic object that is her/his target. S/he can then contemplate (theorize) and expose (describe) the effects of the interpretation. That is why we say that the discourse analyst, unlike hermeneutics, does not interpret, s/he works (in) the limits of interpretation. S/he does not put her/himself outside the history, the symbolic, or the ideology. S/he puts her/himself in a dislocated position that allows her/him to contemplate the process of producing meanings in her/his conditions. (Orlandi, 2013, p. 61, our translation)

Thus, the analytical device built for this research aims to examine the reader-effect triggered during the planning, the conduction, and assessment of Biology classes by the trainees when they took up teaching. With this, we seek to discuss the mediation types of the authorial text, taking as a reference the author-role (trainees) and reader-effect (students) assumed in the practice of teaching, as well as the functioning of the text through reading.

The analysis will focus on two trainees, Tasso and Alice. Such choice was made according to the following criteria: i) they attended the same internship field during the research; ii) they produced and mediated the same genre of authorial text (comic strip); and iii) they mediated the texts for three classes, from the Biology curricular component of the second year of High School.

Didactic mediation and reader-effect in the internship: discourses in analysis

The research results will be organized, presented, and discussed by the notion of fragments, that is, the “fragment is a discursive unit: correlated fragment of language and situation” (Orlandi, 2006, p. 139, our translation). The fragments proposed here are a) the reading and the desirable reader; b) the reader-effect and the knowledge in Tasso’s teaching; c) the reader-effect and the knowledge in Alice’s teaching.

Fragment 1: Reading and the desirable reader

We start with planning. Alice and Tasso chose to produce their authorial texts in the form of comics, based on the very school trajectory in which their teachers used this textual genre, in addition to the fact that many high school students are comic book readers. Then they state that:

Taking these experiences into account and combining them with the knowledge acquired during the undergraduate course, we believe that the use of comics in the classroom promotes a differentiated interaction with the scientific content. Such interaction takes into account the students’ previous experiences and knowledge, their subjectivity and creativity, factors commonly neglected in traditional science and biology teaching and learning, in favor of memorization and abstractions distant from the students’ experiences. (Alice and Tasso’s teaching project, 2016, p. 4, our translation)

We observe that the trainees’ choice of textual genre is based on what Ribeiro et al. (2012) point to the influence that the construction of reading practices at school, by teachers, suffers from the reading practices experienced by them in the family or school environment.

In the perspective of dialectical didactic mediation, it is necessary to “transform/convert scientific content into teaching content, giving it the teachable, understandable and conservative properties of the knowledge of the science of origin” (Oliveira et al.,

2007, p. 145, our translation). Thus, we see that the trainees' teaching proposal follows their school and academic trajectories, constituting the pedagogical tone of reading practice that takes into account the students' immediate knowledge and the interaction with the scientific content, bringing it closer to the subjects' reality.

The trainees indicate that the project aims to “build a theoretical basis for the use of comics in biology classes and, mainly, to acquire knowledge from teaching experiences that differ from the traditional current”. Thus, they give clues that they are looking for “novelty” for their teaching practice, which at first would be done through the reading of a less educated genre. They also refer to the importance of a theoretical contribution to this reading. This fact brings us back to the classes they had in the Teaching Practice discipline, as the theoretical perspective of this activity was greatly emphasized.

The teaching project is intended for three classes, in the second year of high school, to promote a greater understanding of the contents of animal physiology previously studied by students. Thus, trainees indicate that:

comics about the subject were produced, which required the association of humor with the concepts studied and the use of creative and interpretive skills for the coherent continuity of the dialogues. The phyla Platyhelminthes, Cnidaria, Echinodermata, Annelida, and Chordata (fish, reptiles, and birds) were specifically studied. Of all the material produced, five comics were chosen to be used in the activity. The students received the material and were instructed to complete it at home, using their knowledge of the subject and consulting the textbook, developing it the following week. As assessment parameters, the correct use of the concepts of physiology and a broader assessment of the student's interpretive and creative capacity was established. (Alice and Tasso's teaching project, 2016, p. 7, our translation)

As observed, the activity of reading Alice and Tasso's authorial texts foresees a creative and interpretive reader-subject, but one that correctly uses the concepts of animal physiology. Thus, the formulation and circulation of meanings by comics would need to be adequate to school scientific knowledge. At first, there seems to be a tension between paraphrase and polysemy, the trainees intend to promote shifts of meaning that do not deviate from the concept studied.

Hence, the author-role promotes a reading of the comics to communicate key ideas and concepts of the teaching contents. Even though the comic text provides a pleasant and interesting reading of the school contents, they emphasize the coherence with the scientific contents, showing the need to outline teaching through a pedagogical discourse installed in educational institutions. “The assumption of authorship implies the insertion of the subject in culture, her/his position in the historical-social context. To learn to represent oneself as an author is to assume this social role and the relationship with the language before institutional instances” (Orlandi, 2013, p. 76, our translation).

It is also important to say that the mediation of teaching content by trainees provides for the construction of texts by school students, something that is close to the

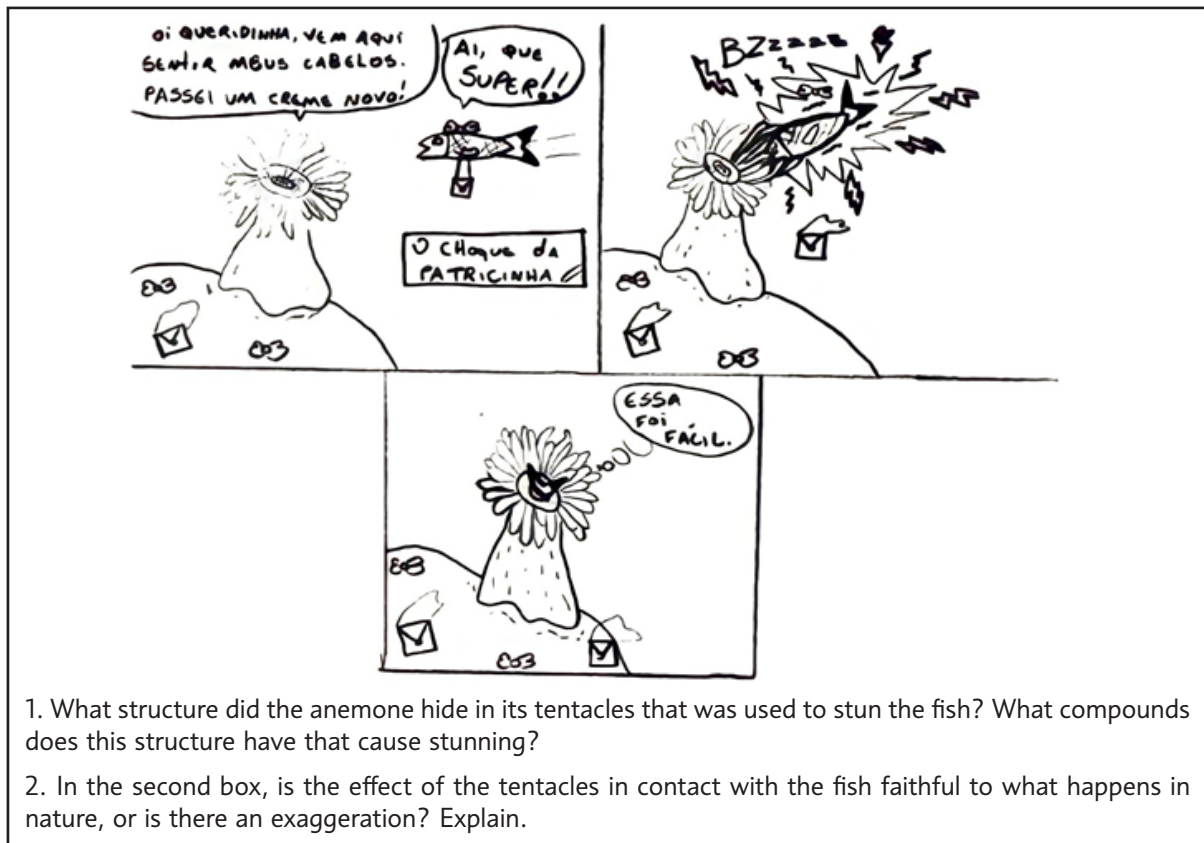
dialectical perspective, since, according to Oliveira et al. (2007, p. 159, our translation), “the text (or the other forms of language) has as communicative intention the student’s knowledge about the content taught so that the teacher can assess the student’s production (learning)”. Therefore, it would be through the production of the text that the trainees would ascertain the student’s conceptual expression and analyze what s/he truly learned.

Below we present the texts in operation in the teaching of both trainees. Tasso being the first shown.

Fragment 2: the reader-effect and knowledge in Tasso’s teaching

The comic strip produced by Tasso, Figure 1, aims to problematize the students’ immediate knowledge about the “cnidarians” feeding process, through a conversation between a goldfish and a sea anemone that attracts her to be eaten. It also brings questions that require school knowledge about anatomical-physiological structures used by cnidarians for this purpose.

Figure 1. *Preppy girl’s shock*



Note: Figure's texts

- Hello sweetheart, come and rub my hair. I applied a new cream.
- Ah, that super!
- BZZZZZ
- That was easy!

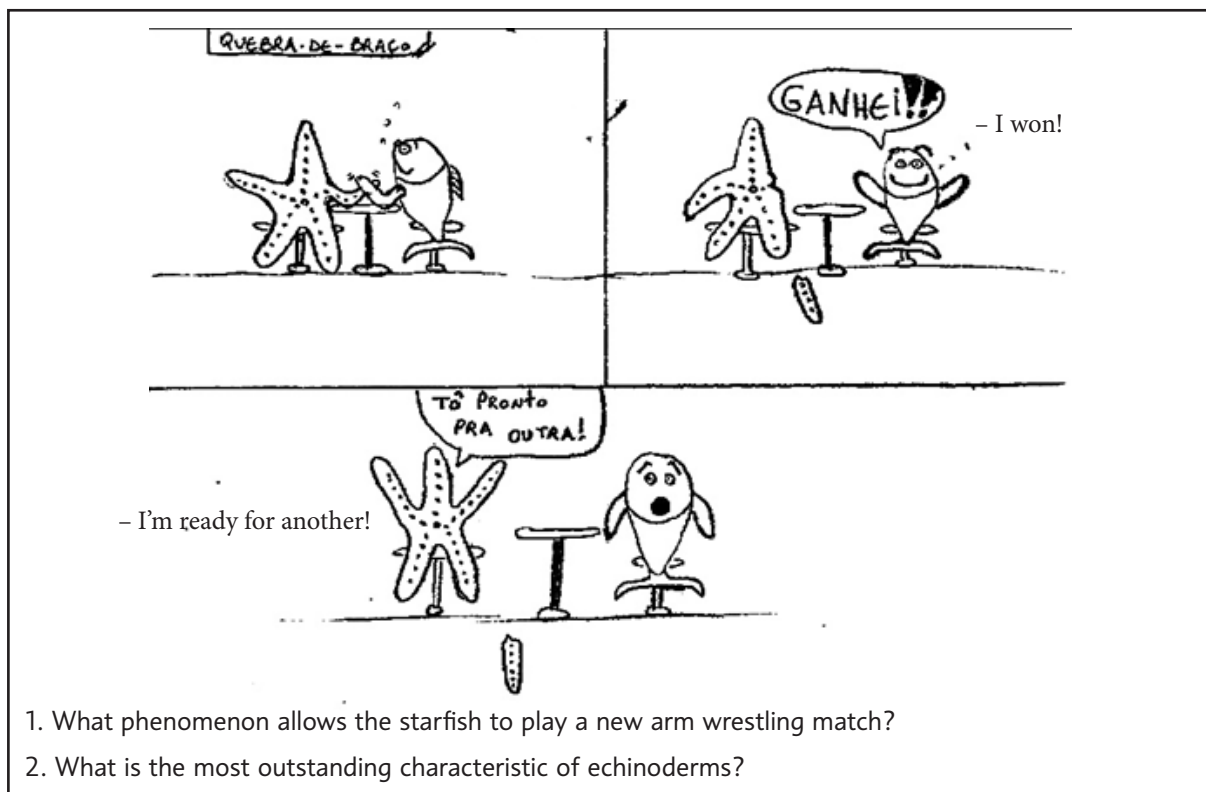
Source: Tasso (2016).

We observed that the strip above opens little space for the interpretation of the reader-student, since the author-subject projects that his reader holds the concepts related to the feeding of cnidarians, more specifically the name of a structure. The trainee expects a paraphrastic reading, which is confirmed by the second question (In the second box, is the effect of the tentacles in contact with the fish faithful to what happens in nature, or is there an exaggeration? Explain.), as it offers clues even to the expected answer by highlighting whether the image is faithful or whether there is an exaggeration of what occurs in nature.

The comics would work for the dialectical mediation of the teaching content, that is, for the confrontation between immediate and mediate knowledge. At the time of the class, the students' answers about the structure used by the anemone to attract the fish (question 1. What structure did the anemone hide in its tentacles that was used to stun the fish? What compounds does this structure have that cause stunning?), revealed analogies such as sensor, whip, poison, etc., which were confronted with the responses expected by Tasso, in the author-role, such as cnidoblast, cnidocilium, nematocyst, toxic substances. These answers were used by the trainee to compare with the scientific names.

In question 2 there was proximity to the ideal reader proposed by the author-role, as the students explained that it would be an exaggeration to represent the comic and the trainee confirms that it would, but does not ask why choosing to offer the answer himself: "because the toxin mixture serves to paralyze the prey and not to cause shock to it" (00:10:54, Tasso's teaching, our translation).

Figure 2. *Arm wrestling*



Source: Tasso (2016).

In the next strip, Figure 2, the biological concept is implicit and, similar to the previous one, it opens up little room for interpretation when designing a reader with knowledge of the “echinoderm” regeneration process.

At the time of mediation, there was a tension between the immediate-mediate knowledge triggered by the reader-effect, because when Tasso asks the class “who are the echinoderms?”, a student replies “It’s the sheep!” (00:17:32, Tasso’s teaching). The student’s answer was probably provided by orality, when he confused the term echinoderm with equines, leading him to think of sheep (ovines). From the discursive perspective, this situation shows that “the meanings are not exhausted in the immediate. They have different effects for different interlocutors” (Orlandi, 2013, p. 50, our translation). It is a situation that shows the notion of contradiction that happens in language.

When asked about the phenomenon illustrated by the comic strip (question 1. What phenomenon allows the starfish to play a new arm wrestling match?), some students consider that when breaking any part of the starfish this part grows again, other students reveal that “regenerating” would be the same as “cloning” an individual. This unleashing of other meanings, perhaps, was not expected by the trainee, since the question was quite objective “what is the phenomenon?”, that is, the author-role sought to curtail the virtual reader, but the reader-effect was deconstructed in this confrontation.

In question 2 (What is the most outstanding characteristic of echinoderms?), regarding the most striking characteristic of echinoderms, most students mention that “they are exclusively marine animals”, “they have an ambulacral or aquifer system”, answers that correspond to the expectations of the author-role. We believe that at that moment Tasso realized that the word expected by him was not meant in the same way by the students, so he decided to accept and explore the meanings expressed by them. In the perspective of dialectical mediation, the proximity between the contradictory points of knowledge (immediate and mediate), often generates a tension field, which can be overcome by elaborating a synthesis. That is what Tasso did, he synthesized the characteristics of echinoderms and not just the most remarkable one.

When assessing his work on the internship, Tasso writes in his journal:

Probably due to my inexperience, I found some difficulties in the teaching practice. We were a little stuck with the slides and the comics solved by the students, [...] our proposal, which was to show the comics and the students’ answers, working on them. I say this thinking that we could have commented on ideas about Animal Physiology containing more parallels with the students’ experiences, making the class more interesting. (Tasso’s journal, 2016, our translation)

The report indicates that the trainee recognizes that he did not provide the intertextualities, as advocated by Ribeiro et al. (2012), or the oral re-elaborations that Nascimento and Cassiani (2009) observed. However, his assessment values the importance of the teacher promoting shifts of meaning, even if the authorial text did not allow for a polysemic reading.

With this, Tasso, in a way, shows that the didactic mediation of texts requires, besides intention, some experience to establish relationships that can transform the class (Oliveira et al., 2007).

Fragment 3: the reader-effect and the knowledge in Alice’s teaching

In the comics mediated by Alice, the students did not only need to read/interpret, but also write the dialogues produced between the characters, thus opening space to rescue/register their initial representations. According to Orlandi (2013, p. 52, our translation):

The condition of language is incompleteness. Neither subjects nor meanings are complete, already made, definitively constituted. They are constituted and function under the form of association, of the relationship, of the lack, of the movement. This incompleteness attests to the opening of the symbolic since the lack is also the place of the possible.

The trainee uses the comic strip, Figure 3, in which the students should complete the dialogue between a “rabbit” and a “bird” about the adaptations of the birds for the flight.

Figure 3. *Brat, the flying rabbit*

– Oh, how I wish I could fly. Could you lend me your wings?

OK!

FEDELHO, O COELHO VOADOR

Aí Ai, como eu gostaria de voar. Você poderia me emprestar suas asas???

– Why am I not high up in the sky?

– Lol! Do you think wings are all you need to fly?

WAAAAHAHA! VOCÊ ACHA QUE BASTAM ASAS PARA VOAR??

UÉ, POR QUÊ NÃO ESTOU NAS ALTURAS??

1. Continue the dialogue mentioning other characteristics that allow birds to fly.

Source: Alice (2016).

The reading of students' responses to the comic strip led to other questions, such as "are the adaptations of bats the same as for birds?"; "What are the consequences of birds that do not fly?"; "What are the benefits of flying?". Questions that, despite showing that students awoke to the appropriation of other knowledge, move in a different direction from that projected by the author-role.

In this sense, the problematization in dialectical mediation

[...]explains the divergences between this knowledge, tending to contradiction, as well as stimulating the student to think and elaborate solutions through her/his available knowledge and, simultaneously, leads her/him to realize that her/his initial knowledge is not enough for the response raised. This contradiction, besides generating cognitive need (motivation), creates possibilities for the subject to investigate and seek new relationships. (Oliveira et al., 2007, p. 151, our translation)

We observed that this comic strip projected a reader-effect that would respond coherently about the adaptations of birds to flight, such as wings, air sacs, developed cerebellum, sternum with keel, pectoral musculature. Such answers were mentioned by the students, pointing to a proximity to mediate knowledge, to scientific content. Once again, we analyzed a text produced by a trainee who was expecting a certain reading.

Alice then explores the following comic strip (Figure 4) about a science fiction experiment involving the hybridization of a human being with a fish.

Figure 4. *The Fishman experiment*

<p>In the eagerness to help marine life, a scientist merged a human and a fish.</p>	<p>Managing to maintain in a single individual the human intelligence and the structures of the fish that make aquatic life possible.</p>
<ol style="list-style-type: none"> 1. Draw what a fishman's morphology would look like. 2. What organs and bodily features presented by the fish would this man need to survive underwater? Indicate in the box the structures visible externally. 3. If this fusion were possible, with what marine services could the man-fish assist the planet and its species? 	

Source: Alice (2016).

This comic strip, different from the previous ones, is open to students' interpretation when asking them to create a drawing and a justification for the performance of this new being in society. There are countless admissible answers. The author-role projected the participation of students in the construction of knowledge, not only in terms of creativity and imagination but supported by a social vision of school content.

This comic strip also contributed as a problematizing activity of the teaching contents on the physiology of fish. When Alice asks about the characteristics of the fish, the students answer that "they did not remember" or that "the subject was very difficult". Such answers make the trainee resume the contents, such as scales, fins and gills, density, viscosity, oxygen rate, caloric capacity, and conductivity. In the dialectic perspective, we can say that

The discussion of the problematizing activity with the student enables her/him to identify and understand the contradiction between her/his initial knowledge and the scientific knowledge taught, and also strengthens her/him to overcome the immediate in the intended mediate and thus elaborate syntheses that express the studied scientific concept, the 'systematization'. (Oliveira et al., 2007, p. 153, our translation)

Concerning the drawings produced by the students about the possible morphology of the "fishman", Alice shows the class that the representations were very creative. About the functions that the new species could provide to humanity, they replied: "expanding civilization", "avoiding water pollution", "avoiding predatory fishing" (00:43:09, Alice's teaching, our translation), that is, the answers brought a social or environmental concern, showing the correspondence between the objective of the author-role and the response of the reader-effect.

As analyzed, from the systematization of knowledge that approximates the teaching relationships between immediate and mediate knowledge, the trainee gets to the moment of knowledge production by students. From a dialectical point of view, through this production, the teacher assesses the clues for learning the teaching content, "expressed in the students' texts or other types of language produced by them. The choice of the task at that moment, selected by the teacher and discussed with the students since the beginning of the work, explains the end desired by the educational practice" (Oliveira et al. 2007, p. 157, our translation).

After teaching, Alice describes some teaching considerations in her journal:

Science teaching has happened in a fragmented way, concepts are not associated with processes and what is exposed does not trace meaningful relationships with students' previous experiences and knowledge. It ends up developing mechanical or repetitive learning [...]. In this sense, art and imagination are tools for building images, the exterior view is only possible when the interior view is open (Alice's journal, 2016, our translation).

In Alice's view, the educational practice should enhance actions that integrate

everyday knowledge with scientific knowledge, with art and imagination as a way for the “pedagogical mediation capable of creating, generating or elaborating teaching situations that allow the student to think or establish dynamic relations between the elements of the natural and social environment” (Oliveira et al., 2007, p. 163, our translation).

Discussions

Regarding the results, we believe it is important to bring up some points.

In the formative sense, the didactic mediation exposed here can also be seen as a discursive, complex, and contradictory process that brings together scientific, school, and everyday knowledge of confronting subject-positions. Although there are general references to guide this process, it is seen that only the immediate conditions of production determine how this mediation will be carried out.

When analyzing the report on the performance in the Teaching Practice discipline, written by an undergraduate student in Biological Sciences, Vilela (2009) indicates that the wording in the report serves as nodal data to expand the knowledge about the Biological Sciences teacher education. It demonstrates that, amid the tensions of the school context complexity, the undergraduate student recognizes his power to select the contents and the ways to mobilize them for teaching purposes. The author also stresses the importance of investing in theoretical approaches to understand the influences and interests in the practice of intervention, which can enrich the debate on teacher education.

In our research, we believe that the inclusion of theoretical approaches to reading enabled a certain reflection on the subject positions (author/reader) of undergraduate students for the production of comics to be used in didactic mediation. Unlike the situation experienced by Nicolli and Cassiani (2012), despite using reading and writing activities in the Supervised Internship classes, the undergraduate students used these activities only to promote the memorization and repetition of concepts in the classes they taught. Such fact was interpreted by the authors as something related to the stories of reading and writing constructed by these undergraduate students throughout their school and academic life. Or as Espinoza (2010) argues, in Science classes, one does not normally think of reading situations where, at the same time that one teaches and learns scientific knowledge, one also teaches and learns to read.

Another element, which differs from the research by Nicolli and Cassiani (2012), was the perception that the undergraduate students of our study had about the texts that can be used in Biology classes. They realized that reading in this area is not built only with explanatory-specific texts, but through different texts, such as comics, which are not necessarily aimed at teaching.

When discussing the functioning of the text in the formative processes, Lajolo (2009) stresses the importance of working with different textual genres. A comic strip originally published in a newspaper, for example, may not include the route and type of reading that the school proposes to it since the situation of its common use is not

necessarily this institution. Thus, school experiences with different readings may favor the subjects' training process to deal competently with the unpredictability of reading situations required by social life. Regarding our investigation, the functioning of a text in a textual genre less conventional to Science teaching reaffirmed these correlations through the clash with the subject-positions at the time of the classes taught by the undergraduate students.

When assuming the responsibility of building a text for teaching, we observed that the trainees expressed the type of reading that could be done for that text. From the reports in their journals, the choice of the comics genre would bring components that would influence the students' attention, stating that the activity provided a meaningful understanding and a more creative expression.

Thus, when we analyze such comics, we observe that the innovation planned by the undergraduate students for their classes would be achieved by introducing the reading of this more polysemic genre, as they believed that the comics would trigger a different interaction with the students. At the time of the class, these authorial texts instigated interpretations, encouraging students to manifest their knowledge, which allows us to defend that these texts were important resources to make problematization in didactic mediation feasible, a step that aims to know the students' representations for promoting the apprehension of scientific knowledge.

It is also worth pointing out that the ways of reading proposed by the trainees were significant. As previously stated, they supposed to break with an authoritarian teaching approach based on memorization and distant from the students' experiences when assuming conduct that privileged dialogical and, above all, creative activities. However, we analyzed that only one of the texts made it possible to foster creativity, the expected innovation, not requiring only finished and expected knowledge. Through reading, students had the opportunity to constitute different meanings, both in terms of biological concepts and their implications for nature and society.

Regarding the importance of working with different texts in Science Education, we agree with Machado and Giraldi (2019, p.17, our translation), as "reading a Science text and a literature text can be polysemic in the same way. What changes are the effects of socio-historical contexts of reading, the interactions between interlocutors, the discursive formations and memories mobilized in the moments of reading". Something that, according to the authors, implies thinking about ways to problematize reading and writing activities through different materialities, in terms of the production and circulation of knowledge.

Concerning our research, one of the limitations found is due to the knowledge and/or recognition of the structures of textual genres by the trainees. That is to say, even though the trainees had consulted the specialized literature on the textual genre chosen for didactic mediation, we consider that the classes in the Teaching Practice discipline were insufficient for this purpose. Therefore, there is a need for other disciplines or workshops to be offered during graduation to contribute to an adaptation and alignment

of what is expected from a didactic textual genre in Science/Biology classes. A similar limitation to that is observed by Nicolli and Cassiani (2012, p. 80, our translation), since the internship “does not have sufficient conditions to remedy all the difficulties found by students/trainees, especially in the sense of expanding the perception of the importance of reading and writing for Science teaching”.

We emphasize, however, that the comics produced by the undergraduate students had a preponderant role for the didactic mediation because they put the author-role at stake with the reader-effects in the teaching-learning process. The predicted readings were not always carried out because, in some moments, alternative meanings emerged, which required oral re-elaborations by the trainees, similar to what was observed by Nascimento and Cassiani (2009). The effective reader is the one who determines the meanings produced at the moment of reading and therein lies the importance of the teacher-mediator leading the student along the paths of scientific culture.

Throughout the study, it is relevant to encourage new investigations around reading in the initial training of teachers and the subject positions arising from this activity. Few productions have been found so far, which expresses the need for more debates in the area of research and the urgency of thinking about language in this field, beyond an instrumental or methodological role. We lack research that analyzes issues around how reading has been produced in Science teacher training courses amid the mediation of school content. This finding is also pointed out by Nascimento’s research (2007), when the author mentions that there is a significant gap in knowledge about the processes involving language in teacher education spaces, considering that:

The teacher has increasingly expanded her/his field of action, therefore, it is necessary to review the training devices including the discussion on aspects of language and mediation. Concerning the appropriation of scientific and technological culture to the understanding of discursive practice, they can help the construction of new methodological approaches that aim at greater participation of the student in the classroom dynamics. The initial teacher training process, therefore, lacks reflection on the characteristics of new educational activities. (Nascimento, 2007, pp. 140–141, our translation)

Considering that there is still much to investigate about reading in teaching, and more specifically in the initial training of teachers, we believe it is important for the area to unite around the construction of a discursive epistemological basis for language in Science Education.

Research conclusions and implications

Here we present some considerations about the didactic mediation of authorial texts and the reading activity in the internship for the training of teachers.

The first point is the fact that the trainees produce the texts that would be included and mediated in their classes, in this case, the genre chosen was comics. The author-role

assumed by them as teaching subjects sought to develop a controversial pedagogical discourse since opening space for them to work with this production in the classroom caused them to put themselves in the place of the student-reader and to intervene in something that bothered them, Science teaching based only on memorization.

Through the trainees' performance involving comics, we saw the perspective of a dialectical didactic mediation as a theory to be explored in the internship, as it can enable undergraduate students to realize that teaching requires constant effort, didactic planning, commitment, criteria for assessment, dedication to advance in the understanding of Science and, above all, that it is possible to encourage even more creativity, imagination, authorship and the participation of students in Science teaching.

In this sense, we believe that analyzing the assumed author-role and, consequently, the triggered reader-effect, can be a way to point out how future teachers imagine the subject-readers in school education. According to what has been shown, our analysis allowed us to observe the meanings that teachers in training expected to produce in their reading activities and to contrast these expectations with their practices, which may enable the problematization and systematization of knowledge about reading that is amid immediate and mediate knowledge.

We emphasize that the different relations of meaning that are at stake in reading are valued, pointing out that, in order to conceive an interpretative activity of comics or other genres, it is necessary to project a reader-subject, who is confronted with the expectations of the author, because "the subject does not read from the position of the one who formulates: s/he is placed in relation to that position. Different readings play there as well as different gestures of interpretation worked on/by the reader-effect" (Orlandi, 2001, p. 68, our translation). Or even, knowing "how a text works in the production of meaning is necessary to teach reading, to give conditions for the reader to work with what s/he does not know" (Orlandi, 2001, p. 68, our translation).

We also want to state about the attempt to put trainees on the move to understand the role of reading in the teaching practice, that is, to lead them to project in the educational act the relevance and impacts of reading for the formation of critical citizens capable of interpreting Biology in society through different languages. According to Orlandi (2012, p. 193, our translation), "the relationship with society is a relationship with language. This, in turn, is a social fact. It is through language that the subject is constituted and it is also through language that s/he elaborates her/his relationship with the group".

Therefore, we consider it reasonable for the undergraduate students to realize that reading is important in the teaching profession, causing them to suspend the view that teaching reading is an easy process and free from historical-social determinations or, above all, an implicit practice in teaching. Favoring the formulation and circulation of texts, throughout the internship, may be a possibility to break with the simplistic tradition of this discourse. Therefore, we argue in favor of a perspective in which the area analyzes more the ideologies that pass through the school space to produce readers and reading teachers who develop creativity, interaction, and authorship in their classes.

Through our research, we emphasize the production of texts for the mediation of knowledge in the classroom, that is, the author-role in teacher education is evidenced, and this was an activity that allowed us to observe the role of pedagogical theories in the constitution of teaching practice, more specifically, to observe the role of language and reading in action.

As a contribution to the area, it is important that research in the field of Science Education invest in problematizing and mobilizing different conditions for the production of reading during the teacher training internship, especially with regard to the study of didactic mediation of scientific knowledge. After all, if we want to broaden and deepen the perception that future teachers have about reading and writing practices in Science Education, we cannot think of them as optional or complementary activities to teaching, but as activities that constitute a work that requires us to rethink how it will be its insertion and, consequently, formulation and circulation of meanings.

We also leave as a contribution that more important than the use of different textual genres in Science classes we should focus on research on the types of reading to produce didactic mediation, as they are the ones that determine the functioning of the chosen text.

In fact, there is a need for more discursive studies on the processes of language functioning in teacher education spaces. Thus, we list some scores for the research area that are intertwined through our study and that can be developed in later works, such as: favoring the epistemological role of language in Science Education through a discursive basis; deepen discussions on reading authorial texts from studies involving the perspective of researchers, undergraduate students, teachers and students of basic education; expanding studies on reading in the didactic mediation of undergraduate students during their internship at schools.

It should be noted, however, that this research does not have a prescriptive purpose for the field of research, but serves as a gesture/contribution to reflect on language in Science Education by bringing elements to a more epistemic view of the production of meanings about teaching Sciences in teacher education.

Finally, we remember that only the intervention/teaching of the undergraduate students during the internship is not enough to overcome the difficulties that the future teacher may have, but it is a condition for them to appear.

References

- Almeida, M. J. P. M. (2015). Divulgação científica no ensino escolar: Possibilidades e limites [Scientific dissemination in school education: possibilities and limits]. In M. Giordan, & M. B. Cunha (Orgs.), *Divulgação científica na sala de aula: perspectivas e possibilidades* [Scientific dissemination in the classroom: perspectives and possibilities] (pp. 43–66). Ed. Unijuí.
- Almeida, M. J. P. M., Cassiani, S., & Oliveira, O. B. (2008). *Leitura e escrita em aulas de ciências: luz, calor e fotossíntese nas mediações escolares* [Reading and writing in science classes: light, heat and photosynthesis in school mediations]. Letras Contemporâneas.
- Cabral, W. A., & Flôr, C. C. (2013). As histórias de leituras dos estagiários de um curso de Licenciatura em Química [Reading stories of the interns in an Undergraduate Course in Chemistry]. *Revista Ensino & Pesquisa*, 15(1), 179–199.
- Cassiani, S., Giraldi, P. M., & Linsingen, I. V. (2012). É possível propor a formação de leitores nas disciplinas de ciências naturais? [Is it possible to propose the formation of readers in the disciplines of natural sciences?] *Educação: Teoria e Prática*, 22(40), 43–60.
- Espinoza, A. (2010). *Ciências na escola: novas perspectivas para a formação dos alunos* [Science at school: new perspectives for the training of students]. Ática.
- Lajolo, M. (2009). O texto não é pretexto. Será que não é mesmo? [The text is not a pretext. Is it not?] In R. Zilberman, & T. M. K. Rosing (Orgs.), *Escola e Leitura: velha crise, novas alternativas* [School and Reading: old crisis, new alternatives] (pp. 99–112). Global.
- Lopes, A. C. (1999). *Conhecimento escolar: ciência e cotidiano* [School knowledge: science and everyday life]. EdUERJ.
- Machado, I. M., & Giraldi, P. M. (2019). Leitura, linguagem e saber: reflexões a partir da análise discursiva de dois textos no contexto da Educação em Ciências [Reading, language and knowledge: reflections from a discursive analysis of two texts on the context of science education]. *Revista Ensaio: Pesquisa na Educação em Ciências*, 21(e12152), 1–21.
- Nascimento, S. S. (2007). A linguagem e a investigação em Educação Científica [Language and research in Science Education]. In R. Nardi (Org.), *A pesquisa em Ensino de Ciências no Brasil: alguns recortes* [Research in Science Education in Brazil: some excerpts] (pp. 131–142). Escrituras Editora.
- Nascimento, T. G., & Cassiani, S. (2009). Leituras de divulgação científica por licenciandos em ciências biológicas [Readings of popular science by biological science undergraduates]. *Revista Electrónica de Enseñanza de las Ciencias*, 8(3), 745–769.
- Nicolli, A. A. & Cassiani, S. (2012). Das histórias de leitura e escrita às práticas docentes de leitura e escrita de futuros professores de ciências [From reading and writing stories

to the teaching and reading practices of future science teachers]. *Alexandria: Revista de Educação em Ciência e Tecnologia*, 5(2), 69–81.

Oliveira, E. M., Almeida, J. L. V., & Arnoni, M. E. B. (2007). *Mediação dialética na educação escolar: Teoria e prática [Dialectical mediation in school education: theory and practice]*. Edições Loyola.

Orlandi, E. P. (2001). *Discurso e texto: Formação e circulação dos sentidos [Discourse and text: formation and circulation of the senses]*. Pontes.

Orlandi, E. P. (2003a). A leitura proposta e os leitores possíveis [*The proposed reading and possible readers*]. In E. P. Orlandi (Org.), *A leitura e os leitores [Reading and readers]* (pp. 7–24). 2. ed. Pontes.

Orlandi, E. P. (2003b). Polissêmico [Polysemic]. In E. P. Orlandi (Org.), *Para uma enciclopédia da cidade [For a city encyclopedia]* (pp. 21–63). Pontes.

Orlandi, E. P. (2006). *A linguagem e seu funcionamento: as formas do discurso [Language and its functioning: forms of discourse]*. 4. ed. Pontes.

Orlandi, E. P. (2012). *Discurso em análise: Sujeito, sentido e ideologia [Discourse in analysis: subject, meaning and ideology]*. 2. ed. Pontes.

Orlandi, E. P. (2013). *Análise de discurso: Princípios e procedimentos [Discourse analysis: principles and procedures]*. 11. ed. Pontes.

Pêcheux, M. (2002). *O discurso: Estrutura ou acontecimento [The discourse: structure or event]*. 3. ed. Pontes.

Ribeiro, N. A., Munford, D., & Perna, G.P.A. (2012). Experiências de leitura em Ciências da Natureza na Educação de Jovens e Adultos: um estudo das práticas de professores em formação inicial [Reading experiences in Natural Sciences in Youth and Adult Education: a study of the practices of teachers in initial training]. *Revista Brasileira de Pesquisa em Educação em Ciências*. 12(2), 129–151.

Vilela, M. L. (2009). A Biologia na sala de aula pelas escritas de professores em formação: um olhar de pesquisa sobre os relatórios da prática de ensino [Biology in the classroom by the writings of teachers in training: a look at research on teaching practice reports]. In S. E. Selles, M. S. Ferreira, M. A. L. Barzano., & E. P. E. Silva (Orgs.), *Ensino de Biologia: Histórias, saberes e práticas formativas [Biology Teaching: Histories, knowledge and training practices]* (pp. 89–105). EDUFU.

 **Leandro Siqueira Palcha**

Federal University of Paraná, Education Sector
Department of Teaching Theory and Practice
PPGE, and PPGECM
Curitiba, Paraná, Brazil
leandropalcha@gmail.com

 **Odisséa Boaventura de Oliveira**

Federal University of Paraná, Education Sector
Department of Teaching Theory and Practice
PPGE, and PPGE: TPEn
Curitiba, Paraná, Brazil
odissea.ufpr@gmail.com

Editor in charge

Maíra Batistoni e Silva

Disclosure statement

No potential conflict of interest was reported by the authors.

Compliance with Ethical Standards

The authors declare this study was conducted following ethical principles.
